Robust Design Data Management for Hybrid Clouds

eBook

KEYSIGHT

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Introduction

Amid rising design complexities and heterogeneous integration, the cloud is a valuable resource for semiconductor design companies. It offers the flexibility and scalability to meet peak demands, access top-tier resources and tools, and achieve faster time to market.

However, the cloud presents critical questions for IT, computer-aided design (CAD), and design team leaders: How can the organization accommodate the distinctive infrastructure and data sets of electronic design automation (EDA) in the cloud? How can it ensure compliance with strict data privacy and security policies? And while some tasks, such as emulation, will stay on premises, how can teams integrate various workflows across different environments?

This eBook discusses the essential data management strategies to maximize the benefits of the following:

- on-premises systems
- public or private clouds
- hybrid-cloud models

The eBook introduces a surgical, design-aware approach to data management to maximize the efficiency of cloud resources while balancing on-premises controls. It wraps up with two cloud usage models using Keysight Design Data and IP Management. These practical examples will help organizations set up robust design data management to prepare for a hybrid cloud journey.

CHAPTER 1

To Cloud or Not to Cloud

In many large semiconductor organizations, design leaders balance network, software, cost, data security, and even physical security as part of their cloud strategies. Let's examine the emerging challenges and trends for cloud and on-premises technologies.

Key Drivers for Cloud-Based Design Workflows

Three trends aim to amplify the adoption of the cloud for its flexibility and elasticity:

1. Addressing peak loads: Bursting simulation and verification tasks to the cloud has gained popularity among large semiconductor design organizations. This method enables faster time to market and is cost-efficient for immediate, short-term needs without on-premises investment.
2. Leveraging artificial intelligence (AI) in EDA: EDA vendors like Keysight incorporate AI into design workflows. AI's exponential data demands necessitate more scalable computing and storage solutions.
3. Boosting verification efficiency: Verification remains the most resource-intensive phase of the product development life cycle. As teams run more designs, the push for faster time to results compels them to use clouds for both burst and sustained capacity.

Advantages of On-Premises Infrastructure

Despite the growing trend toward clouds, many semiconductor design organizations continue to leverage the on-premises infrastructure for the following reasons:

- Enhanced control: On-premises systems offer more control over the infrastructure and enable quicker response to outages, with on-site IT teams making immediate fixes.
- Compliance with security requirements: An on-premises approach allows sensitive design files, intellectual property (IP), and systems to stay behind the company's firewall. Specific industries have stringent regulatory standards that dictate how and where to store data.
- Reduced latency: For design tasks requiring high-performance computing, the proximity of on-premises servers can reduce latency compared with cloud servers.
- License and legal constraints: Large companies may have invested heavily in third-party IPs. Since the cloud is outside the corporate LAN, additional licensing steps and stringent security checks are necessary to enable cloud use.

