

Best Practices for Deploying ClioSoft SOS7 on AWS

May 2019



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Abstract

Semiconductor Integrated Circuits (ICs) are at the center of a number of modern technological innovations. To keep up with the ever-increasing pace of innovation, IC design teams require robust, scalable design management (DM) solutions to enable seamless global collaboration and to increase productivity. This paper outlines the advantages of and best practices for deploying the ClioSoft SOS design data management software on the AWS Cloud platform. Also included is a reference architecture to guide semiconductor CAD and IT organizations in the implementation of a design data management solution in the cloud.

Introduction

The Design Management (DM) platform is a crucial component of IC design environments. At its core, a DM platform is a revision control system for a geographically and functionally diverse team of engineers and managers who contribute to the successful tape-out of a chip or the release of an Intellectual Property (IP) block. While managing revisions of design objects is only a basic requirement of DM, the design data, flows, and methodologies used in IC design environments mandate that a DM does a lot more. The following are some of the key features of a DM tool that bring efficiency and elegance for an IC design team.

- **Version control** – Tight integration of a version control system into Electronic Design Automation (EDA) tools from vendors such as Cadence, Synopsys, Keysight, and Mentor (Siemens) for a better user experience.
- **Design objects as Composite objects** – The ability to handle multiple files as one, logical, atomic object for version control. Typically, a schematic, layout, or a physical design database is a collection of files.
- **Object locking** – Mandatory locking of binary design objects to prevent concurrent edits and merging. A significant number of objects in IC design flows/data are binary and it is extremely difficult and time consuming to merge if they are concurrently edited.
- **Labeling** – Tag design objects with movable and immovable tags to capture the design team's intent.
- **Optimizing storage** – IC designs are notably different than software design flows because of the size of some of the design objects that are managed. In the absence of a good DM solution, storage can be unnecessarily expensive.
- **Connecting teams** – Robust solutions for connecting remote design teams in the same company, as well as with partner organizations.
- **Reuse** – Support for design reuse within and across projects.
- **Third-party tool integration** – Connect with third-party tools, such as Issue tracking systems, through APIs.

ClioSoft SOS7 Design Management

The ClioSoft SOS7 Design Management platform is a cohesive environment that allows geographically and functionally diverse teams to focus on design implementation. SOS7 is specifically designed to address the needs of hardware flows.

The SOS7 platform seamlessly integrates with many EDA tools and fits non-intrusively into EDA tools and flows. Design data from various tool vendors and flows can be managed under one repository. Tight integrations with schematic and layout tools (such as Cadence Virtuoso and Keysight ADS) allow users to work natively within the tool.

SOS7 also integrates with bug tracking tools (such as Atlassian Jira), CI/CD tools (such as Jenkins) and open source editors (such as vi, emacs, and eclipse). A comprehensive command line interface and APIs supported by SOS7 allow quick and easy integration with virtually any tool and standardized design flow.

The SOS7 design data management platform provides a unique feature, the Cache server, that helps to manage disk space and minimize the effect of network bandwidth latency on the user experience. SOS7 creates shared smart cache areas where all design files, which are not being modified, are hosted. User access to these design files is provided by tool-managed Linux symbolic links in the user's working directory. This is one key feature that can help reduce up to 90% of the design team's storage requirements. A cache server also functions as an agent that prefetches the files for remote users, in case of geographically diverse scenarios. This means that remote teams do not wait on data to be available at their site, so they don't waste time when a tape-out deadline is approaching.

A typical design database is a collection of files. Often, the design engineer is not concerned about the individual files that are changed in the database as a result of the run. From a management-of-the-design-data perspective, a change to any file in the design database should be treated as a new revision of the design data. SOS7 incorporates ClioSoft's patented UDMA technology, which allows CAD teams to define a composite object as a collection of files. The tool automatically tracks changes to individual files in a composite object, and translates it as changes to the design object, instead of the individual files changed during the design cycle. This is a very powerful feature for design teams to have when they manage a large quantity of data.

Design teams are increasingly incorporating IP reuse methodologies to shrink product development cycles. An IP can be developed in-house or may be purchased from an external vendor. The SOS7 design platform incorporates referencing features that allow

design teams to choose specific releases of IP for their project. SOS7 also provides an option to track IPs used in upstream products in real time.

The ClioSoft SOS7 design management platform scales well for teams of all sizes. The customer base supported by the SOS7 platform ranges from small startups with a few engineers to large IC manufacturers with several products developed concurrently by thousands of engineers. With proper setup and configuration, the SOS7 design management platform can be scaled for the requirements of any team.

Startups and Small Deployment

A small startup might have only a few engineers working on an initial product idea. The notable characteristics of such organizations is that compute resources are scarce and often the CAD and IT teams are also part-time design engineers. [Figure 1](#) shows a simple, on-premises deployment that might resemble a startup environment.

