HPC Research Mini Project-

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HPC in Media & Entertainment

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Abstract:

The following paper will give the reader an understanding of the components of a high-performance computer cluster (render farm) within the Media and entertainment space. Basically an outlook of where the industry is heading, an understanding of commonly used applications, and industry best practices.

Introduction:

Computer-generated imagery (CGI) and Visual effects (VFX) is where computer-generated imagery is created and combined with footage from a camera. Once it was a luxury only affordable to production houses with big budgets. Whereas now with the decrease in hardware costs via utilization of mass-produced hardware and affordable software. Now VFX has become mainstream so that premium television content also requires high-quality CGI and VFX, making it an important ingredient in the movie-making, storytelling, and entertainment. Advancements in modern CGI are only made possible with the aid of sophisticated software algorithms and powerful and robust hardware.

High performance clusters of computers, large pools of storage and high bandwidth networks are the foundation for which a VFX pipeline is built upon. A typical studio will employ specialist engineers in areas of networking, storage, and infrastructure. As technology advancements allow for faster and more powerful platforms, artists push the creative boundaries producing ever more complex geometry, lighting and effects, which in turn pushes the technology to its limits thus creating a new set of challenges for technology partners to innovate and overcome.

Literature Review:

The world's top film and television studios use NVIDIA to power the most advanced, visually rich feature films and TV shows ever made. NVIDIA accelerates media and entertainment workflows in the following steps:

Virtual Production- They create, iterate, and collaborate in real-time by connecting the virtual production set directly to artists.

Rendering- Rendering is basically the process where the data in a 3D scene is converted into a series of 2D images, as seen from the digital camera's point of view. In film work, these calculations are done offline in batches, typically taking anywhere from minutes to hours to days to process an individual frame. GPU rendering has become a standard in the industry. With GPU rendering, artists can choose to generate more iterations or render much faster than by traditional means. With new RT Cores, photo realistic ray-tracing can now be achieved in real time, enabling higher fidelity workflows from interactive rendering to virtual production.

Let us take Qumulo as our next example. The ability to leverage the cloud is a major benefit for VFX studios, as their effects are becoming increasingly more complex (which requires more compute resources) while at the same time, project deadlines are becoming tighter.

The right technology is necessary to ensure that these workloads are handled quickly and adequately, with the current protocol support and necessary performance.

In Qumulo (A storage company helps companies deal with cloud. One of the Top Three Film Animation Studios chooses Qumulo for Motion pictures and series.) The VFX pipeline is similar to an assembly line. Each worker performs a task before handing off what they've done to the next person on the line. Pipelines are like snowflakes; no two are alike.The differences are that, in VFX, each worker is an artist and the pipeline enables the entire team to see the work as it evolves so it can be evaluated and, if necessary, adjusted for better results. A VFX production pipeline is complex, with many different processes and many interdependencies among them. The biggest challenge Qumulo faces is managing the sheer volume of information required to produce photorealistic imagery. It is often necessary to assemble terabytes of data that must be passed through to the renderer and ultimately a compositor.

In the terms of rendering, animation, media and entertainment, a lot of boost and variations has been witnessed since the early '90's to the 2000's cloud and HPC Boom. These days, 4K resolution has become standard, and that requires a lot more detail and data than a 1080p/Full HD shot. But that's just going to change again before long; 8K televisions are starting to roll out, and then it could be onward and upward from there with higher fidelity color, audio and picture sure to come in the future.

List of References:

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http://www.acmemicro.com/Solution/GPU/Media-Entertainment

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Summary of References:

HPC is used for problem-solving, including life sciences, manufacturing, and oil and gas, and more use cases are appearing over time. Talking about further use cases, the main motives of using HPC in Media & Entertainment are speed, cost, a flexible deployment model, fault tolerance, and total cost of ownership.

In order to stay competitive, content creators in the M&E (Media & Entertainment) sector are under pressure to produce or distribute original content more frequently and faster. Without the HPC it would be nearly impossible to store, manage, and deliver these huge quantities of digital content, animation, VFX, etc in an agile, dynamic and cost-effective manner. From the black and white era to the AR/VR era we have seen tremendous growth in Media and Entertainment via HPC, AI and other technologies.