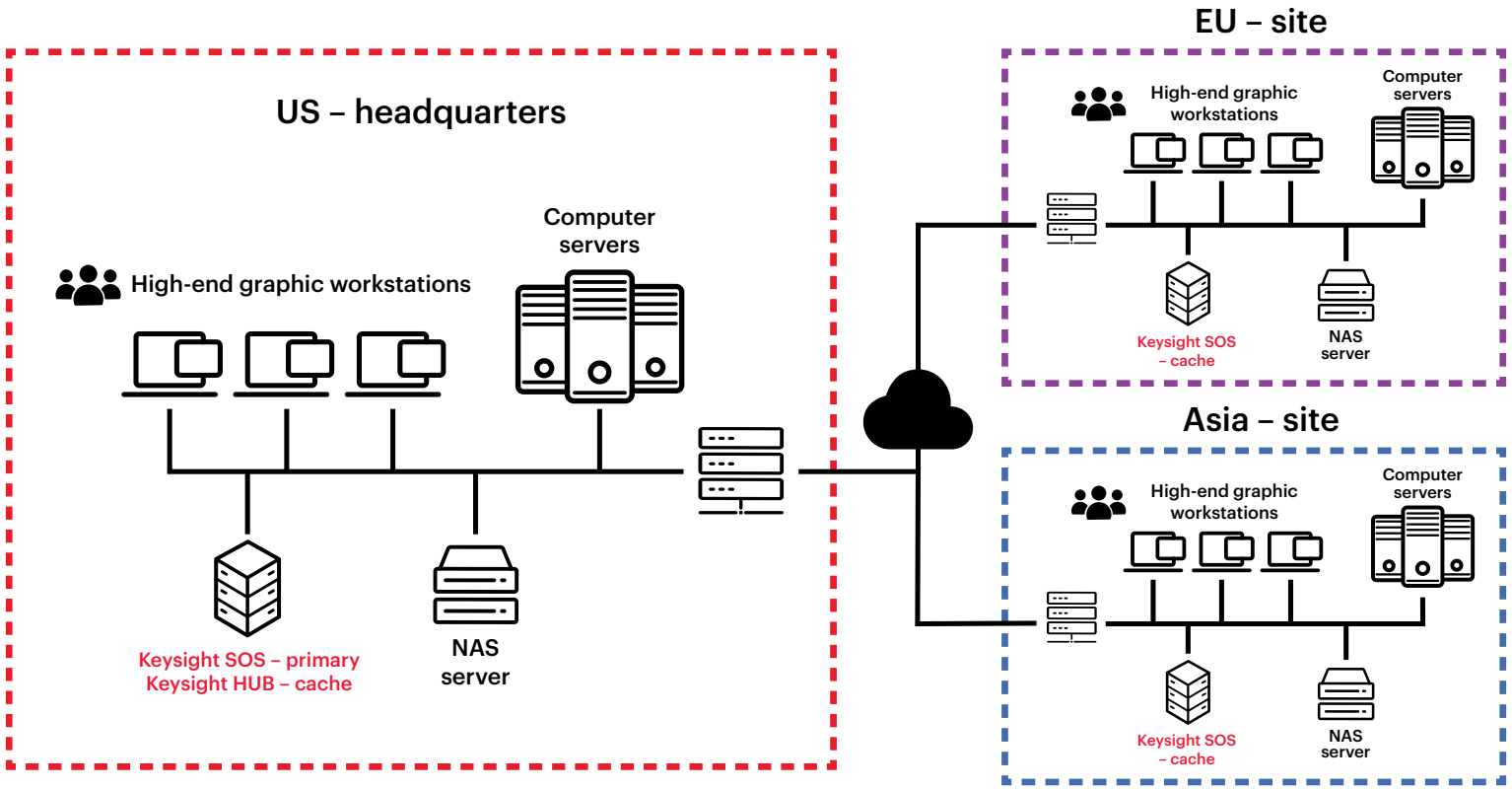


Figure 1. An on-premises example

This dichotomy underscores the necessity of a hybrid approach, combining the cloud's scalability with the option to keep specific design data and workflows on-premises.

CHAPTER 2

Maximizing the Value of Hybrid Cloud Strategies

For years, semiconductor design organizations have relied upon on-premises data centers with fixed computing capacity to run their design workflows. However, with increasing computational demands, they are looking for cloud-based solutions. Migrating EDA workloads to the cloud can present technical and economic challenges. Therefore, using on-premises data centers combined with the cloud is often a lower-risk approach. This hybrid strategy enables an initial proof-of-concept phase, during which design teams can fine-tune network, storage, and compute performance parameters. Keysight has observed this transition to hybrid cloud models among large organizations and startups.

Benefits of a Hybrid Approach

The main advantages of adopting a hybrid strategy include flexibility, security, and resilience.

Flexibility

Computing demand fluctuates cyclically throughout the product development life cycle. The cloud service provider automates provisioning, enabling companies to burst capacity into clouds during peak loads while keeping fewer portable workloads on-premises. Companies can return the resources to the cloud when the tasks are complete. This process enables companies to achieve more efficient IT spending without constraints from their existing infrastructure.

Security

Companies can store sensitive design data using on-premises resources for regulatory compliance. IT teams gain more control over data privacy and security settings through encryption, access control, or geofencing.

Resilience

By developing portable applications operating on-premises and in the cloud, businesses can maintain operations during system outages, minimizing unplanned downtime. This setup also aids in quick disaster recovery and minimizes unplanned outages.