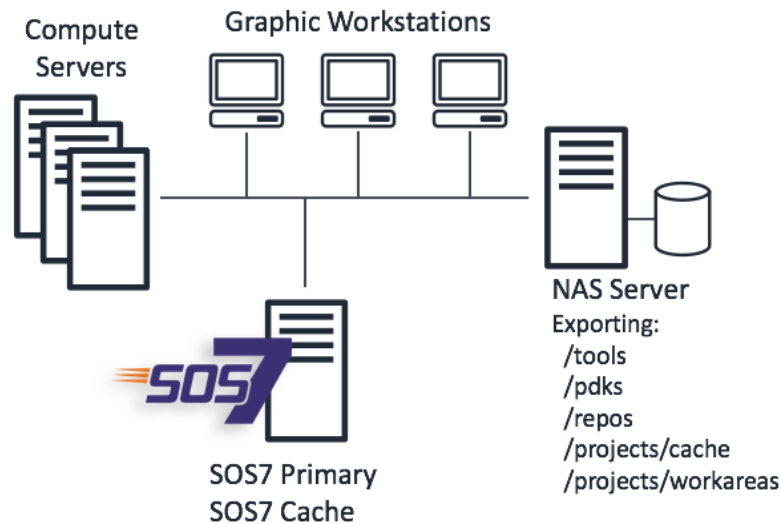


Figure 1 – SOS7 Startup Eenvironment

The workflow of a startup environment typically includes:

- The high-performance NAS file server exports volumes using NFS protocol
- Each machine (servers and workstations) mounts the NAS-exported NFS volumes
- Workstations render high-end graphics and the server accesses large data stored on the NFS volumes for typical activities

Design tools, such as layout editors, must be able to render complex graphics that display millions of polygons. The responsiveness of the EDA toolset directly affects user experience. Another challenge of this on-premises setup is that shared NFS/NAS drives can easily be a bottleneck. Local drives offer strong performance, but the complex logistics involved in replicating a large amount of ever-changing data on several local drives mean it's not a practical solution for most customers.

SOS7 is optimized for this type of design environment, which includes shared, smart cache areas that hosts all the design files that are not being modified. User access to these design files is provided by tool-managed Linux symbolic links in the user's working directory. This is one key feature used by most ClioSoft customers to create links to the cache workspace, because it can help to reduce the storage requirements of the design team by up to 90%.

Enterprise Deployment

In principle, enterprise deployments are identical to startup design environment, but tend to be more complex. Typically, there are multiple teams of engineers working on multiple design projects. To handle more complex design flows and datasets, there are multiple NAS/NFS servers and compute devices on the network.

When you connect multiple sites across geographically diverse teams (see [Figure 2](#)), you introduce an additional level of complexity. Typically, each site is (or should be) a replica of a main design site.

