Technology &Information System

SECPI153

Members

ABDULLA ADAM MOHAMUD	A19EC9043
ZEIAD WAEL	A19EC9047
AMJAD PARKER	A19EC9044

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INTRODUCTION

Design thinking can be thought of as a combination of a way of thinking blended with tools that enable us to be able to solve problems that we face. These problems can range from issues in our life's and society, all the way to more severe issues in large corporations that could cause a huge impact if unsolved.

OUR PROJECT

The department of CICT at the University of technology Malaysia (UTM) has been facing a rapid and accelerating demand for information technology resources both in terms of software and hardware aspects during the COVID-19 pandemic and the fact students and lecturers as well as staff shifted suddenly to working from home culture.

This when combined with the natural process of the university expanding, has created what can only be described in our opinion as a perfect storm scenario, where they were suddenly required to support the entire population of UTM lecturers, staff and students with sufficient access to online resources.

Facts about UTM

Currently the number of students at UTM is 32,325 students.

UTM provides many facilities and labs for activities and research purposes such as mivielab

These resources range from access to the e-learning platform and all the way to managing daily transactions which include but are not limited to staff portals, Tech support and teleconference communications via the UTM WebEx platform.

Now it should be known that all these demands require computing power to facilitate smooth operations during these difficult times.

This brings us to the problem.

The problem

Our problem statement was the following; The CICT is facing a rapid system software expansion with limited physical resources.

Now, by physical resources its important to understand that this is not limited to the hardware itself but also can be contributed to the lack of physical space for servers running various required system software or as we can call them operating systems.

The solution

We came to the conclusion that the impact from the lack of physical space to add more system software can be significantly reduced by increasing the adaptation of virtual machines (VM) running on hosts in UTM data centers.

To get to this solution we had to implement the human centered design thinking that we learnt in our course by Dr. oh eg su. This process comprises of multiple steps which we will discuss in the following part including some evidence to support them.Brain storming was one of the essential processes towards achieving our goal.

The process

Design thinking process starts by empathizing, this refers to the fact we need to properly understand the problem being faced. Not only we need to understand the

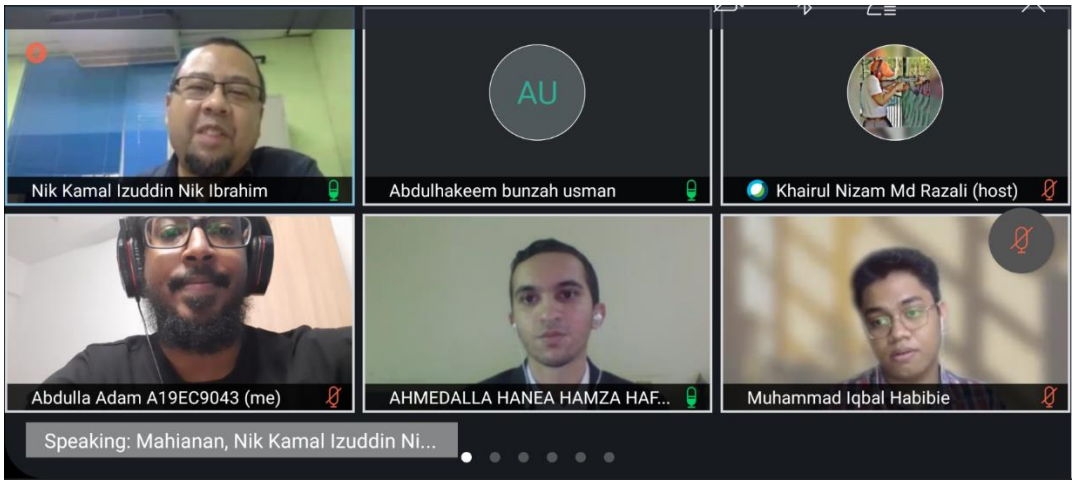
problem based on what we think is happening but rather to understand it from the prospective of the individuals who are facing the problem. The reason is the fact different people can see things differently.

This meant we needed to talk to a person who is directly facing the issue discussed above.

For our interview we had an online discussion via video with the following individuals :Nik kamal Izuddin Nik Ibrahim in companion with Mr Khairul nizam, Mr Jaffar, Mr Haslan & Mr rozi.

The reason we selected to hear from them was the fact these members were from the IT infrastructure Datacenter and Networking team. Meaning they were the perfect candidates to hear from and discuss with when it comes to system software.