Data Management Challenges with Hybrid Models

The shift to a hybrid cloud model introduces significant challenges in managing design data, particularly in network storage, usability, and workflows.

Challenge No.1: Complexity of EDA data

EDA workflows involve gigabytes of data across process design kits, IPs, text files, and binary files generated by different tools across multiple repositories. The environment is typically heterogeneous, with varied combinations of operating systems, tools, and library versions. In addition, other products require different sets of shared libraries. Because of issues with data accessibility or outdated versions, cloud-based workflows risk wasting valuable runtime.

Design teams must define specific data usage protocols for cloud workloads to address this complexity. A design data management (DDM) platform with advanced version control and data sync can help ensure disparate design data is accessible and up to date.

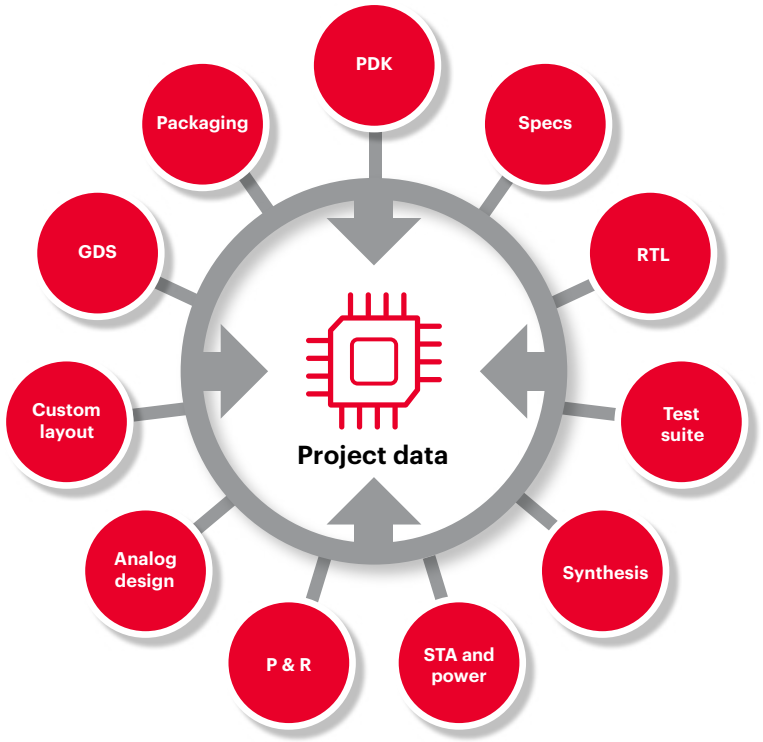


Figure 2. Complexity of electronic design automation (EDA) data sets

Challenge No.2: Cloud usability

Ensuring the correct file versions for simulation or verification falls on the design teams, where errors can lead to critical time and resource losses. Over the past few decades, companies have implemented virtual file systems to connect on-premises and cloud data, but most have failed. The virtual file systems could introduce potential problems, particularly with slow or unstable links. If something goes wrong with the system, the entire workflow will crash.

Challenge No. 3 Workflow integration

Customized on-premises workflows with specialized tools and IPs need careful cloud adaptation to avoid escalating costs. The CAD team plays a critical role in this transition, automating workflows with scripts and hooks to ensure operational efficiency in a hybrid environment. However, these solutions are difficult to maintain and scale with the organization's growth. Design teams should look for a DDM platform that can scale for multitool, multisite EDA workflows.

Challenge No. 4: Collaboration with multiple partners

Today's integrated circuit (IC) designs require efficient and secure sharing of design files across teams with diverse tools and methodologies. Optimizing network storage across each participating site is essential to streamlining operations and enhancing efficiency. Given the escalating risks associated with data breaches and the complexities of export controls, implementing fine-grained access control at each partner site is non-negotiable. Furthermore, secure data transmission is a critical function of the DDM system. As such, all data in transit requires Secure Sockets Layer encryption protection if no VPN exists.

