

TS-3 Using Quill as a Tool for Real-Time Rendering

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Abstract

Real-time rendering are performed through interactive videos such as in video games, Virtual Reality (VR), and Augmented Reality (AR). Oculus Quill can be used as a tool to create content for VR, which can then be transformed into AR using game engines such as Unity. The intuitiveness of Quill allows a greater possibility for developers.

Keywords: render farm, visual simulation, virtual desktop infrastructure, high-performance computing

1. Introduction

We value art and culture as much as the effort we put into our developments in technology, so we built a render farm as a tool that allows the entertainment industry in Taiwan to prosper. With the provided rendering service at National Center for High-performance Computing (NCHC), related fields are presented with much bigger possibilities.

Render farm is a cluster of networked computers with a high performance speed and enormous amount of data storage devoted to rendering images, typically used for producing animated films. We made render farm accessible through Virtual Desktop Infrastructure (VDI), allowing users to take advantage of this platform with any device available to them at any location. This was intended for students who may not have access to an equipped device when needed. This also means that users can use the render farm and still do work on their own device with no

interference, allowing companies to work more efficiently.

So far, over 100 films in Taiwan were rendered using our platform by students and companies from the industry. The newest Render Farm was launched in March of 2018, which allowed not only CPU rendering, but also GPU rendering. The throughput is also greatly improved to support complex and large scale simulations.

For having a reputation for global technology manufacturing and professionals in Taiwan, we constantly update ourselves with the newest technological trends. Virtual Reality (VR) is one of the most talked about topics in the technological industry, and it has been utilized in many fields, but most successfully in film, animation, and video game.

2. Background

Rendering is the way a computer draws an image by calculating the color of each pixel. The process of rendering, for example, is when an

image contains a pixel that is red, and a filter is added to make the red pixel blue, the software will have to recreate this blue pixel when it exports the finished image¹. This means that any image edited or generated through computer programs, whether it's photorealistic or non-photorealistic, needs to go through the process of rendering.

Videos are a sequence of images played in order, so to render a video means to render a sequence of images. When it comes to movies or animations that involves Computer Generated Imagery (CGI), the more details an image have, whether it is geometry, texture, lighting or shadows, the more render time will be requires.

To put it in perspective, modern film and TV footage runs at 24 frames per second, a single frame from Monsters University can take up to 29 hours to render². This means that the film, which is 1h44m long, would have taken about 10,000 years to finish if it was rendered with one CPU. This explains why render farms are needed in the film industry, because it can shorten this time to couple of years.

VR is like a monitor, but instead of having a still screen in front of the user, the screen is all around. The VR devices today typically come in headsets that cover the eyes to prevent peripheral vision, cutting out any context that would disconnect the user from the virtual world. The user may spin their head, and the camera would follow, pointing to the direction the user wants to see in a scene, thus giving the user an immersive experience.

Having a 360 degree video also means that the render needs to cover all around instead of one direction. When VR content is created in 3D, the user may not only see an environment in 360, but also move around in the virtual space. Any interactive experience will require real-time rendering.

Quill is an example of a VR experience. It provides a creative platform for users to illustrate and animate using the Oculus Rift. It allows users to paint directly inside a 3 dimensional virtual space. Users can create animated content by using the Oculus Touch to paint 3D materials, and move them frame by frame to create an animation.



Fig. 1. The interface and produced content of Quill.

3. Concerned Contents

For interactive video such as video games and most VR experiences, the rendering process cannot be done ahead of time, because what the user sees corresponds with the way the user moves in the scene. Rendering process that is done as the video plays are called real-time rendering, and this requires a high-performance computing system.

Another example to demonstrate NCHC's real-time render farm was by performance art. It has a high data throughput that can help the performer to do a large scale VFX simulation and to create new kinds of cross-disciplinary performances. A project that was done at NCHC shows the performer dancing with projected visual effects, which reacts in response to the performer. The rate of how the visual effects plays and reacts shows the performance speed of the real-time renderer.

The render farm computers at NCHC provides real-time rendering supported by both Unity and Unreal, which are two of the most used game engines by the public today³. Using the real-time rendering engines on the render farm computers present a faster frame rate.