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Gaps:

Content creation standards are being driven to even higher resolution (8K).

Trends such as OTT, VR and HDR are creating all new pipelines.

Studio has to rapidly expand and contract to accommodate spike projects.

Studio's seek low or no commitment consumption models.

An inability to call on high-power and fit-for-purpose infrastructure leads to costly outsourcing.

Trying to stay ahead of the competition means that a studio may need to open new facilities, close, or merge existing ones.

Being forced to move large parts of the infrastructure and render farms to accommodate electrical power constraints.

Discerning and increasing sophistication of the viewing audience requires more realistic VFX.

Hypothesis:

In Hollywood movies we have often seen the proper use of VFX i.e. Visual Effects and CGI i.e. Computer Graphic imagery in famous movies like Marvel Studios, Disney Pixar and so on. Considering the scenario of Bollywood movies, we have not yet seen that much progress. Still we can find some movies that we can count like Robot, 2.0, Ra.one etc. If we advance HPC in this entertainment industry then it will improve our GDP as well as viewers will enjoy it all over the world.

Experimentation:

Year after year, digital revenues account for an increasing share of the industry's total revenues. Prior to the pandemic, PwC predicted almost 62% of the estimated $2.6 trillion in revenues the global M&E industry was expected to generate in 2023 would come from digital sources.

As media consumption behaviors shift from simply viewing content to immersing in it, brands are focusing their attention on ways to turn audiences into active participants. The existing trend toward live and pre-arranged entertainment creates major engagement opportunities, supplemented by faster-running augmented reality (AR) or virtual reality (VR) technology.

- Create groundbreaking AR experiences: Inspired by the BBC show *The Green Planet*, six leading creative, technology, and science organizations came together to deliver a truly unique experience. The result allowed audiences to discover, observe, and even nurture some of the world's most exotic plants through high-resolution holographic images and AR technology.
- Live render in 3D: StudioLab, from Verizon and Walt Disney Studios, live rendered 3D Sith jet troopers into the *Star Wars: The Rise of Skywalker* afterparty. The troopers, all actors sporting AR glasses several miles away, could interact and engage with event attendees.

Advances in 5G and high performance technology are just as much about innovation as they are about a shift in employee culture. Just 55% of media and entertainment leaders and practitioners feel that they are maximizing the opportunities presented by 5G. For

organizations that are prepared to maximize 5G opportunities, the benefits are huge. The promise of sub-second latency in which livestreaming technologies deliver livestreams in less than a second creates remarkable opportunities to capitalize on audiences who crave speed and offers more ways for media companies to capture, analyze, and act on consumer data.

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Observations:

- Creating more realistic effects, more quickly HPC helps speed image modeling, animation and editing while also providing the massive horsepower required by today's rendering farms. This enables more complex, lifelike effects and photo realistic visuals. AI can automate some animation tasks, freeing people to focus on fine-tuning their creative visions.
- Enhance VR/AR and gaming HPC provides the power for a new generation of immersive experiences. AI can be used to make games more interactive and compelling, for example, by improving the actions and reactions of non-player characters (NPCs) or serving up personalized experiences based on the user's preferences and behavior.

Application:

Media and entertainment companies are responsible for delighting the world with real time digital streaming content, television shows, movies and immersive gaming experiences. From using high resolution computer generated imagery (CGI) and visual effects (VFX) to render lifelike scenes in seconds, to streaming content to audiences around the world in real time, to matching viewers with rich content, High Performance Computing (HPC) has long been used to speed media creation and delivery. In recent years, artificial intelligence (AI) has begun creating new ways for media and entertainment companies to speed time to market and save money while offering new and improved experiences to increasingly well-qualified audiences. As AI and HPC converge, media and entertainment companies will continue to innovate on these increasingly powerful systems to bring us face to face with new worlds and ideas.

Conclusion:

HPC continues to be the biggest transformation in the media and entertainment sector. While M&E organizations are looking to build out digital strategies, the economic and

business models required to succeed in the digital landscape are challenging and would require a significant shift in mindset and approach. Further,dramatic changes in the regulatory environment are also impacting business models. In this changing paradigm, M&E organizations would need to be nimble and flexible and operate with a long term integrated strategy to build sustainable businesses, stated the report.