In conclusion, successfully addressing these areas calls for a modern DDM solution that optimizes network storage, maintains accurate version control, and seamlessly integrates workflows in a hybrid cloud environment.

CHAPTER 3

A Surgical, Design-Aware Data Management Approach

Keysight's surgical, design-aware data management strategy marks a pivotal shift in how EDA workflows happen within a hybrid cloud environment.

How a Design-Aware Approach Works

This approach addresses the needs of small organizations without on-premises investments and large enterprises seeking to manage peak demand efficiently. Three key components make data management for hybrid clouds more cost-effective and reliable.

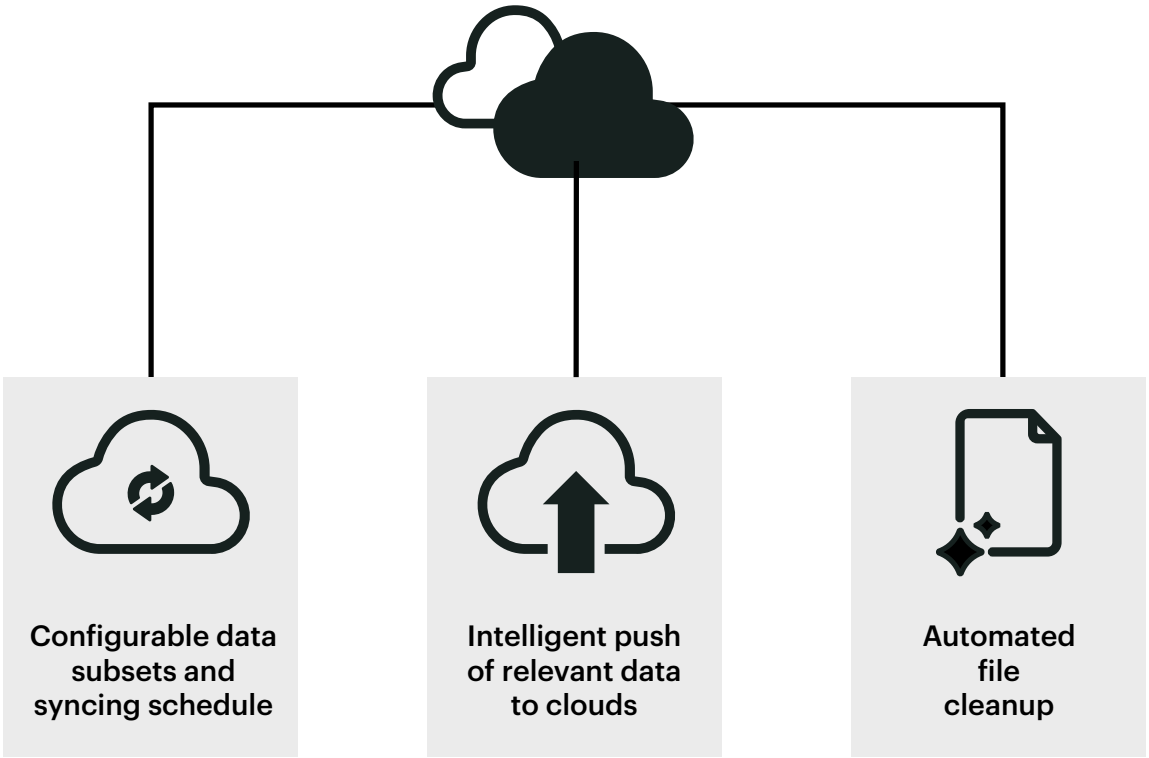


Figure 3. Critical components of design-aware data management for clouds

No. 1: Configurable data subsets and syncing schedule

A design-aware approach surgically collects and synchronizes the correct versions of design objects required for the workload without user interaction. The setup involves a Keysight Design Data Management (SOS) cache server on shared storage that auto-synchronizes with the primary on-premises server, optimizing bandwidth and reducing synchronization time.

Cloud resources are dynamically allocated to meet peak demands, with design verification results transferred back on-premises to control costs while ensuring essential data is available in the cloud for simulation tasks.

