



VFX and Finishing Studio in the Cloud with WEKA and Autodesk Flame

Deploying an End-to-End Post Production Workflow with WEKA and Autodesk Flame

REFERENCE ARCHITECTURE

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Introduction

Media & Entertainment (M&E) companies are experiencing exponential growth in data creation as they generate more and more video content and transition to 4K and 8K video formats.

Data volumes are growing at the same time that the turnaround times for video production have decreased. Additional VFX and finishing workstations may be needed on short notice to serve the needs of globally distributed and dynamic teams of creative artists. These seats must be capable of accessing data with high bandwidth and low latency, with multiple staff accessing the same file systems in parallel to satisfy VFX and finishing and other workflow needs.

Purpose Of This Document

This document describes a reference design for quickly deploying Autodesk Flame workstations with WEKA Data Platform in the public cloud. The design utilizes the WEKA Data Platform running on a public cloud (in this case, AWS) to satisfy the bandwidth, storage, collaboration, availability and other data challenges that modern VFX and finishing pipelines create.

This reference design:

- Complies with the [VFX Reference Platform](#), ensuring that it works as expected, with no surprises for either artists or studio technologists
- Adheres to applicable [MPA content security best practices](#) to protect digital content
- Facilitates collaboration on short-term and long-term projects
- Enables fast and simple to deploy environments that reduce total cost of ownership (TCO)

VFX and Finishing Workflow

This design is intended to help studio technologists achieve studio in the cloud with less effort. For production studios coping with accelerated schedules, higher resolution content, rapid growth, and increased staffing, increasingly sophisticated VFX and finishing deployments don't scale at the necessary rate. The result is unhappy artists, missed deadlines, higher costs, and constant management of infrastructure. When outages occur, vendors should be proactive to avoid impacting production schedule and budget overruns. Using the proposed reference design, WEKA has enabled numerous studios to grow the number of active artists, enable global collaboration, accelerate schedules, and contain budget overruns.

- With Autodesk Flame, WEKA Data Platform, and this reference design, WEKA customers have achieved:
- Deployments in less than an hour
- As much as 50% savings in clouds costs
- 10x faster Flame workflows
- Ability to handle higher resolution media and operate at Multi-PB scale
- Accelerated onboarding of talent and collaboration around the globe including artists in India, Brazil, and South Africa
- Higher artist productivity and faster task turnaround

Use of this reference design simplifies cloud deployment of Autodesk Flame. The cloud approach delivers the performance, scalability, security, and flexibility required for demanding VFX and finishing workloads. It better meets business needs without requiring costly investments in server and storage equipment that can quickly become inadequate or out of date. Storage and compute-intensive rendering activities also leverage on-demand cloud resources instead of fixed assets.

Requirements for Post-Production VFX and Finishing

This solution has been designed to satisfy the following requirements which are becoming critical for distributed VFX and finishing workflows.

Requirement 1: Studio in the Cloud

Creative talent is globally distributed, so it's a requirement to support geographically distributed VFX and finishing artists using Autodesk Flame workstations that are integrated with the public cloud and utilize cloud resources efficiently and elastically. Companies need the ability to support multiple VFX and finishing sites as well as individual artists working in remote locations.

- **Req 1.1:** Provide ability to run independently with Linux or MacOS-based clients. Artists are using public cloud hosted instances of Autodesk Flame. These instances may be exported over PCoIP (Teradici). Also, provide the ability to support Autodesk RV running on Microsoft Windows for review.
- **Req 1.2:** Support snapshots every 30 minutes for versioning. This allows artists to go back to previous versions of their work without having to deal with complex recovery.
- **Req 1.3:** Support remote snapshots every 4 hours to provide site-level disaster recovery. This includes artists' Flame environments and the Autodesk Framestore, protecting against region-level degradation and failures.

Requirement 2: Simplify Scaling

Support the ability to scale up and down rapidly to add and remove staff from projects.