Here is an image from the interview:



(Figure 1: Interview screenshot)

During this interview we started by asking questions about the daily life and a little bit about them self as IT professionals to try and empathize with them. Nik kamal has responded to that by elaborating a little on his background and surprisingly

mentioned that he used to be stationed in Kuala Lumpur but was moved recently to the main campus. This was as you might have expected by now, due to the huge increase in demand for IT services at the campus at JB. That question also made him feel more relaxed and open to discuss issues and challenges they face at work.

When it comes to the issue with rapid expansion, he mentioned that they run approximately 400 servers as virtual machines while keeping the rest as physical hosts. This in our opinion sounded enough to handle the load but it turned out we were wrong since we realized that the number of required machines is significantly higher, not only that but they were being bottle necked by other factors such as bandwidth availability which we will not discuss in this report given we are focused on the system software aspect.

Mr. Nik kamal was extremely professional and very friendly. Also, the amount of information and his insight into the difficulties being faced where fascinating. Unfortunately, given time constrains we were unable to get more information about the situation from him and had to be more creative in the upcoming steps. We managed to record a video of the interview for reference purposes later and for parts of the interview to be incorporated into our report video.

Define and design:

In this process we had to go over all the information we got from our interview. Since we were unable to ask all the questions we had in mind, we were lucky given that some students who were doing the same chapter as us were asking the same questions we wanted to ask. When we were done going over his answers, we defined the most critical aspects of the issues being faced and they were the following.

The increase in demand for ICT services was partially temporary meaning a huge investment likely wouldn't be a feasible move. Hardware cost especially when we are talking about data centers and network infrastructure tend to be extremely large in general. With the likely scenario being that the demand would go back to lower levels once the COVID situation ceases to exist and both students and staff are back to their regular physical activities.

The second aspect to the problem is the nature of physical machines in using extensive amounts of energy and other resources in order to achieve required functionality; therefore, we realized a possible solution needs to address that aspect as well.

Ideate:

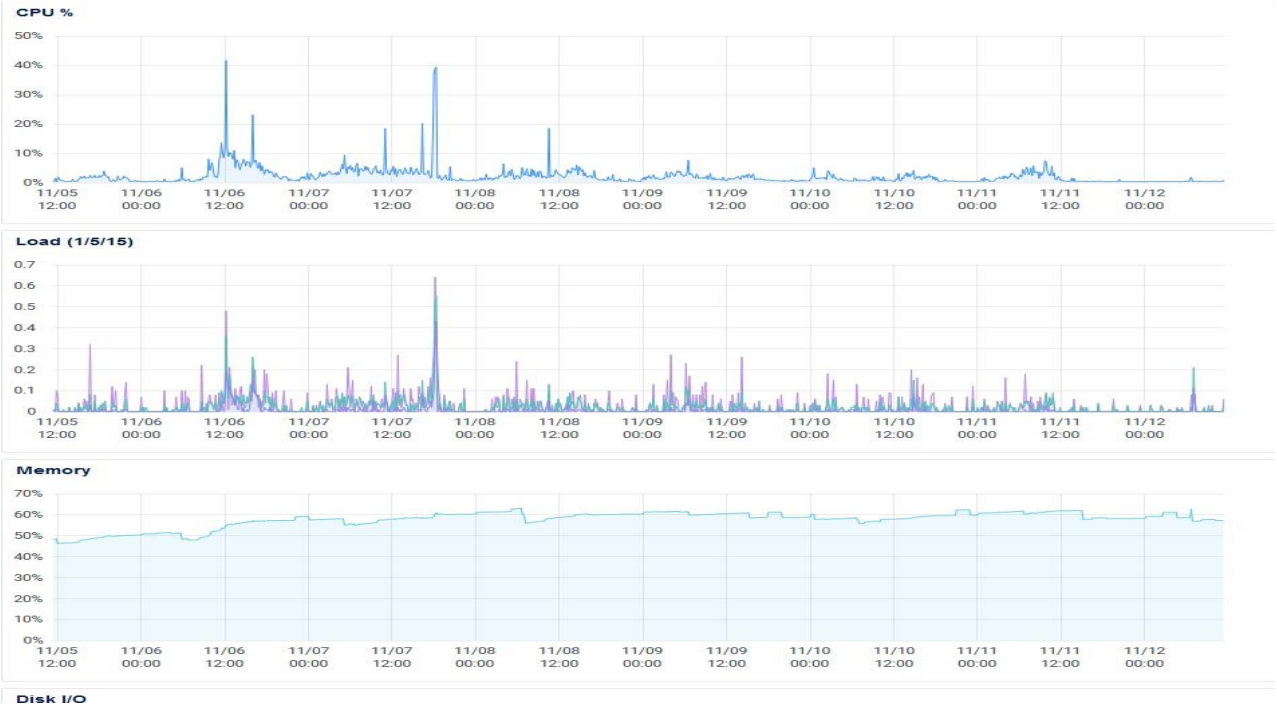
After brain storming, we came up with the idea of solving this challenge with a two-dimensional approach. The first was improving what is out there that was proven to be working. In our case it meant to increase the capacity of virtualization within the Datacenter.