Render farm may help with the render time, as well as the speed of software provided by a stronger machine which improves the workflow. However, the production time cannot be decreased. The steps in the animation production pipeline before the point of rendering from a typical animation studio includes but not limited to the following⁴:

- Modeling
- Surfacing
- Rigging
- Layout/ Set dressing/ Anim Prep
- Character Animation
- Crowds
- Character Effects/ Simulation
- Effects
- Technical Director
- Matte Painting
- Lighting

For big animation studios such as Disney, there are enough members in the team to distribute the worktime. But, for one creator or a small studio, it is a lot harder to create a complete animation even when they have created a great concept to animate.

Today, there are a few illustration/3D modeling and animation tool for the VR, which can shorten the traditional 3D animation process done in 3D software. It is a new way of animating that is more intuitive, which has an easier transition to using our real-time renderer. Quill is one of the more intuitive tools that will be introduced.

4. Importance or Significance of Tutorial

Quill is a great tool to create content for Unity or Unreal, which can then be rendered in real-time by the super computers at NCHC. Render is normally the last step to the production pipeline, and each step is important for the next. For example, if a 3D model is not rigged properly, it will not animate properly. This makes it harder for one person to complete the job without any help.

The traditional 3D animation pipeline would most likely take years to master each step. Oculus Quill can skip the steps of modeling, rigging, texturing, and go directly into animating. Even though it may not have a final product as realistic or as detailed as an animation made with 3D software, but it is a great option for making quick and simple animations, which can then be used for other purposes.

At NCHC, animations created with Oculus Quill are imported into game engines supported by the render farm, which can be built into VR or even Augmented Reality (AR).

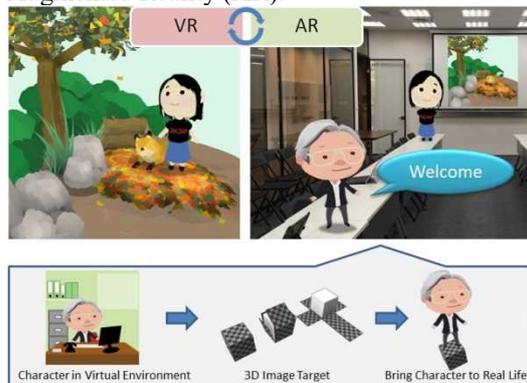


Fig. 2. An example of how content created by Quill can be applied into VR/AR.

Although VR/AR is beginning to emerge with the animation industry, most AR developers are not animators who can create 3D models. Moreover, a lot of applications of AR do not

necessarily require detailed models, since there are still limitations to most AR devices available that restricts files that are too big. Quill is a great tool for such users to quickly create their own IP for demonstration purposes.



Fig. 3. Quill is also a great tool for creating contents for smartglasses.

5. Possible Outcome

One specialty about Quill is that there is no limit to the canvas size; it can be zoomed in and out endlessly. The only limit to Oculus Quill is the system that it is running on. A powerful computer is required to run the Oculus Rift, and its processor and graphics card determines how smoothly Quill runs on the Oculus Rift.

NCHC are finding ways to connect VR equipment to the render farm through virtual desktop. If succeeded, this opens up a whole new way of using the render farm, and extends the possibility of VR creations to the next level.

6. Conclusion

The central thinking of NCHC is to fill the gap between technology and art. However, it has been a hard task due to the limited people who have knowledge to both sides. Thanks to the developers of Quill, the bridge between technology and art seem to be found.

7. Reference

1. Maxim-Eden-Robynd-TomaszMSwidzinski-Sareesh Sudhakaran – <https://wolfcrow.com/blog/what-is-a-render-farm/>
2. Takahashi, Dean. “How Pixar Made Monsters University, Its Latest Technological Marvel.” VentureBeat, 24 Apr. 2013, venturebeat.com/2013/04/24/the-making-of-pixar-s-latest-technological-marvel-monsters-university/.
3. Unreal Engine 4 Vs. Unity: Which Game Engine Is Best For You? <https://www.pluralsight.com/blog/film-games/unreal-engine-4-vs-unity-game-engine-best>
4. Willett, Nora, et al. “Animation Production Pipeline.” Physbam, 29 Mar. 2011, [physbam.stanford.edu/cs448x/old/Animation_Production_Pipeline_\(2d\)_Nora_Willett.html](https://physbam.stanford.edu/cs448x/old/Animation_Production_Pipeline_(2d)_Nora_Willett.html).