- **Req 2.1:** Simplify collaboration between artists by enabling them to share media content across Flame environments. Gain the ability to add new artists to a project at a single site to deal with short term bursts of work or increase the project team's capabilities across different steps in the workflow like color grading or compositing.
- **Req 2.2:** Automatically handle situations like accelerated schedule, project scope creep, and higher resolution media. Support auto-scaling the environment to dynamically adapt, ensuring that bandwidth and capacity meet requirements with a minimum of oversight while minimizing cost.

Requirement 3: Follow the Sun

Enable artists at multiple sites in different regions across the globe to collaborate on the same project. Facilitate a follow-the-sun post production model where the artists have quick access to the same media regardless of their location.

- **Req 3.1:** Work on the same project "around the clock" using a follow-the-sun strategy. For example, teams in the US and India might employ this strategy for a time-critical project:
- **US team:** Working 4 PM to 1 AM GMT (8AM to 5PM PST)
- **India team:** Working 3:00 AM to 2:00 PM GMT (8:30AM to 7:30PM IST)
- **Req 3.2: Camera to Cloud.** Ingest on-location shots from studio or production sites into a cloud studio for post production workflow.

Reference Design

Core Components

Figure 1 shows the core components of the reference design using Autodesk Flame with WEKA Data Platform in the AWS cloud. This design is based on successful, real-world deployments by existing WEKA customers. These components support VFX and finishing artists running Flame on public cloud using WEKA in a geographic region.

For clarity, the figure illustrates deployment on AWS, but the same architecture can be deployed and supported on other public clouds like Google Cloud and Oracle Cloud Infrastructure. Many aspects of Flame deployment on AWS using WEKA have been described in the blog, [Introducing Autodesk Flame on AWS](#).