The other solution we chose was to implement dockerization on operating systems. The way dockerization technology works is by basically having the operating system run in a sealed environment which is similar to hyper visors in Virtual machines. With one major difference being that they require far less resources when we compare them to virtual machines. Combining this with Kubernetes would be excellent in efficient management of system software deployment and updates while ensuring smooth and reliable operations at less cost in both bandwidth and manpower.

This would result in a more secure environment with easier management of system software management.

Prototype and testing:

Given the nature of our idea, prototyping and testing it would not be an easy task by any means. But given the fact one of our members has used it recently in one of the events managed by his cyber security club we got some amazing performance values. Down below is a figure of a containerized Ubuntu image running a web application that was being hit by over 500 IP addresses during the event and still did not go over 40% usage despite having only 1GB of memory and a single core processor. This served as a proof that containerizing system software results in far more efficient performance.



(Figure 2: System load on OS using Dockerization)

Prototype and testing:

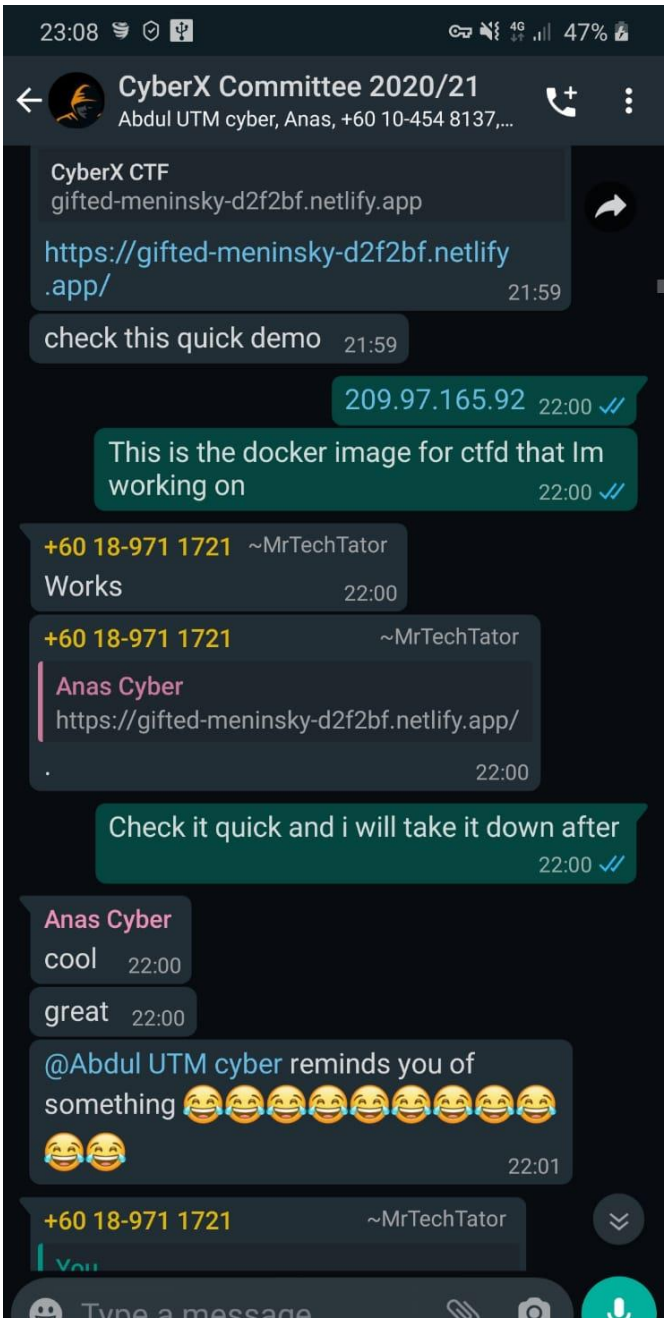
In this TIS course, we used design thinking process in order to come up with a viable solution towards challenges being faced by CICT at UTM. During the process we implemented multiple steps including brain storming to achieve what we believe would be a good idea, and then we tested the idea to ensure it would be a great fit.