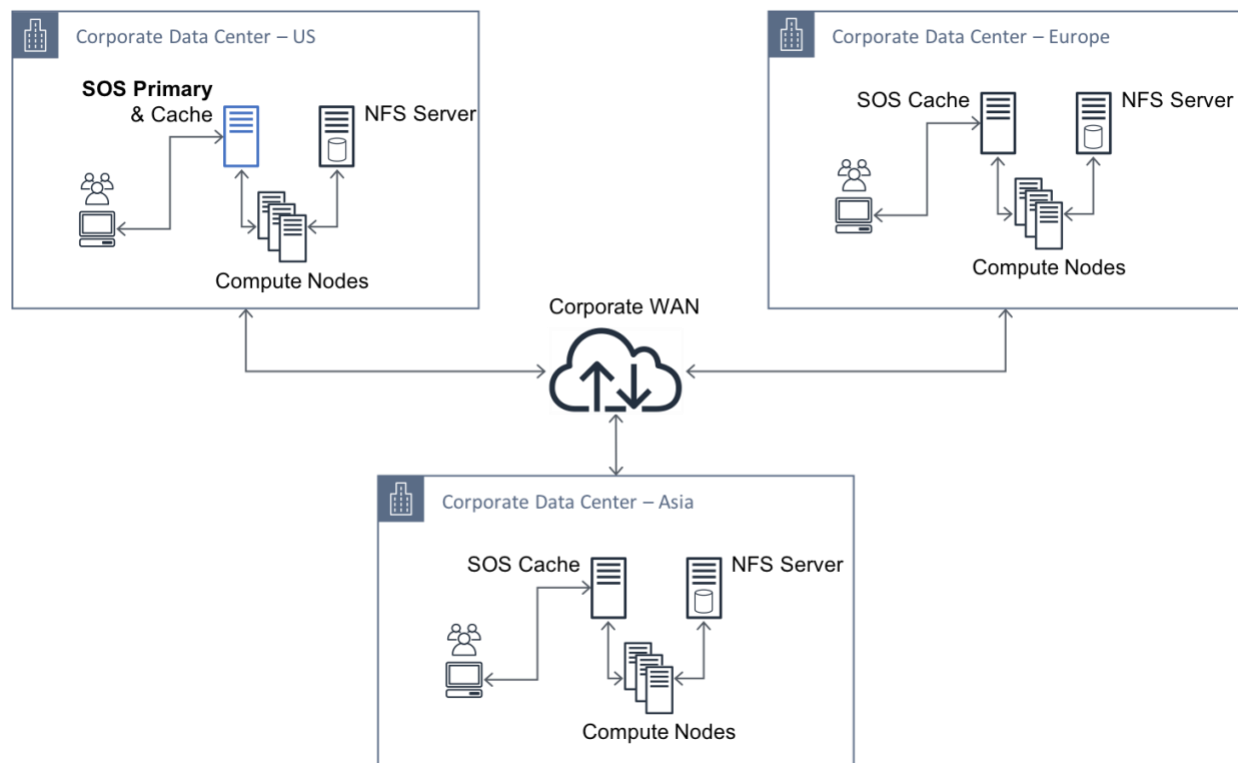


Figure 2 – Multi-Site Enterprise Deployment

The cache server provides a robust solution in enterprise deployments at both primary and remote sites. Optimizing storage is a critical issue at both primary and remote sites when your CAD and IT teams have a larger, and more complex, data set that must be shared across sites. By design, a cache server only fetches data that is consumed at that site, and you can configure it to prefetch the data before the user requests it. Because it tracks which data is being used, it can also scrub the unused design objects. The SOS7 Cache server not only optimizes the storage requirements, it also reduces the effects of latency to transfer data to the site.

SOS7 supports distributed hosting of project data, which means a project repository can be partitioned to be hosted locally at the sites where the majority of the team is located, and it can be made available and tracked at other sites using SOS7 referencing feature set. The distribution of SOS7 server and projects across sites enables enterprise deployments teams to maximize their resource usage while providing uncompromised data availability.

Enterprise Collaboration

A growing trend the IC design industry is a need to collaborate between teams from different companies. Several large design houses co-develop their products with small startups and specialty design houses. SOS7 can support this combination of design development models with SSL communication and server-side authentication support.

Challenges of the On-Premises Environment

Peak-capacity planning – On-premises environment setup requires an upfront capital investment. Your IT teams must plan for the compute and storage resources for all phases of the project. Depending on the nature of the project, this is not a small task. Your project team might reach maximum capacity, which can impact productivity or leave hardware resources unused. Both cases could impact your project schedule and costs.

Continuous upgrades – As your project progresses, the simulation and verification tasks become more complex and consume more resources. The CAD and IT teams must constantly upgrade the infrastructure to handle the workload. Planning these upgrades is more difficult if multiple teams share the infrastructure and have competing deadlines. Typically, even well-planned hardware upgrades are time consuming and cause disruptions to design teams.

Reliability and uptime – Reliability is a major concern with an on-premises CAD infrastructure system. One of the biggest concerns for any data center is server uptime. If the CAD system goes down, the loss of productivity could significantly increase engineering costs. Depending on your tracking method, tracking and calculating 100% uptime can be imprecise.

High-availability & disaster recovery – Server farms, which were previously maintained at each design center, are often consolidated into a limited number of data centers. For example, if your company has 20 design centers across America and Europe, you might consolidate all their servers into four data centers, geographically

distributed across the two continents. Maintaining the high-availability of data centers is challenging and often depends on the reliability of external factors. In addition, IT teams need a well-curated plan for disaster recovery for server farms.

Design Management in the Cloud

Deploying your IC design environment in the cloud allows for high scalability, high availability, and reliability that is difficult to achieve with an on-premises environment. The challenge is how to set up such a complex design environment in the cloud, while matching the requirements of startups and enterprise deployments.

Deploying a ClioSoft environment is a simple and straightforward process. To make your deployment easier, you can leverage AWS CloudFormation and an Amazon Machine Image (AMI) to build your ClioSoft infrastructure on AWS in less than an hour. After your initial environment is setup, you can access existing design data and collaborate with other design teams, vendor organizations, and quickly enable global access controls.

AWS Cloud Usage Model

The AWS Cloud provides a robust and extensible platform that you can use to implement a complete design environment in the cloud, including a wide range of compute and storage solutions. You can implement the ClioSoft SOS7 design management platform to optimize disk space while making sure the data is available in the AWS Cloud.