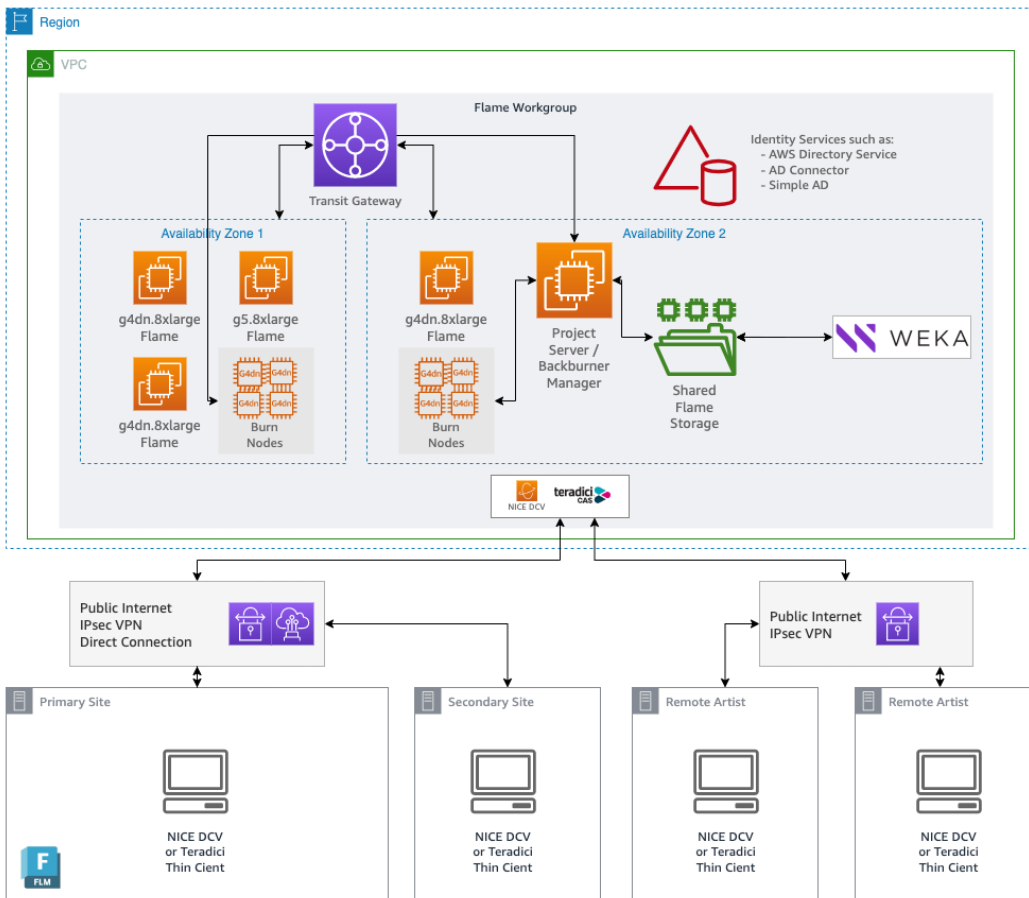


FIG. 1 Reference design for Autodesk Flame deployment (AWS shown).

The reference design incorporates the following components:

Compute

- **Project Server / Backburner Manager.** Provides Flame project management and coordinates rendering on separate burn nodes.
- **Flame Workstations.** Each Flame workstation is enabled by a properly sized, GPU-accelerated compute node. For example in AWS, these include G5.8xl and G4dn.8xl instances.
- **Burn Nodes.** Appropriately sized, GPU-accelerated nodes to perform rendering.

Data Storage

- **WEKA Data Platform.** Provides shared data storage for use by Autodesk Flame workstations and Burn render nodes. Because data performance is critical, the storage is configured to ensure that all workflows take advantage of WEKA's performance, simplicity, and scale.

WEKA is able to run in multiple public clouds and on premises, delivering bandwidth that scales to hundreds of gigabytes per second with latency below 250 microseconds while simplifying data protection and data movement between locations.

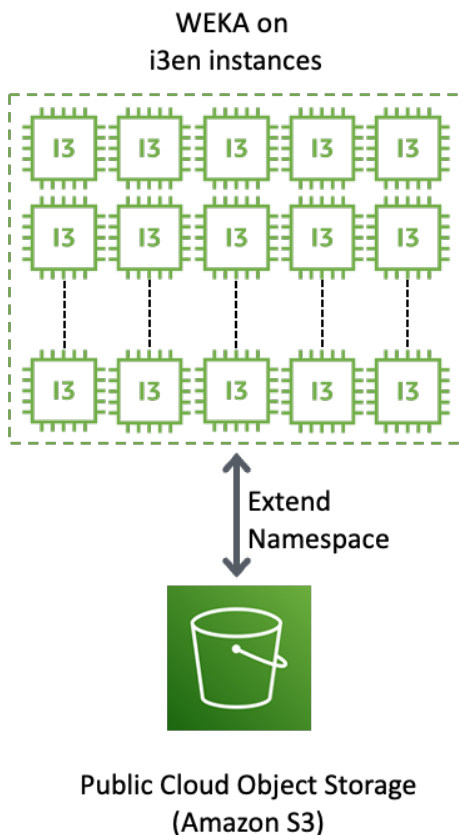


FIG. 2 WEKA Data Platform tiering to public cloud object storage (AWS shown).

Cloud (AWS-Specific)

- **Availability Zones.** To ensure availability, the reference design utilizes two AWS Availability Zones (AZs) in a single region, and supports data replication to other regions for synchronization, DR, etc.
- **AWS Transit Gateway.** Provides secure, high-bandwidth network connectivity between AZs. Managed multicast support facilitates Flame workgroups.
- **Identity Services.** Choose from AWS Directory Service, AD Connector, or Simple AD.

For deployments on other clouds, the reference architecture incorporates similar functionality available in the target cloud environment.

Client Connectivity

Flame Workstation output is delivered to artists using either:

- **Nice DCV.** A high-performance remote display protocol that delivers remote desktops and application streaming securely.
- **Teradici Thin Client.** Utilizes PC-over-IP (PCoIP) to deliver a secure, high-performance, and responsive desktop experience.