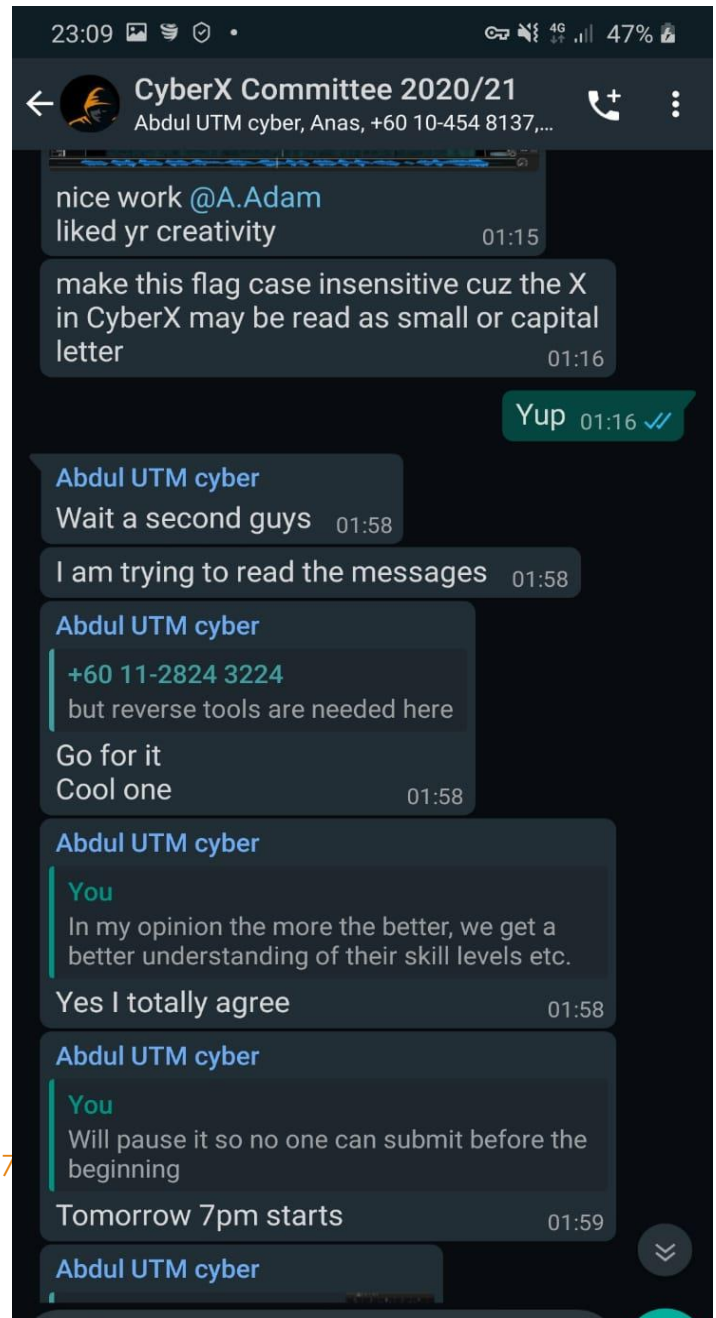
After prototyping the system, the moment of truth was upon us since we had to deploy it and see how it would turn out.

Within minutes of launching the competition the server load started going up pretty fast but then the container architecture showed its capability. The load dropped back to almost 5% within minutes of starting. We felt excited given that we were having over 110 students using the platform at the same time.

The competition ran for five days and we never had any issues with the system.

Below are some of the responses that we got from the team working on the platform.





Overall, this project has been an amazing opportunity to implement design thinking elements in an actual problem scenario and to see that it has worked really well makes us proud.

References:

Docker Documentation. 2018. *Compose File Version 3 Reference*. [online] Available at: <https://docs.docker.com/compose/compose-file/> [Accessed 15 November 2020].