Hybrid AWS Cloud and On-Premises Model

The hybrid environment (see [Figure 3](#)) extends your existing data center to the AWS Cloud. You can configure your entire SOS7 environment to access both your on-premises data center and your environment in the AWS Cloud. This allows to have an initial proof of concept phase, during which you can determine network, storage, and compute performance parameters, before you release to production.

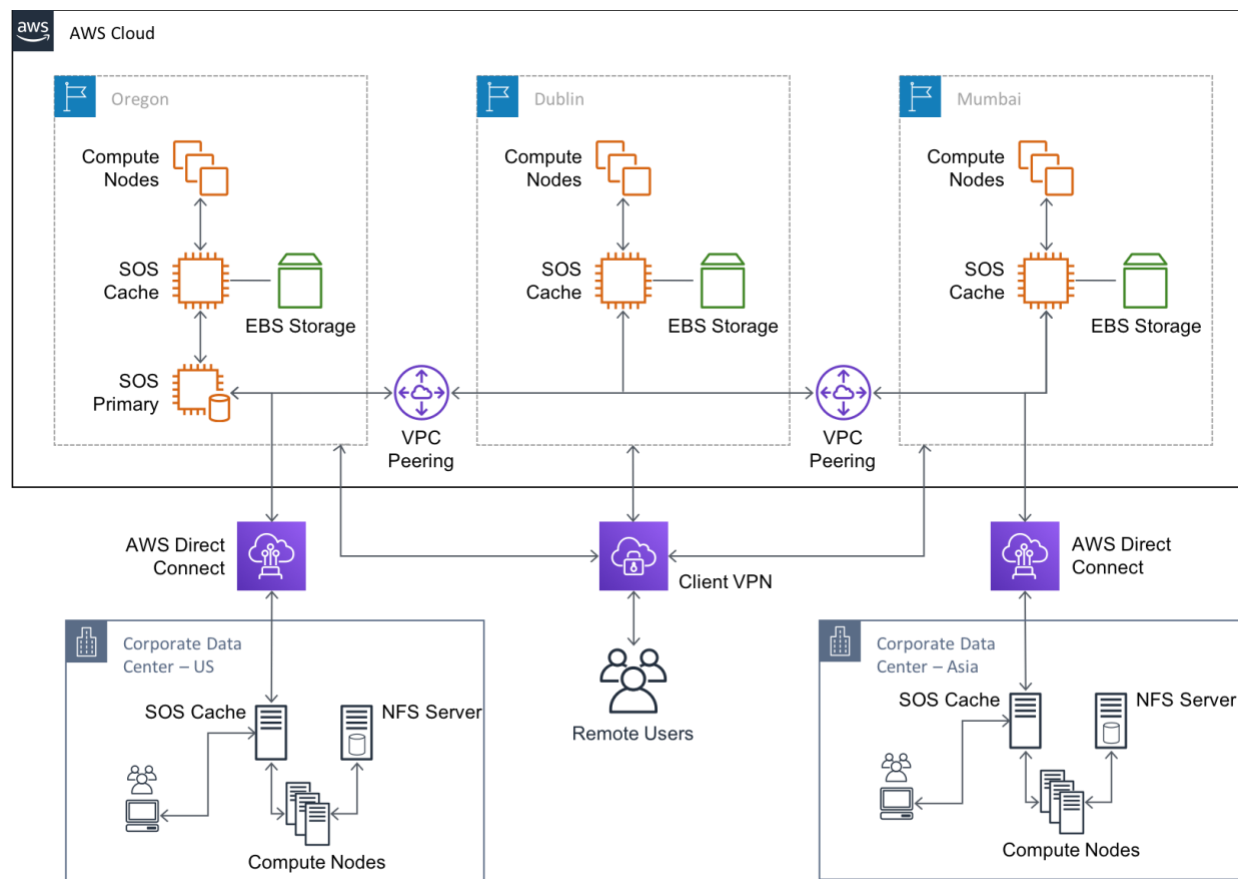


Figure 3 – Hybrid environment

In this hybrid environment, [Amazon EC2 instances](#) host all of the primary SOS7 servers and the repositories, with the SOS Cache hosted in the on-premises data centers.

The distributed architecture support of SOS7 servers enables you to host SOS7 repositories in multiple [Amazon EC2 Regions](#), such as Oregon, Virginia, Ireland, and Singapore. Each Amazon EC2 Region is designed to be completely isolated from the other Amazon EC2 Regions. This achieves the greatest possible fault tolerance and stability.

AWS also provides a number of storage solutions. The choice of the storage solution depends on the size of the design team, project, and performance requirements of the jobs to be run in the cloud. For more information see [Cloud Storage with AWS](#).

[Amazon CloudWatch](#) provides you with data and actionable insights to monitor your applications, understand and respond to system-wide performance changes, optimize resource utilization, and get a unified view of operational health. You can configure CloudWatch for detailed visibility into your SOS7 environment.