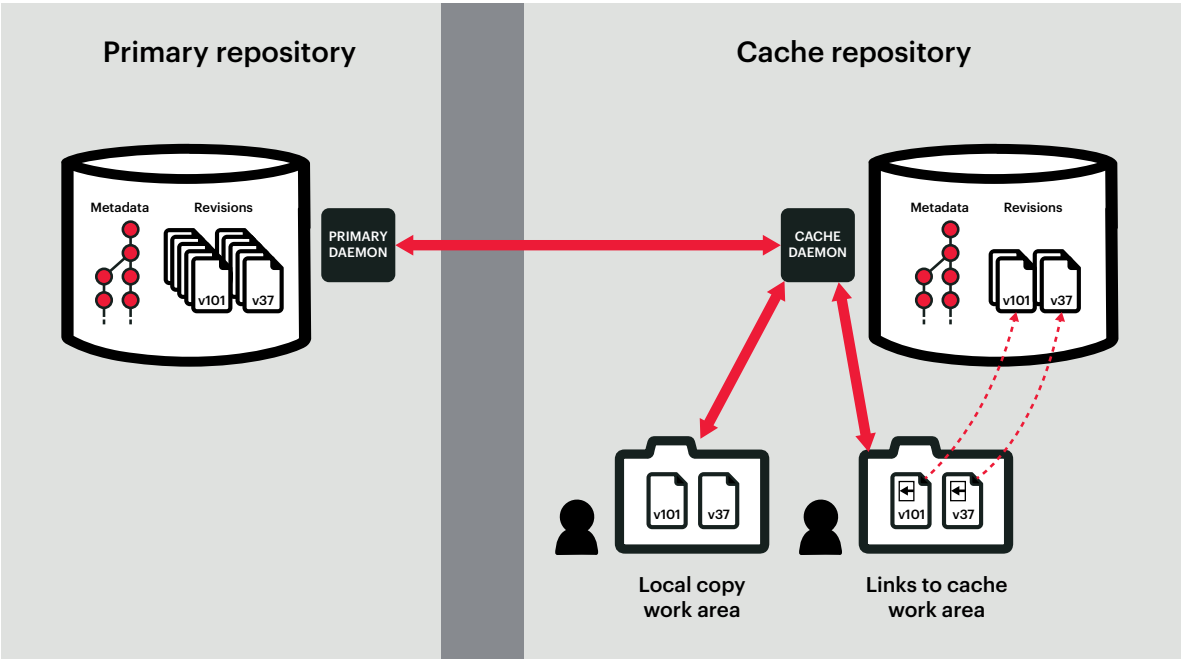
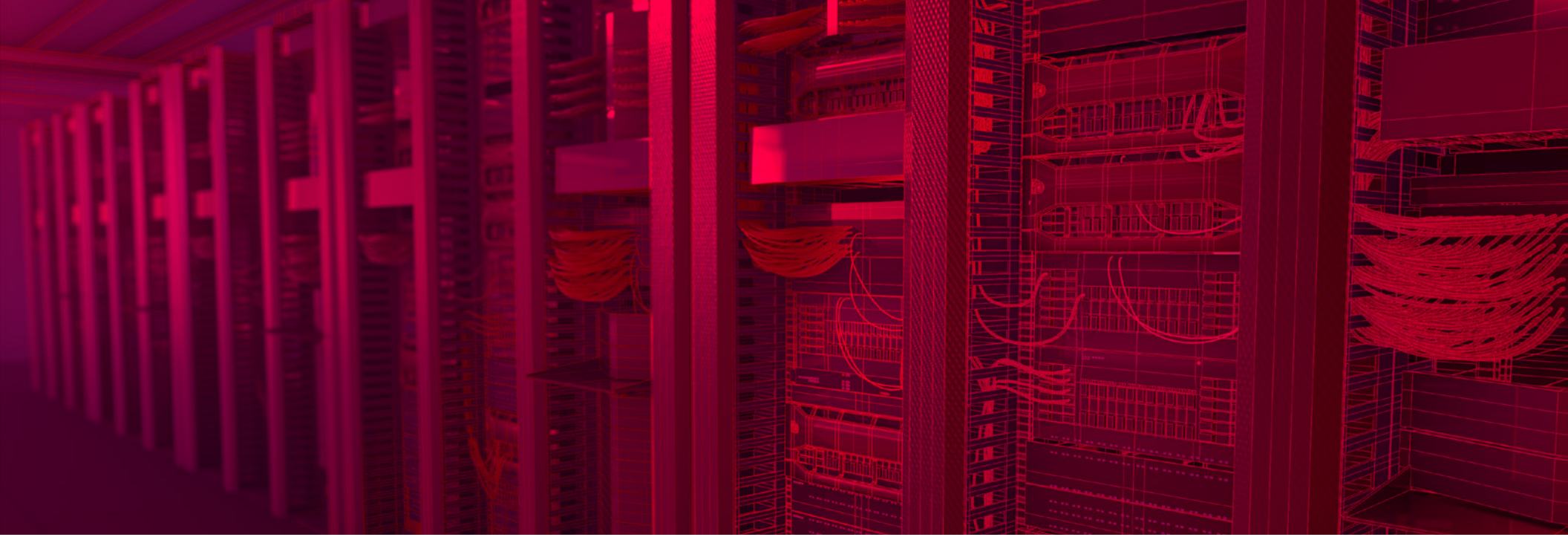


