Zero to USD in 80 Days

Transitioning Feature Production to Universal Scene Description at DreamWorks

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ABSTRACT

Productions at DreamWorks starting with How To Train Your Dragon 3 will use Universal Scene Description (USD) [Pixar Animation Studios 2016] as the primary asset and shot representation across the production pipeline, from modeling to compositing. In this talk, we discuss the motivation for adopting USD at DreamWorks and our strategies for adoption on a highly constrained timeline - 80 working days from the initial discussion to having the first production-ready USD scenes. We review our methodology for organizing and planning an extensive USD integration, present details of our implementation, and discuss the successes and challenges encountered in the adoption process.

CCS CONCEPTS

• **General and reference** → **Design**; • **Social and professional topics** → **Systems planning**; • **Computing methodologies** → *Graphics systems and interfaces*; • **Software and its engineering** → Collaboration in software development;

KEYWORDS

pipeline, scene description, software

1 MOTIVATION

In spring of 2017, DreamWorks began using a new proprietary rendering software, Moonray. It was then necessary to adopt a new scene description format in order to represent Moonray scene objects (geometry, cameras, materials, etc) that had no representation in the existing DreamWorks scene description format (ASG), which is strongly tied to the legacy DreamWorks rendering software. USD has many of the features to which DreamWorks is accustomed as well as many desirable features not available in ASG. USD is also broadly extensible, making it a clear choice for a new scene description.

2 PLANNING FOR ADOPTION

A small cross-department advisory group of TD, Pipeline, and R&D staff was formed to advise on all USD decisions. This group first met with teams at other studios to gain insights and ask for advice about their own experiences with adopting USD. The advisory group then drafted a full-pipeline map of every department workflow, the applications used, the files and file formats produced and consumed, the inter-relationship of data between departments, and where USD data should be produced and consumed. That information was used to generate a comprehensive task list of all work required to design, draft specifications, implement software, and document USD usage in the DreamWorks pipeline.

USD was first deployed to a short whose purpose was to validate new software and workflows. Dedicating the short as a deployment sandbox enabled accelerated testing and validation (as opposed to deployment on a standard production), and was instrumental to successful USD adoption.

3 DESIGNING A USD PIPELINE

The long-term goal at DreamWorks is to use USD as the common interchange between workflows for both asset and scene data. To accomplish this, several intermediate pipelines were designed where some workflows will write and read a minimal set of ASG data in addition to a complete set of USD data, in order to support ASG-reliant applications until they can be updated. Likewise, Alembic geometry caches serve as the primary geometry data representation as we investigate USD-native geometry as a replacement.

The design of our USD shot and asset representations maintained many of the characteristics of the ASG designs they replaced, a significant benefit in implementing these quickly. For asset representations, USD was found to be more capable than ASG for crafting a generic structure to represent multiple asset types, as well as complex asset structures such as assemblies, variants, and LODs. In all design deliberations, the advisory group would strive to respect a philosophy of "keeping the U in USD" - maintaining a data model for all assets and shots that enforces meaningful USD data, not simply valid USD data.

4 SUCCESSES AND CHALLENGES

Creating pipeline tools to generate and read USD data was fast and straightforward. The tools that ship with USD, including usdview and the Katana plugin, were extremely useful for validating our data model, and proved faster than our previous proprietary and third-party toolsets. We succeeded in representing our variety of asset types, and in some cases improved upon our prior representations. The usd-interest Google group was a valuable resource for finding answers to questions that came up during the adoption process.

The USD integration effort also presented challenges. Reviewing and revising all workflows across the pipeline for USD was time-consuming and sometimes difficult to model. Gaining a complete understanding of USD's LIVRPS composition scheme was elusive, and we had to revise our stage layering on several occasions where we made assumptions about composition behavior that proved to be incorrect. Adjustments to our shot and asset model mid-production required strategically-scheduled, labor-intensive restructuring of data to minimize impact on artists. Embracing USD's declarative data model was difficult in places where our asset model has traditionally been partly procedural, notably around animation curve data. Managing the complexity of large scenes forced the prioritization of work around instancing and other techniques that had initially been scheduled for later in the adoption process. Artist outreach and education required a continuous effort, and was often contentious during the initial rollout. Deploying USD simultaneously alongside a new renderer and a new lighting application made debugging an exercise in multivariable problem solving.

5 CONCLUSION

With careful planning and a small team of dedicated engineers, DreamWorks transitioned from a proprietary scene description to USD for most production workflows in only a few month's time. Faced with the challenges of an aggressive production schedule, rapid pipeline-wide design, and the conceptual jump to USD, there was still enormous benefit from developing and deploying a USD-based pipeline. We believe production artists and developers at DreamWorks now have a more scalable and adaptable solution to asset and scene description, and that DreamWorks as a studio is better positioned for industry alignment. By sharing our experience, we hope to encourage wider adoption across the industry and further the growth of USD as an industry standard.

REFERENCES

Pixar Animation Studios. 2016. Universal Scene Description Website. (2016). http://www.openusd.org Accessed: 2018-02-08.