Though the connectivity between your on-premises environment and AWS can be established through basic ISP-powered networks over an [AWS VPN](#), depending on the design team size, for optimal performance, you can also set up a solution such as [AWS Direct Connect](#).

The hybrid model also provides a key feature: scaling for peak usage. The project data is available on the AWS Cloud already. Setting up an SOS7 Cache Server on an EC2 instance in all AWS regions allows your projects to scale quickly. In the model in [Figure 3](#), because the data for their jobs is already available in the SOS7 Cache server, the design teams that want to schedule simulation and verification jobs can launch EC2 instances on-demand based on their compute needs.

This type of deployment can be ideal for medium and large environments.

All-in AWS Model

The all-in AWS model (see [Figure 4](#)) is no longer dependent on the on-premises data centers, you only need a desktop client to access the AWS Cloud. A lack of initial investment in on-premises compute infrastructure can also be a significant factor. Typically, you can run such environments with basic ISP connectivity over an AWS VPN.

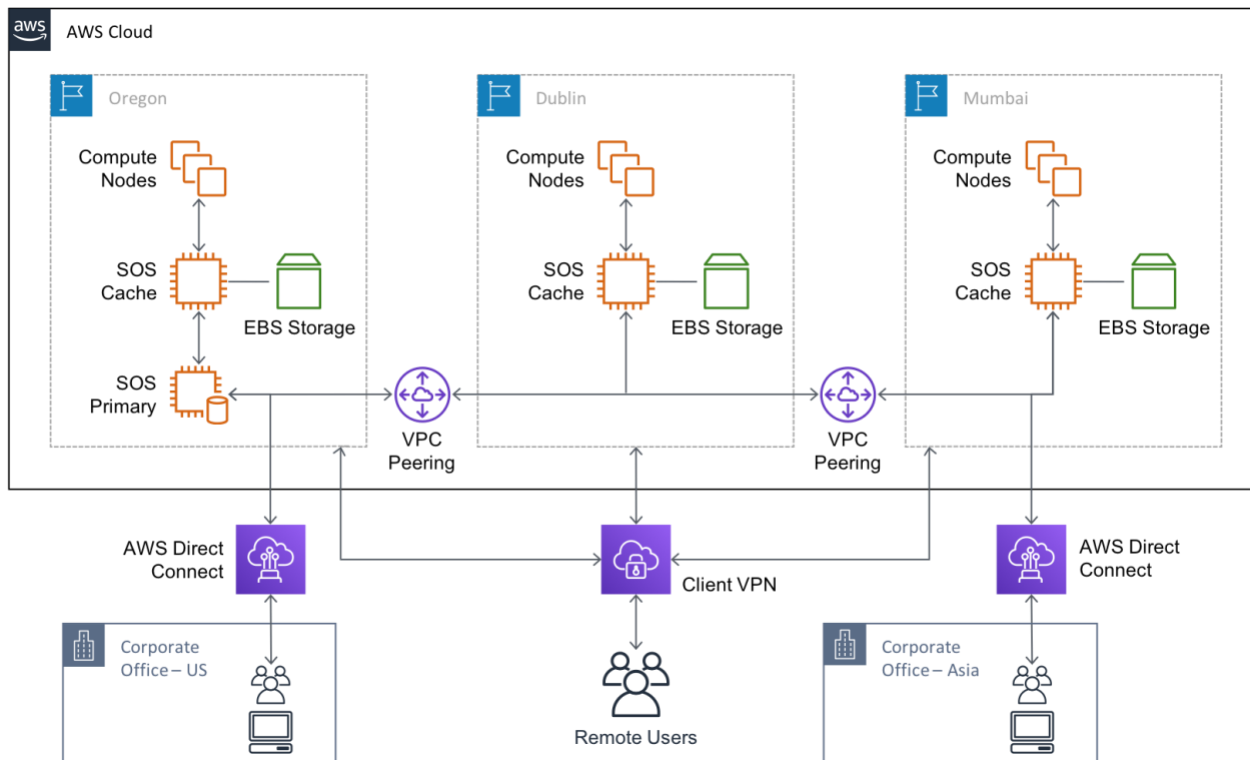


Figure 4 – All-in AWS architecture

Because the entire design environment in this architecture runs in the cloud, the requirements for the design teams' access to the tools and design data must be considered carefully. Design teams often must run workstations that support high-end graphics to design and debug simulation data. Though you can use open-source solutions such as VNC to access workstations, you can also use commercial solutions, including [AWS WorkSpaces](#).

Enterprise Collaboration

The AWS Cloud is an ideal solution for collaborating on design development activities between partner companies. An enterprise that collaborates with a specialty design house to co-develop an IP can setup an all-in-cloud solution for the specialty design house. With proper security setup, the availability of design data can be restricted to known sites.