Figure 4. A design-aware data sync flow between on-premises system and cloud



No. 2: Intelligent push of relevant data to clouds

Keysight SOS connects a primary data center with multiple remote sites and a cache server. Users access the data repository through this cache server, which tracks their usage patterns and data requirements at each site. Leveraging insights into these patterns, the cache server synchronizes only the data essential for current tasks. Syncing only relevant files reduces the data footprint significantly (gigabytes instead of terabytes). This feature enables more efficient use of cloud resources, invoking expensive simulator licenses and compute resources only when required.

No. 3: Automated file cleanup

Keysight has architected seamless data transfer processes that remove manual work to move data in and out. Once the cloud-based task is complete, the results are sent back to the on-premises system for analysis, and the cloud machines shut down. Keysight SOS automatically removes unused data from the cloud to address compliance and cost issues.

CHAPTER 4

Practical Examples of Hybrid Cloud Usage Models

Keysight works with mainstream cloud providers to deliver a robust and extensible design environment in hybrid clouds.

Example 1: Hybrid Model with Microsoft Azure

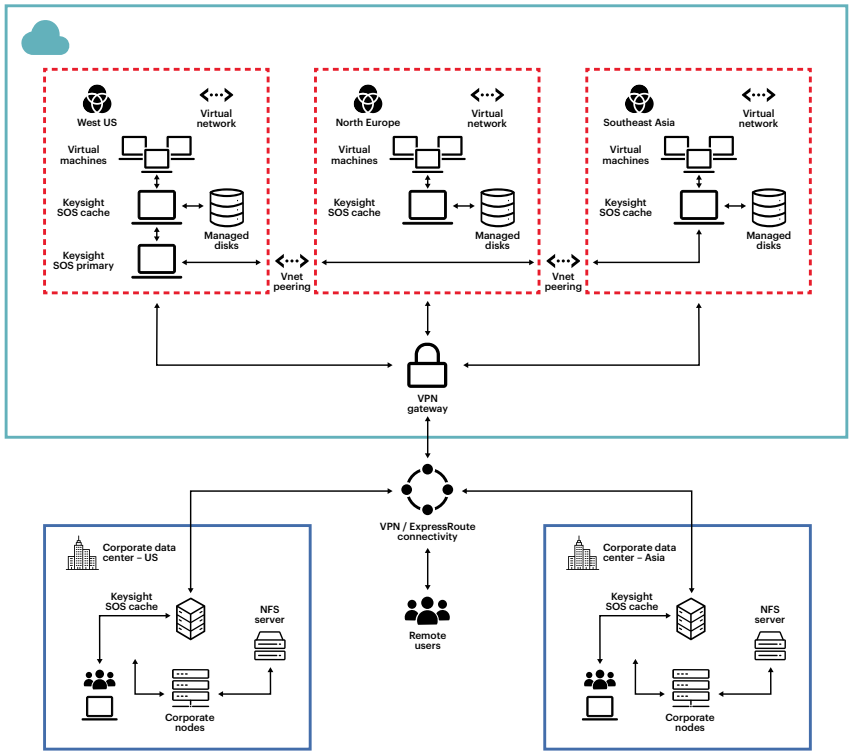


Figure 5. A hybrid model with Keysight and Microsoft Azure

With an intelligent, design-aware approach, Keysight Design Data Management (SOS) connects a primary data center with multiple remote sites and a cache server. Users at the remote site establish links to the data repository via the cache server on their site. In the meantime, the cache system limits the data necessary to sync between the primary and remote locations.

