Domain Track Status – Computer Graphics in Gaming

What does quality mean in your selected domain?

Quality in computer graphics is determined by visual aesthetic, resolution, and rendering time. In both still images and animations, customers have high expectations for how accurately the graphics depict reality. Rendering time is not as much of a concern with still images, but is crucial to animations that must render several images a second. When the rendering time for each frame is too slow, the motion in animations becomes jerky and unstable. This delay in updating the frames is referred to as lag, and has perhaps the most egregious effect on customers’ opinions of graphics, particularly in games.

What are the important factors?

Rendering algorithms are the most significant factor in computer graphics. Two of the most common ways to render graphics are ray tracing and radiosity. These algorithms, because of their differences in implementation, can produce different results and artifacts (errors in the image) when rendering the same graphic. Thus, the algorithm chosen to render a graphic depends on the purpose of the graphic. For example, a slower but highly detailed algorithm might be appropriate for medical graphics, where the images are rendered prior to being displayed. On the other hand, a faster but less detailed algorithm might be appropriate for a video game, where images cannot be rendered prior to being displayed due to their dynamic nature. In this scenario, the number of frames rendered per second is more critical than the exact details of the graphics and necessitates a faster algorithm.

What processes are currently used?

Although time consuming, the most effective process of measuring graphical quality is via visual analysis, by both developers and customers. Visual analysis by the developers takes place to ensure some level of quality prior to releasing a product to customers. Developers also track resolution and frame rate, two quantifiable metrics that guarantee some level of quality. But in the end, customer opinions matter the most, and many companies have employed detailed processes for gathering customer feedback. These processes often involve releasing a limited number of trial versions during development to gather customer feedback before making a product publically available. The sooner customers look at the graphics, the sooner improvements can be made to the graphics.

What processes do you suggest?

As discussed in the previous paragraph, we recommend gathering customer feedback as a means of assuring quality in computer graphics. Beyond that, the quality assurance processes for computer graphics are largely similar to those of other software programs. In this field, it is crucial to have an excellent process for monitoring performance, as this is the primary criteria that customers use to judge end products. Although performance is less of a factor in generating still images, it is nevertheless important for both still images and animations. To that end, having a testing harness to run code in different configurations and gather performance metrics from is an absolute must. Furthermore, many graphics applications today rely heavily on complex algorithms. These algorithms should be thoroughly tested to ensure that they function as intended throughout the lifetime of a product.

Are there any regulations or standards?

Interestingly enough, there are few regulations and standards associated with computer graphics. A Google search yields a couple SIGGRAPH articles dated prior to 2000 that bear little relevance to current development. We hypothesis that this is primarily the result of two related factors: customer expectations and a rapidly changing industry. As computer graphics have improved, customer expectations for graphics have risen dramatically. Consequently, new technologies are being developed year after year and readily incorporated into the industry. Standards and regulations, which are time consuming to generate and come to an agreement on, simply have not been able to keep pace with the changing technologies. Features that are now commonplace in graphics APIs may not even have been present a few years ago. Therefore, the standards are more or less defined dynamically by the expectations of developers as new technologies and features are introduced.

What are the common problems associated with quality assurance in computer graphics?

There are three primary problems associated with quality assurance in game graphics: varying customer opinions, unpredictable platform usage, and modding.

By the very nature of people, customer opinions are prone to wide variation. Consequently, feedback gathered from a subset of customers may not accurately reflect the general opinion of customers. In some cases, the variation may be so great such that there is no opinion of customers as a whole. Therefore, a certain amount of discernment and analysis is necessary to interpret and apply customer feedback.

One challenge the software industry faces is the unpredictability of what platform the software will be used on, and this is especially true of gaming. Gamers have a tendency to make alterations to their computer to improve or enhance its performance. While this generally makes for a more enjoyable user experience, this customization may introduce bugs particular to a gamer’s unique setup. Because of the infinite configurations that are feasible, it is impossible for gaming companies to anticipate all of the bugs that may occur.

More recently, companies are encountering another problem by enabling their customers to mod. Modding refers to users modifying or extending a game to make it more to their liking. Although companies and impose some limitations, how the users mod a game is largely outside of companies’ control. This can be both beneficial and detrimental—beneficial because users can improve a game and expand the customer base for the company, and detrimental because opinions of poor mods may transfer to the company.

What metrics are used?

Frame rate and resolution are two quantifiable metrics used that are related to the game product itself. These are crucial in guaranteeing some level of quality in the game prior to the beta release. Post beta release, the most crucial product metrics are problems per user month and customer satisfaction. Customer satisfaction can be gauged by gathering feedback as well as tracking game usage metrics, such as retention of users and traffic. Traffic can be broken down further into the number of users playing the game in a given time period, how long a user plays the game in one sitting, and how frequently the same user plays the game over a given time period. For MMORPGs, an absolutely paramount metric to keep track of is the total number of users the system can support simultaneously. Some of the most crucial process metrics are the fix quality, fix backlog, fix response time, and percent delinquent fixes. All of these are necessary metrics in responding to customer problems and maintaining customer satisfaction.

What metrics do you suggest?