Get Started With ClioSoft SOS7 on AWS

ClioSoft AMIs on AWS Marketplace

ClioSoft Inc. publishes a standard, one-click install solution for the SOS7 primary server that you can get on the AWS Marketplace. The Marketplace AMI is preconfigured with the latest SOS7 release, which can be used by 50 concurrent users consuming up to 500GB of repository disk space.

After evaluating several options available on AWS, ClioSoft Inc. recommends the following configuration:

- RHEL7 or Amazon Linux
- Amazon Elastic Block Store (Amazon EBS) GP2 volume 500GB disk space
- All dependencies to run the SOS7 server
- SOS7 continuous backups on Amazon Simple Storage Service (Amazon S3) buckets
- m5.xlarge instance for 50 users

For a quick test or a proof of concept, the AMI is preconfigured with a test SOS7 server definition and a test project. We strongly recommend conforming server and project names to your corporate conventions for production use.

ClioSoft strongly recommends setting up a backup for primary servers before you start up the primary server. The AMI is preconfigured to mount an Amazon S3 bucket. The SOS7 server definition can use this mount point to run continuous hot backups.

The AMI is also provisioned to use the instance as a FLEXlm license server. If you are an existing ClioSoft customer, you can request license files from ClioSoft by contacting support@cliosoft.com. If you intend to evaluate ClioSoft SOS7 software,

contact the ClioSoft Sales team at sales@cliosoft.com. The FLEXIm license file requires you to use specific ports, which you can configure when you set up your Security Group.

ClioSoft strongly recommends that you start up a single SOS7 service on an instance launched with the AMI available on the AWS Marketplace. The SOS7 service can host multiple, unlimited projects. However, for ease of management, we recommend that you set a limit of less than 100 projects on the SOS7 server.

If you expect to have more than 50 users connecting to the server, or expect to use more than 500GB of repository storage, you can contact ClioSoft Support (support@cliosoft.com) for customized recommendations.

The ClioSoft SOS7 Marketplace AMI is available in these regions: Virginia, Oregon, and Dublin. The AMI is available at: <https://aws.amazon.com/marketplace/pp/B07SBJZD6N>

Reference Architecture

The reference architecture in [Figure 5](#) shows the process to deploy an SOS7 environment with two CloudFormation templates: one for the SOS7 setup and one for the NFS server. This architecture is very similar to the deployment for an on-premises environment, and can be used to scale from a small design team to globally located large-scale collaborations.