Keysight SOS servers' distributed architecture enables repositories to be hosted in multiple Microsoft Azure regions. Each region is isolated from the other areas for maximum fault tolerance and stability.

Microsoft Azure's varied storage options cater to team sizes, projects, and performance requirements. Basic ISP-powered internet can establish connectivity between the on-premises environment and Microsoft Azure. Microsoft Azure ExpressRoute offers an enhanced solution for larger teams or more significant performance needs.

Example 2: Hybrid Model with AWS

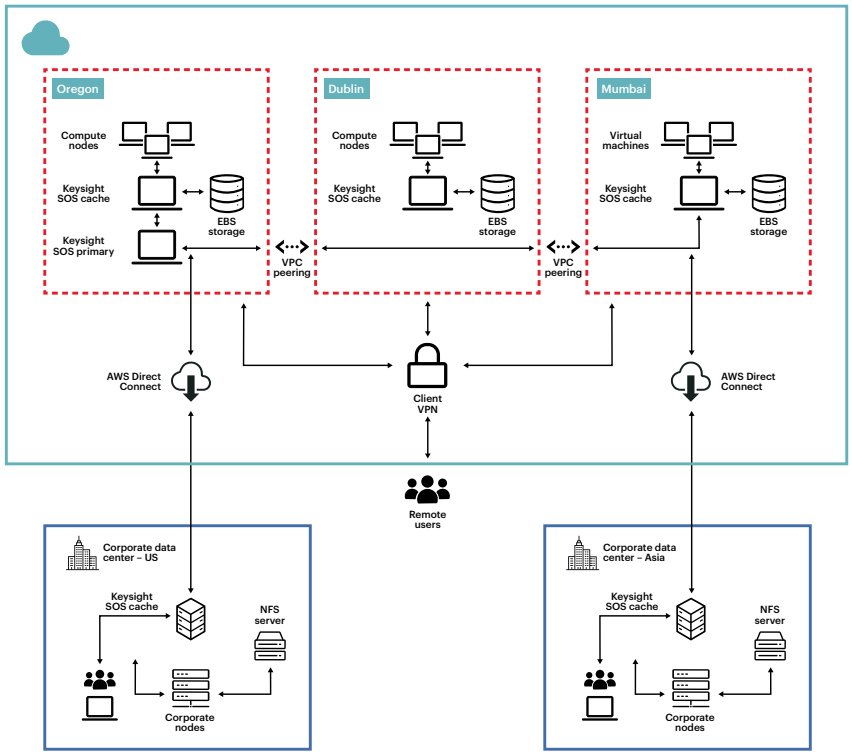


Figure 6. A hybrid model with Keysight and AWS Cloud

Design teams leveraging a hybrid cloud model can configure their entire design environment to access both on-premises data centers and Amazon Web Services (AWS) Cloud.

As shown in Figure 6, the distributed architecture support enables design teams to host Keysight SOS repositories in multiple AWS regions, such as Oregon and Virginia in the United States, Ireland, and Singapore, to maximize fault tolerance and stability. The hybrid model also provides a key feature: scaling for peak usage. For instance, it begins with design teams identifying differences and tagging hierarchies for simulation within on-premises work areas. Keysight SOS then synchronizes the necessary data with AWS cache servers, automatically updating the SOS work area based on specified tags. Subsequently, simulations begin in the cloud, with results integrated into Keysight SOS or retrieved directly from AWS Cloud.

