CHAPTER 1
INTRODUCTION

1.1. Background

Universitas Bina Nusantara Alam Sutera resides Animation program under Visual Communication Design Department. In Animation program, students are equipped with knowledge and skills of newest development of 3D animation computer graphic technology to answer the requirement of creative industry (BINUS University, 2012:1). So, Animation program students learn to use, and operate 3D computer graphic as their main field of study.

Animation program focuses on 3D animation computer graphic. Animation program students are taught using 3D authoring tools, such as Autodesk 3DS Max (BINUS University, 2014), Autodesk 3DS Max offers 3D modeling, 3D animation, and 3D rendering (Autodesk, Inc., 2013a). Of all three, 3D rendering requires computer resources the most.

3D rendering is a process of transforming 3D model scene into 2D array of pixel for display (Carroll, Hadzic, & Katsak, 2012:1). Hughes (2013:6) stated that one of the factors that affect computer graphics development is CPU speed. CPU speed affects the speed of image generation, which in this case, is rendering process. Rendering a single frame involves a series of mathematical operations and typically imposes significant load on the system (Carroll et al., 2012:1). Verma (2012:29) states that even when using advanced rendering algorithms, time required for computation is a lot. Kang (2014:1) also states that development of 3D graphic has increased amount of data used, hence created a lot of problem with duration of calculation process. This makes 3D rendering process a compute-intensive process.

Animation program students of Universitas Bina Nusantara Alam Sutera show a problem regarding rendering process. A survey is conducted to find the problem in the population of Animation program students. The survey is online questionnaire, using Google Docs, given to sample of Bina Nusantara Alam Sutera Visual Communication Design students, started on March 10, 2015, and collected on March 17, 2015 with total response of 50 responses. The result states that 66% of students are not satisfied with their current render speed.

There are already several solutions regarding resource scarcity. The simplest solution is to replace or to add computer resource. Adding computational power to the existing system is indeed the simplest solution, but this solution has its own complexity. Laptop computer is not upgradable in a meaningful means; replacing CPU is hardly possible. Thus, the owner of laptop computer needs to replace a whole computer instead of the CPU only. Similar complexity happens in desktop computer. Although desktop computer has more freedom in terms of upgrades, there are some restrictions regarding upgrades. Socket matching and CPU chipsets are some complexity in upgrading CPU. If no meaningful upgrades can be done, most parts needs to be replaced. So, the end line of this solution is that this solution needs a lot of money. In a matter of fact, 76% of students refuses to upgrade of replace their computer, whether it is laptop or desktop computer, if it is for rendering process only.

Second solution is commercial render farm. Render farm is defined as a cluster of computers, connected together dedicated for rendering process (Sheharyar & Bouhali, 2013:118). A commercial render farm is a render farm specialized for commercial use, meaning that the render farm is leased to one or several client for rendering purpose for a price. However, it seems that render farm is not an option as well. According to the survey, 0%, or nobody, would use any commercial render farm available as their rendering solution. The result indicates that the students choose not to use commercial render farm.

Third solution is to use Universitas Bina Nusantara Alam Sutera laboratories. Campus of Universitas Bina Nusantara Alam Sutera resides some laboratories with considerable processing power, meant for Visual Communication Design Animation Program subjects, which involves rendering. But students seem to prefer not to depend on laboratories. 76% students choose not to use laboratories outside class period.

Sheharyar and Bouhali (2013:117) also states that rendering is compute-intensive and time-consuming process, but it is a highly parallelizable task. That means, rendering process can be decomposed and distributed among several compute units. This is called distributed rendering. A distributed rendering is also implemented in render farm. By employing distributed rendering on several network connected computers, the workload of rendering process is distributed to several computers so that each computer receives a significantly lighter workload, allowing the render process to complete in much shorter time.

1.2. Problem Definition

The problem is defined as a scarcity of computer resource to perform rendering process which causes rendering process to consume a lot of time. This scarcity is always present as a counterpart of a faster rendering time, which is also always present in comparison to current rendering time. As the solution does not include any upgrades of any computer, any usage of commercial render farm, or any usage of laboratory, the problem is redefined to: increase render speed to a level which satisfies Bina Nusantara Alam Sutera Visual Communication Design Animation program students by using the existing computer resources.

1.3. Scope of Work

The project covers the development of distributed rendering system consisting of several computers connected by local network. The system itself consists of network configuration between computers, applications that bridges users with system, and integration to the chosen 3D authoring tools, which is Autodesk 3ds Max 2014.

The project is able to render a single image using Autodesk 3ds Max 2014. The task is distributed among several computers in the local network and each computer renders a part assigned by the requester. At any moment, only one task is rendered in the local network.

1.4. Objectives and Benefits

1.4.1. Objectives

The main objective of this project is to develop network shared rendering as a solution of the problem of CPU resource scarcity among Animation program students. This project is intended to solve the root problem, and satisfies Bina Nusantara Alam Sutera Visual

Communication Design Animation program students with the increased render speed.

1.4.2. Benefits

The main benefit of this project is to help Animation program students of Visual Communication Design in Universitas Bina Nusantara Alam Sutera, in enhancing render speed. By this benefit, hopefully the Animation program students can achieve better results of their studies.

Furthermore, this project is able to become a future reference of a similar solution model to a similar problem with different scope of project.

1.5. Methodology

The development uses waterfall model as its methodology. Overall, methodology consists of analysis, design, and implementation.

1.5.1. Requirement Definition

Requirement definition is done in several steps. The first step is gathering requirements, which is done by survey with samples representing target population of Universitas Bina Nusantara Alam Sutera Visual Communication Design Animation program students.

Second step is requirement analysis. This step involves analysis of requirements gathered. The analysis will generate sets of requirements needed by the design process.

1.5.2. System and Software Design

System and software design process is done by generating sets of design plans from the previously analyzed requirements. Design plans includes state diagram, flowcharts, use case diagram, class diagram, and sequence diagrams.

1.5.3. Implementation and Unit Testing

Implementation process is done by generating codes from the previously designed design plans. Implementation also involves unit tests to ensure everything runs as it should be.

1.5.4. Integration and System Testing

Integration process is done by combining previously generated components into actual system, and test the whole combined system to ensure everything runs as it should be after the integration. Render speed evaluation is done to compare render speed of current system with proposed system.

1.5.5. Operation and Maintenance

Operation and maintenance involves distribution of new system to target users and evaluation from users about the new system's performance.

1.6. Organization of Report

CHAPTER 1

This chapter contains background, problem definition, scope of work, objectives and benefits, research method, and organization of report.

CHAPTER 2

This chapter contains literature reviews that were used in developing the application.

CHAPTER 3

This chapter contains methodology for the application development, involving requirement gathering, requirement analysis, and finally generation of design plans.

CHAPTER 4

This chapter contains system specification, application usage procedure, application testing, and evaluation.

CHAPTER 5

This chapter contains summary and suggestion about the proposed system and application.