For artists working at a primary or secondary customer site, connectivity can take place through an IPsec VPN, AWS Direct Connect, or the public Internet. Remote artists connect via IPsec VPN or public Internet.

Requirements Satisfied

The core components, configured as illustrated in Figure 1, fully satisfy Req 1: Studio in the Cloud. The complete solution is 100% software-based. It can be deployed in the cloud and ready to ingest and serve video to VFX and finishing artists in less than an hour.

Deploying this reference design enables M&E companies to create VFX and finishing workstations in a range of public clouds to support VFX and finishing artists working at customer sites or remotely (Req 1) using either Linux or Mac clients (Req 1.1).

The WEKA Data Platform enables artists to collaborate without needing to copy data for the different steps required for post processing workflows. The same system can be used to serve the needs of 4K UHD editorial, color correction workflows, and rendering with Burn without tuning. VFX and finishing Engineers can standardize on a single content platform with WEKA.

For versioning, WEKA allows engineers to take frequent local snapshots, as frequent as every 10 minutes, while artists are working, providing versioning (Req 1.2). An artist can quickly and easily rollback to an earlier version for any reason should it become necessary.

The WEKA Snap-To-Object capability is an elegant data protection solution for VFX and finishing environments. This feature enables committing a full copy of the snapshot of the data to an object store, which can be used to restore the data on the original WEKA cluster or onto another WEKA cluster. After the first snapshot-to-object has been completed, subsequent snapshots are stored in an incremental manner so commit time is limited to just the changes and is extremely fast. WekaFS also supports sending snapshots to a second object store in parallel using the Remote Backup feature. This leverages the incremental nature of snapshots, only sending the changes across the wire to the destination object store. Snapshots can be committed to the Object Store at regular intervals, for example every hour to further protect content from loss of availability or to satisfy other needs. (Req 1.3).

Installation and Configuration

Installation on AWS is accomplished using CloudFormation templates. Installation on other clouds can be accomplished quickly using Terraform.

For deploying WEKA, the WEKA Self-Service Portal (start.WEKA.io) is a planning tool for deploying WEKA clusters in AWS. Users simply enter the capacity required and configure advanced parameters such as required performance. WEKA clusters can be provisioned across multiple cloud locations (for example using AWS multi-AZ) for added reliability. Once parameters are entered, the defined WEKA configuration can be immediately deployed as a CloudFormation stack. The cluster deployment process takes about 10 minutes.

Plan your Weka.

THE FILE SYSTEM FOR THOSE WHO SOLVE BIG PROBLEMS.

This calculator is designed as a self-service tool to match your storage and performance requirements to the most cost efficient EC2 instance based on your application needs. If you need help you may want to visit [Self Service Portal Documentation](#).

The screenshot shows the WEKA Self-Service Portal interface. On the left, under 'Your Requirements', users can configure:

- CAPACITY:** Total Capacity (15 TB), Tiering (SSD Only or SSD+S3), SSD Capacity (%: 20), and SSD Capacity Required (3 TB).
- PERFORMANCE:** Selection between IOPS and BW, R/W (80%), and IOPS (100K).
- Region:** US East (N. Virginia).

 On the right, under 'Your Options', a table lists recommended EC2 instance types based on the requirements:

Instance Type	Cluster Size	Capacity (TB)	Usable Capacity (TB)	IOPS (K)	BW (Gbytes/sec)	Action
i3en.2xlarge	6	15.0	15.0	Up to 435	Up to 4.4	Deploy to AWS
i3en.3xlarge	6	22.5	22.5	Up to 419	Up to 6.7	Deploy to AWS
i3en.6xlarge	6	45.0	45.0	Up to 607	Up to 7.2	Deploy to AWS

 A 'Show All' button is located at the bottom right of the table.

FIG. 3 WEKA Data Platform being deployed on AWS

Scaling and Availability

Scalability and availability are critical for important VFX and finishing projects. This reference design makes it simple to add and remove Flame Workstations as needs change.