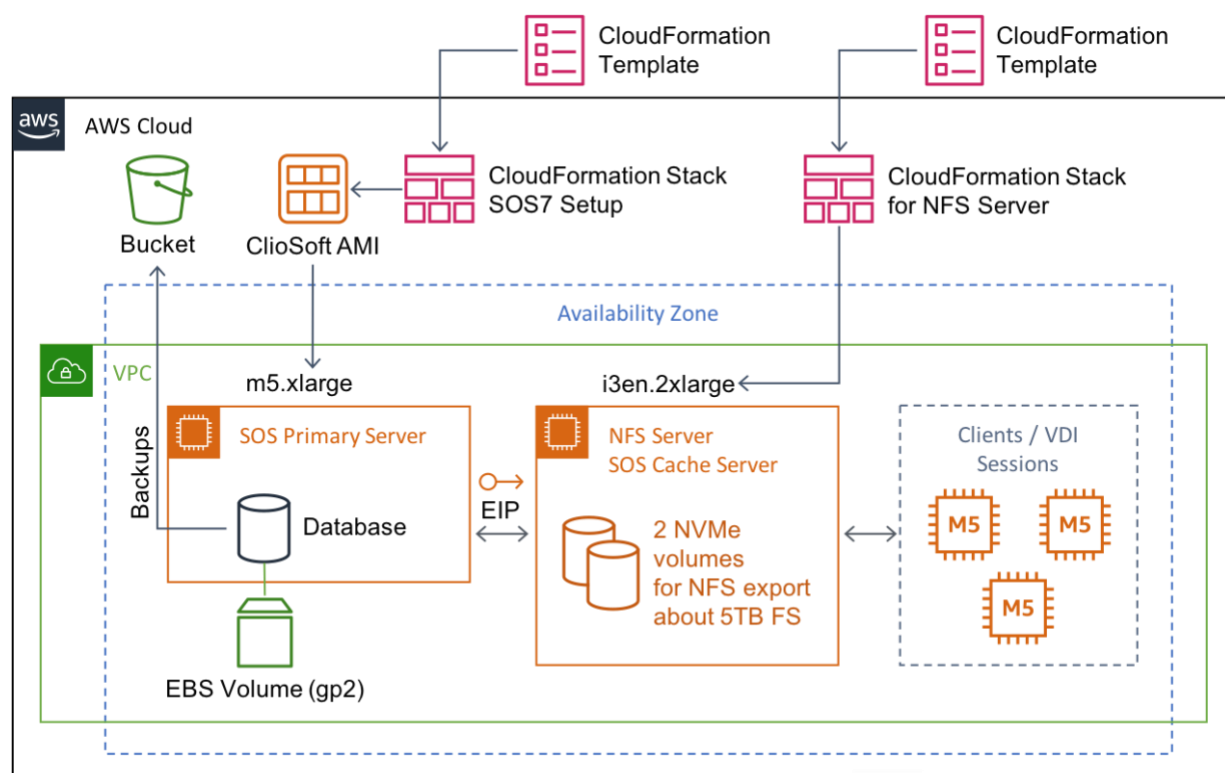


Figure 5 – Startup & Small Deployment

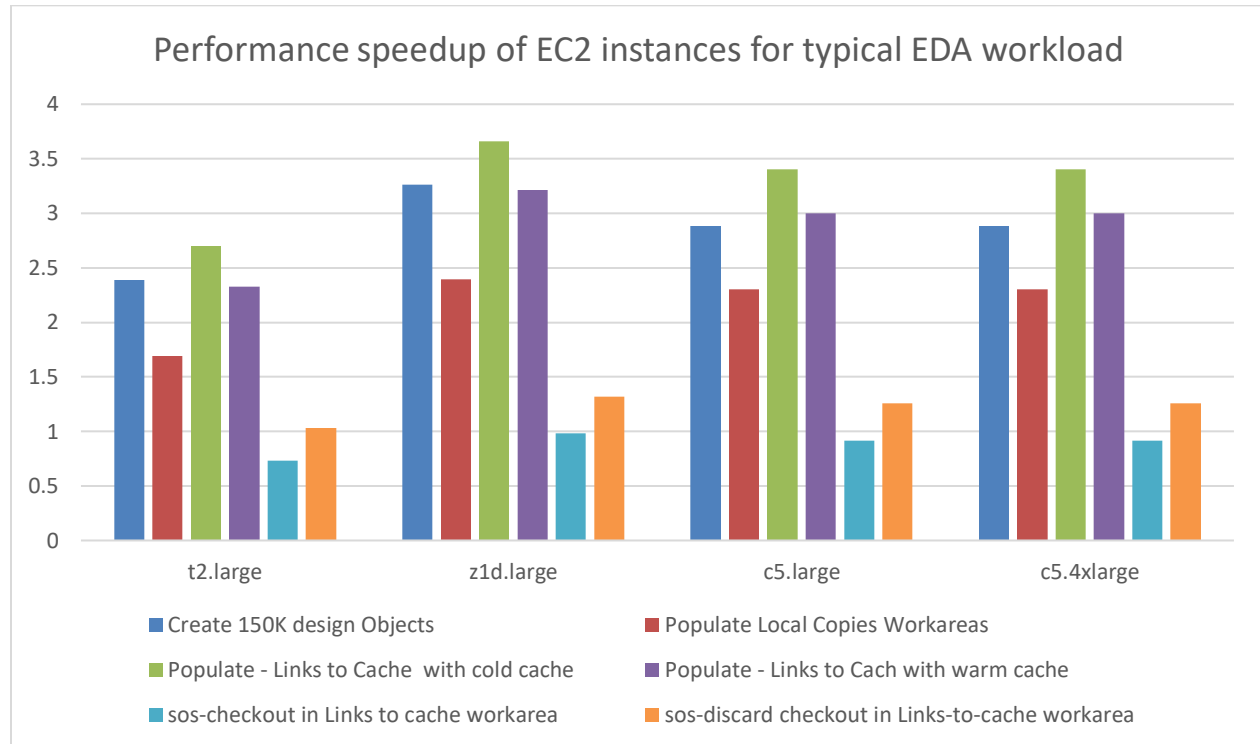
Performance & Scaling

Expected Performance on the AWS Cloud

Datasets used in EDA workloads are somewhat unique. A typical design engineer's work area consists of large number of binary files, which are large, often in GB size. The dataset used to test the AWS Cloud infrastructure is a typical to design teams that create high performance SOCs, and includes analog and digital design libraries.

For performance benchmarks, the reference architecture in [Figure 5](#) was set up in the AWS Cloud with a goal to compare it to a typical, on-premises infrastructure. ClioSoft used a number of standard benchmark tests to compare the two environments, which are similar, but not exactly the same because the options available on the two platforms are different. The results of the comparison of the on-premises environment to the cloud environment showed the typical operations gaining 2–3.5x in performance.

