

Predictive and Proactive Pipelines: Approaches to Monitoring and Optimizing CG Film Production

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Figure 1: A complex scene from "Ralph Breaks the Internet" and its corresponding render statistics

CCS CONCEPTS

- **General and reference** → **Performance; Metrics; Validation;**
- **Computing methodologies** → *Rendering.*

KEYWORDS

pipeline, optimization, efficiency, metrics, performance, rendering

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1 OVERVIEW

A primary goal of animation and visual effects studios is to create fully realized characters, worlds and experiences that immerse the audience in our storytelling. Delivering groundbreaking visuals in a tight production time-frame creates challenges that push the limits of hardware and software resources.

Critical to the success of this process are the groups that work to monitor, optimize, and strategize ways to deliver creative work at large-scale, often multi-site, facilities. This encompasses multiple

areas of focus, including, but not limited to, monitoring current practices to identify inefficiencies and waste (e.g. broken data and bad renders), implementing more optimal processes (e.g. level-of-detail and multi-processing techniques) and creating production-facing tools to better inform artists and managers of the state of their work. Some types of systemic waste, such as storing unnecessary or redundant data, inefficient process, overly-complex deliverables, and lost render cycles due to broken data, create real-world problems, affecting not only the cost of production, but artist well-being and ultimately the sustainability of the filmmaking process.

This panel will bring together industry experts from multiple visual effects and animation studios to share and debate ideas, anecdotes, and approaches to identifying both problems and opportunities around efficiency improvements in the filmmaking process. They come from varied backgrounds and roles, including rendering and software optimization, data and analytics, and pipeline and project supervision. In addition to tools and techniques, we will also explore the cultural and production challenges around fostering greater responsibility for efficient deliverables.

While the high-level goals largely align, there are notable differences in each studio's production model, including their department and pipeline design, single versus multi-site make-up, client and vendor structure, etc., which in-turn informs their approaches to team structures, tools and techniques employed, areas of focus in the pipeline, degrees of technical versus cultural emphasis, and more. This will foster an engaging dialogue on the merits of each approach and how our unique histories and needs have driven our current innovations and challenges. Comparing and contrasting each studio's process during panelist and open audience discussion may reveal new insights and opportunities, providing value to the wider graphics community as a whole.

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2 FORMAT

This will be a moderated panel. Each panelist will have three to five minutes for a brief overview of their studio's current focuses, efforts and challenges. This will be followed by a moderated Q&A session with questions on specific topics directed to one or several panelists to compare and contrast approaches, with a few open topics for group discussion. The introductions and moderated section will comprise no more than 70 minutes, followed by 20 minutes devoted to open audience Q&A. Supplemental material and questions will be prepared to cover additional topics should time remain.

3 SAMPLE QUESTIONS AND TOPICS

What is your studio's definition of efficiency? Is it possible to measure and evaluate it in a meaningful way at the global scope of the filmmaking process? For example, render and scene-load times are simple ways to quantify optimizations, but a more complete view of efficiency touches on other production concerns such as scheduling strategy, approval process, iteration time, and creative complexity. How do you or could you account for those?

What are your team's primary goals and desired areas of impact? For example, do you focus on reducing render footprint, labor weeks, iteration time, or something else? How do you measure success?

How are your teams structured and scoped? If production-based, how do you maintain a through-line across projects? If studio-based, how do you partner with productions and adapt to their needs?

What are some of your studio's historical optimization approaches? What are some of the more difficult or unexpected challenges you or your team has had to deal with? How did your studio/team's efforts begin and how has that grown and evolved over time?

What is your approach to metrics and analytics and what tools and techniques are you using to collect, interpret and present them? With such a broad spectrum of available data, (e.g. versions, production status, render times, shot content, dependencies, etc.) what are some of the ways you connect and relate these data? Do you leverage any computational learning techniques?

How do you gather data to identify problems? What is the right balance of instrumenting passive metrics collection and reporting, active outreach and consulting, and shadowing the floor to understand how the pipeline helps or hurts artists to iterate and deliver? How do you interpret and synthesize the results?

Likewise, what are your primary efficiency and optimization efforts and what tools and techniques are used? Do you focus more on workflow/process improvements versus low-level software profiling and optimization, or vice versa? Which aspects do you automate and/or apply adaptive or heuristic models?

If you facilitate faster iteration and reviews, but the result is the same labor time with more creative versions, is that efficient? How do you quantify those gains and who ultimately decides whether to spend or save those iterations for elsewhere?

How much do you employ software and pipeline optimization (tool efficiency), versus data and analytics (monitoring and responding) versus management philosophy (communication, awareness and empathy)? Issues are often a combination of these, so how do you determine the proper lens and how does this inform your approach and ultimate solution?

When is the right time to identify and act on optimization efforts? Premature optimization could target the wrong area or have unintended results, but waiting too long risks reactive firefighting.

How much tolerance to late pipeline changes do your productions typically have and how has that influenced your approach and time frame for getting involved?

Which teams own "optimization", "monitoring" and "efficiency"? Are only TDs and engineers involved, or are there expectations for artists? How are groups held accountable? How would you like to see these roles evolve? What examples of "natural consequences" are built into the production cycle?

What is your process for engaging with artists and creative leadership on a production? What kinds of resistance or other challenges have you encountered? Where have you had success?

What general trends or shifts have you observed over the years in terms of project complexity, metrics integration, and production culture? Are there techniques or tools you have incorporated from other industries? How has the availability and adoption of open-source software and products impacted your approaches?

Is there anything different you are trying now or would like to try in the future?

4 PANELISTS

Sean Palmer - Tactics Supervisor, Walt Disney Animation Studios

Kaori Ogino - CG Technology Supervisor, Industrial Light & Magic

Aidan Sarsfield - Head of Production Technology, Animal Logic

Munira Tayabji - Visual Effects Supervisor, DreamWorks Animation

Mark Hills - Head of Systems Development, Framestore

Renee Tam - Lightspeed Lead, Pixar Animation Studios

Pavani Rao Boddapati - Visual Effects Supervisor, Weta Digital

Moderated by:

Claudia Chung Sanii - Workflow Supervisor, Walt Disney Animation Studios