The WEKA cluster can be manually scaled or use auto-scaling to ensure that data performance and capacity keep pace with the number of workstations and artist activity.

On a public cloud like AWS, file serving by WEKA is implemented by a group of backend EC2 instances (for example i3en) running the WEKA software and fully dedicated to the WEKA cluster. NVMe storage is attached in these instances. The resultant storage system is scalable to hundreds of backend instances, delivering the performance and capacity to support tens to thousands of artists.

The WEKA Data Platform operates as a distributed cluster protected from 2 or 4 failures within each cluster. If an instance failure occurs, the cluster quickly rebuilds the data. In the event of an instance failure, a new instance can be added to the WEKA cluster to avoid any reduction in performance or capacity. A WEKA cluster can utilize two or more Availability Zones within an AWS region for even greater availability. Additionally, the WEKA software can replicate file systems across different regions. This is explained in detail later in the document.

Auto-Scaling

After deploying the WEKA cluster via CloudFormation, an auto-scaling group is created to simplify cluster size management. The number of WEKA instances can be controlled either by changing the desired capacity or by defining custom metrics and scaling policies in AWS.

The WEKA cluster scales to deliver the necessary performance for VFX and finishing workflows. The correct rules enable resources to be shutdown and released when not in use. For example, if a project doesn't require weekend work, the resources can be released on Friday afternoon and spun up again on Monday morning, reducing costs.

Requirements Satisfied

The scaling capabilities of this reference design satisfy the objectives detailed under Requirement 2: Simplified scaling. The reference design allows Autodesk Flame Workstations to be easily added or removed, enabling studio technologists to add new personnel to a project for a short time (Req 2.1). Use of auto-scaling groups allows the design to adapt to changes in the number of workstations to ensure that data bandwidth and capacity remain adequate (Req 2.2).

File System Design

The WEKA Data Platform is designed to support shared access via NFS, SMB, and Object (AWS S3) Protocols. In addition, WEKA offers client software which implements a POSIX filesystem driver that avoids the bottlenecks of file sharing protocols like NFS. The POSIX driver enables each Flame Workstation to access the WEKA cluster as if it is a local drive.

All clients can share the same file systems regardless of protocol, so any file written is immediately available to any client, making WEKA a strongly-consistent truly distributed hybrid cloud file system. This provides significant benefits for post-production workflows in which different processes may preferentially utilize different protocols. When organizing projects for post-production workflows, WEKA recommends the use of its file systems. Up to 1,024 virtual file systems are supported per cluster at this time.

Because Flame Workstations run on Linux, the native WEKA POSIX-compliant client is the strongly preferred option. WEKA customers are able to move data at line rate, i.e in the GB/s range, using the POSIX client. This is enough to support multiple 4K Ultra HD streams simultaneously per Flame Workstation.

Artists can also use SMB-Direct to connect Microsoft Windows virtual instances to the WEKA cluster for the purposes of review with Autodesk RV. This solution provides enough storage throughout to serve multiple 8K resolution streams to the Microsoft Windows system.

Cross-Region Replication

WEKA makes possible the delivery of file-system-level snapshots to other regions, making it possible to share content and collaborate across geographic regions.

WEKA Snap-to-Object functionality enables WEKA snapshots to be uploaded to public cloud object storage services like Amazon S3. Combining this capability with S3 cross-region replication enables a file system to be migrated from one region to another.

WEKA snapshots can be used to recreate a file system stored on object storage on another WEKA cluster running in another public cloud region providing cross-region disaster recovery.

Additionally, WEKA Snap-to-Object functionality can be used to ingest data from a production site to the cloud and from the cloud to other remote deployments for additional processing. More information on this can be found in the real-world example below.

Low-Cost Archive

Snap-To-Object provides a convenient means for archiving a project onto lower-cost object storage, including AWS S3 Glacier Instant Retrieval, at project completion. Additionally, older project files can be tiered to object storage as well, keeping them accessible for artists to reference and use if needed.