Note that this is not a strict apples-to-apples comparison between the two infrastructures since comparable options are not available on the two platforms. The following chart shows the performance speedup of some of key operations observed on EC2 instances for a typical EDA workload.



Future Efforts

AWS Native Reference Architecture

The previous architectures in this paper provide guidance for building a functional, production-ready ClioSoft SOS7 environment. The additional architecture in [Figure 6](#) is an AWS native approach that reduces the customer-managed overhead by using AWS managed services. For example, you can eliminate the NFS server and use Amazon FSx for Lustre, and move the database to Amazon Relational Database Service (RDS).

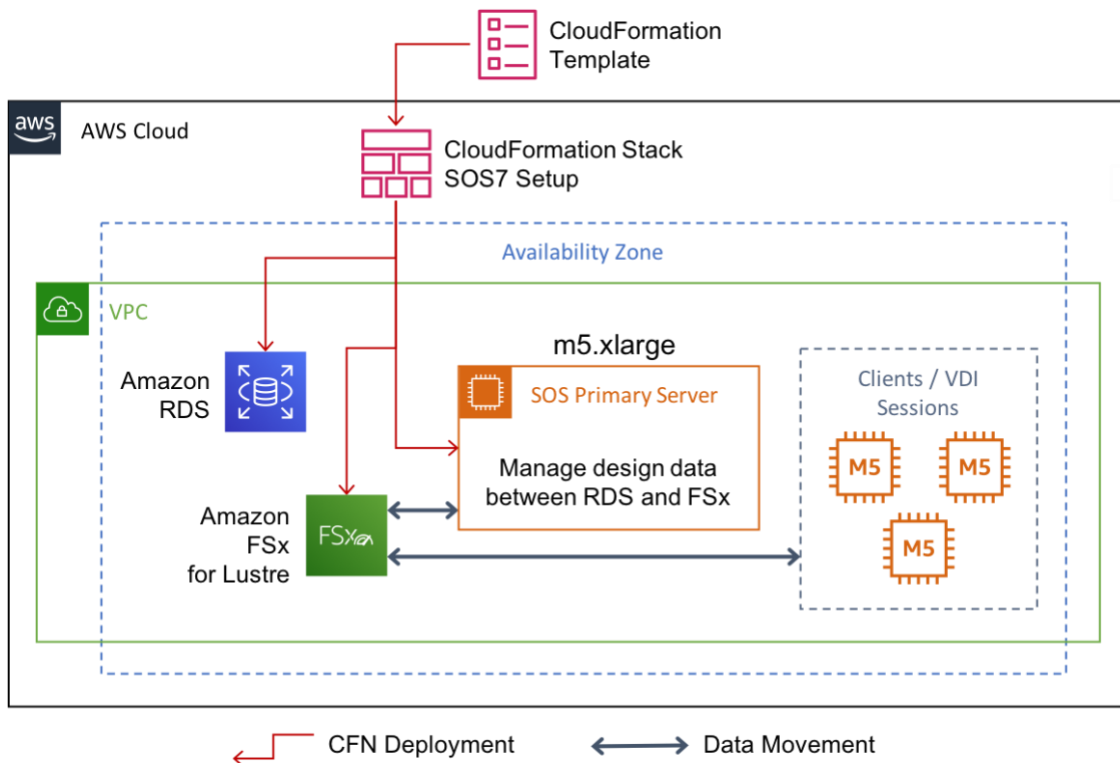


Figure 6 – AWS Native Reference Architecture Example

Documentation & Solutions

ClioSoft Inc. is partnering with AWS to create documentation and workshops on how to implement an optimal AWS native solution. This includes, but is not limited to:

- Sample CloudFormation templates for optimal setup environment
- CloudWatch to monitor the performance of your SOS server
- Integration of additional ClioSoft products with AWS infrastructure.

Conclusion

ClioSoft SOS provides a scalable, multi-site design data management solution that enables IC design engineers to efficiently collaborate with teams across the globe, which increases engineering productivity. By deploying a well architected ClioSoft SOS infrastructure on AWS, you can benefit from high levels of scalability, availability, and reliability that is difficult and expensive to achieve in an on-premises environment. Additionally, the distributed nature of the ClioSoft SOS data management solution ensures your design and IP data is intelligently synchronized to the cloud, enabling the seamless bursting of peak EDA workloads to the cloud.

Contributors

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Further Reading

For additional information, see:

- [ClioSoft SOS7 Product Page](#)¹
- [Optimizing Electronic Design Automation \(EDA\) Workflows on AWS](#)²

Document Revisions

Date	Description
May 2019	First publication

Notes

¹ https://www.cliosoft.com/www2/products/soc_design_management/

² <https://d1.awsstatic.com/whitepapers/optimizing-electronic-design-automation-eda-workflows-on-aws.pdf>