Continuous Replication

WEKA supports continuous replication of content using the WEKA Synchronized Snapshot functionality which sends incremental updates from a WEKA cluster at one location to another cluster at another site. There is no need to create the file system from these incremental snapshots as the destination is automatically updated. This means artists at the second site can benefit from continually updated source media. This facilitates overlapping work schedules, enabling a true workflow pipeline across multiple global teams.

Requirements Satisfied

The file system capabilities incorporated in this reference design satisfy the objectives detailed under Requirement 3: Follow the Sun, enabling staff at sites in different regions to collaborate on the same project. Snap-to-Object schedules can be created such that new data can be efficiently moved from one region to another so that work can continue on a project around the clock. (Req 3.1). Using the same mechanisms, data can be efficiently ingested at the edge and moved to the cloud. (Req 3.2).

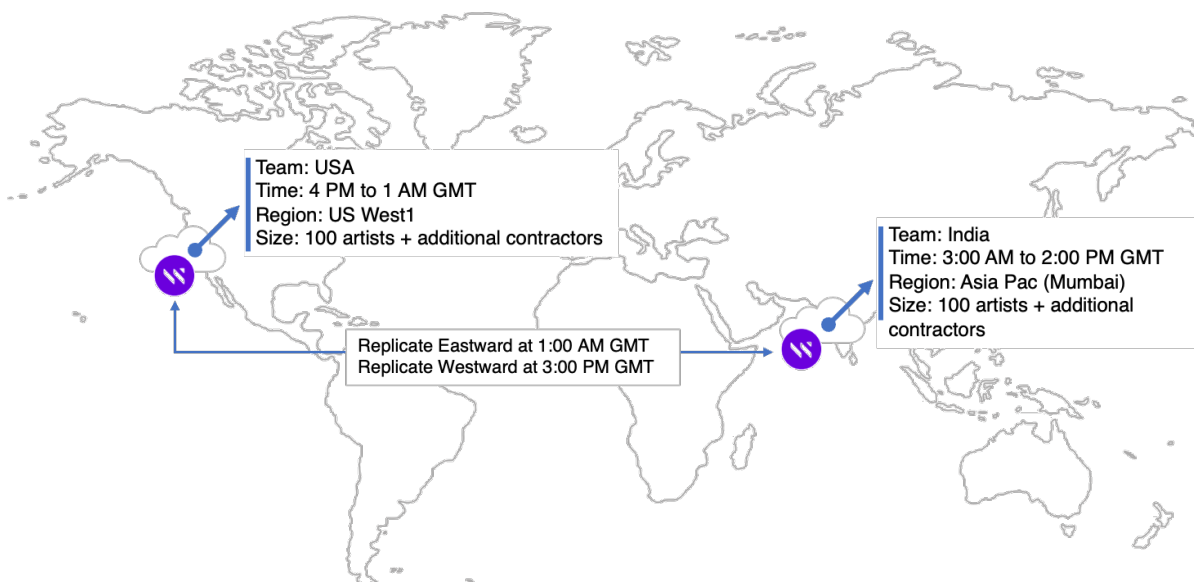


FIG. 4 WEKA enables global collaboration between sites by easily replicating data between sites

VFX Pipeline Design Options

This reference design supports a number of additional design options that make it possible to tailor a VFX pipeline to address specific requirements.

Several additional AWS integrations are available:

- **Amazon CloudWatch.** WEKA offers integration with CloudWatch for monitoring and logging.
- **Tiering.** WEKA supports tiering of cold data to S3 with instant retrieval, significantly reducing storage costs.

Data stored in WEKA Data Platform can also be easily integrated with other DCC tools. This includes the host of infrastructure services that come with Autodesk Flame that facilitate workgroup activities, including collaborating among multiple Flame artists, performing media I/O in the background, and scaling rendering options.

Supported Autodesk services include:

- Backburner for queue management of Autodesk Burn nodes as described earlier
- Autodesk Wire for media sharing and collaboration
- Autodesk Wiretap Gateway for accessing media and metadata from Creative finishing applications

Real World Example

A joint Autodesk and WEKA customer has implemented Autodesk Flame and WEKA Data Platform as part of their VFX studio running in a public cloud (AWS). The customer's VFX Studio Technology team supports the VFX Pipeline team's operational requirements:

- Spans two locations – region 1 and region 2 with 100 artists at each location collaborating on the same projects using a follow-the-sun model.
- Accommodates an additional remote artist contractors during crunch time at site 2 who are given VPN access to the local Flame sessions.
- Satisfies defined service levels for responsiveness through local access to Flame sessions through Teradici CAS (now HP Anywhere) and availability ensured through local and remote disaster recovery)
- Drives an end-to-end, Autodesk-powered workflow pipeline including supporting microservices (for example: check-in/check-out, task status, pipeline dashboard).

The solution consists of:

1. Two Availability Zones – each in its own VPC and located in a different region
2. VPC peering between the two regions
3. Autodesk Flame running on G5 instances; deployed using AMI
4. Autodesk Burn running on G4dn instances for rendering
5. Autodesk ShotGrid for production tracking
6. Delivery of Flame and other application output using Teradici CAS (now called HP Anywhere)
7. Eight (8) node WEKA cluster using i3en.6xl instances – configured to autoscale as needed
8. Object storage (Amazon S3) for tiering and snapshot storage

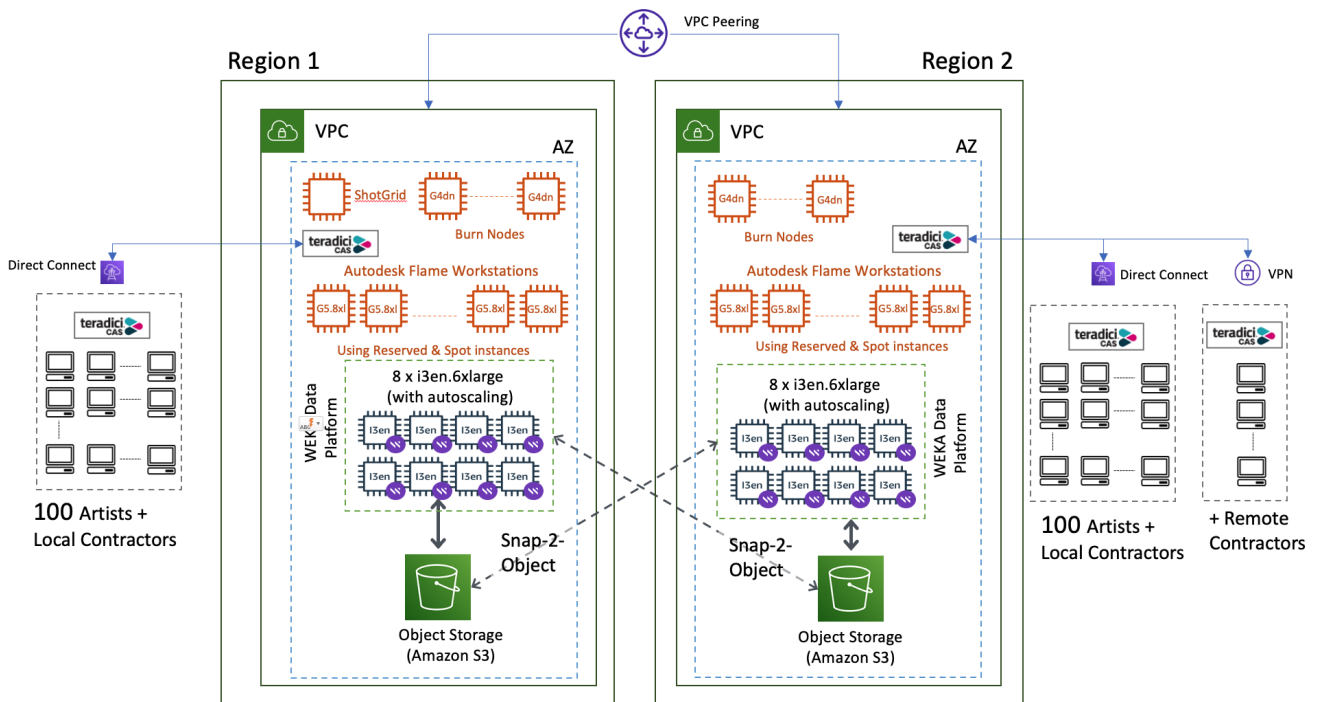


FIG. 5 WEKA Data Platform plus Autodesk Flame and related functions deployed in a Public Cloud

Here is the workflow that is used to keep the two sites in sync. Each site can access the previous day’s work from the other site.

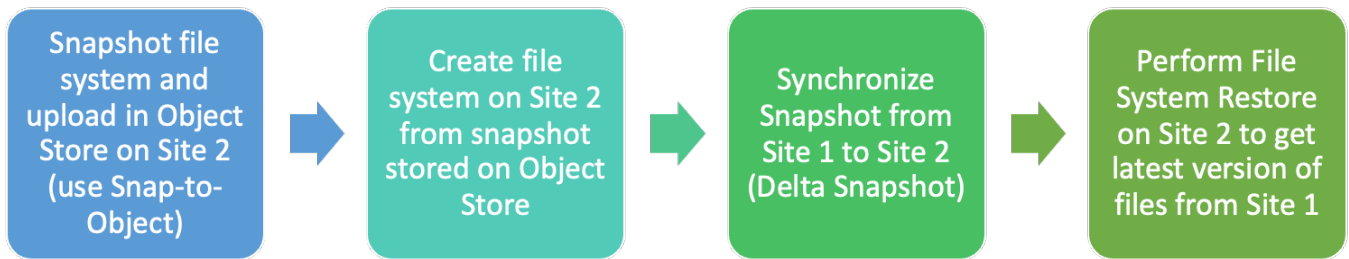


FIG. 6 Leveraging WEKA Snap-to-Object with Synchronized Snapshots to sync data between sites.

Summary

Setting up additional Autodesk Flame Workstations used to take weeks with upfront costs. The reference design described in this document enables studio technologists to deploy Flame Workstations on demand without sacrificing performance or availability. This reference design satisfies the requirements for distributed VFX and finishing workflows including:

- Studio in the cloud
- Simple scaling
- Follow-the-sun workflows

In collaboration with Autodesk and AWS, WEKA has identified the best methods for deploying and scaling Flame and related services in the cloud, enabling the creation of elastic workgroups that better satisfy artist needs. This includes the ability to share projects across multiple offices, as well as include remote artists in collaborative workflows.

The WEKA Data Platform offers innovative storage capabilities that increase performance and availability, eliminating the need for multiple types of storage and frequent data copies.

Getting Started with WEKA

WEKA is committed to helping M&E companies leverage the latest digital technologies to succeed in the face of massive data growth. In addition to enabling VFX and finishing in the cloud, we can also assist in the following areas:

- Reduction in turnaround for each pipeline stage: Lighting, rotoscoping, compositing, rendering
- Real-time rendering
- Virtual production
- Next-generation machine learning VFX and finishing pipeline
- Computer vision and generative modeling

If you're ready to get started, we're here to help you build your next-gen VFX and finishing pipeline.

References

Product & Technology	
WEKA	
WEKA Data Platform Datasheet	https://www.WEKA.io/wp-content/uploads/files/2022/10/about-WEKA-data-platform.pdf
WEKA Data Platform Architecture White Paper	https://www.weka.io/resources/wekaio-architectural-whitepaper
Autodesk	
Autodesk Flame	https://www.autodesk.com/products/flame-family



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