This automated, design-aware process minimizes human error and optimizes cloud resource utilization in medium and large design environments. It enables design teams to harness the computational flexibility of the cloud while maintaining on-premises control.

CHAPTER 5

How Keysight Powers Diverse End-User Applications

Keysight Design Data Management (SOS) and IP Management (HUB) empower organizations with a design-aware solution for efficiently managing design data and IPs across hybrid cloud environments. They cater to the varied needs of startups, enterprises, and enterprise collaborations.

Startup Deployment

Startups or small teams often have limited computing resources and dual-role team members (CAD / IT and design engineering). Keysight offers a simple out-of-box deployment, optimizing resource use and focusing on mission-critical tasks.

As shown in Figure 7, the high-performance network-attached storage (NAS) file server exports volumes using the Network File System (NFS) protocol. Each machine (servers and workstations) mounts the NAS-exported NFS volumes. Workstations render high-end graphics, and the server accesses large volumes of design data stored on the NFS for typical activities.

Keysight SOS addresses the size, complexity, and nuances of semiconductor design data, methodologies, and workloads. As a complement, Keysight HUB provides teams with the quintessential framework for effective organization, governance, and oversight of intellectual property. It offers multiple options to store IP:

- Option 1: Uploading IP as a self-contained package. Keysight HUB helps manage and track various releases of packaged IP while maintaining all the metadata required to browse and search for an IP.
- Option 2: Keeping IP in a third-party design management platform, software configuration management system, document management system, or shared network drive.

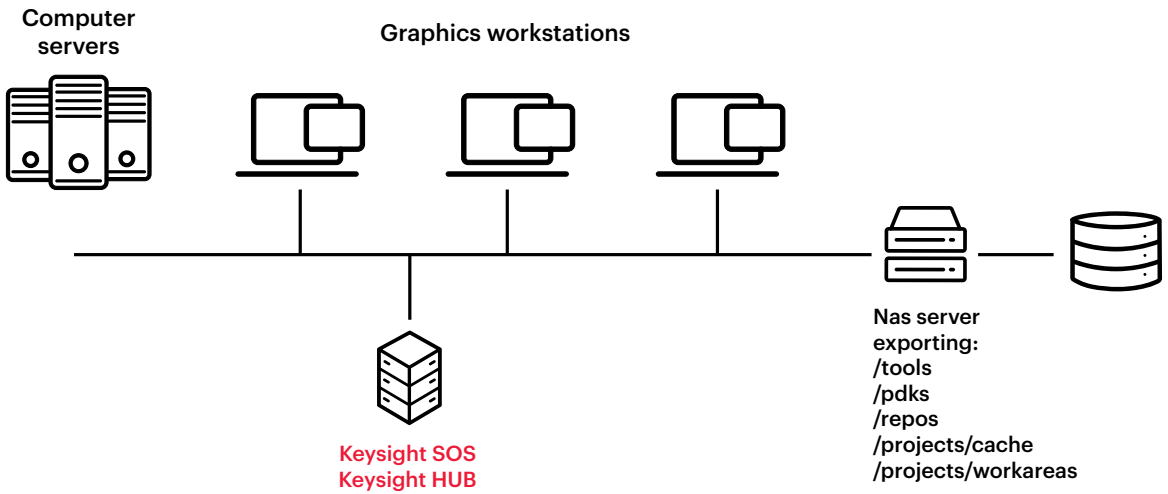


Figure 7. Startup deployment

Enterprise Deployment

In larger, more complex enterprise environments, especially those with geographically dispersed teams working on multiple projects, multiple NAS or NFS servers and computing devices are necessary to handle complex design flows and data sets. The deployment process also involves replicating the leading design site at each location.

Keysight HUB offers data and IP management options, serving as a central repository of tribal intelligence and organizational memory. Keysight SOS server provides a robust solution at primary and remote sites to make storage more efficient. Keysight SOS cache server fetches and prefetches data based on user requests and tracks the data usage. The cache automatically optimizes network storage data transfer at each site based on the characteristics of the IP data.

The synergy of Keysight HUB and SOS optimizes storage, reduces latency, supports distributed project hosting, and enhances design traceability across global teams.

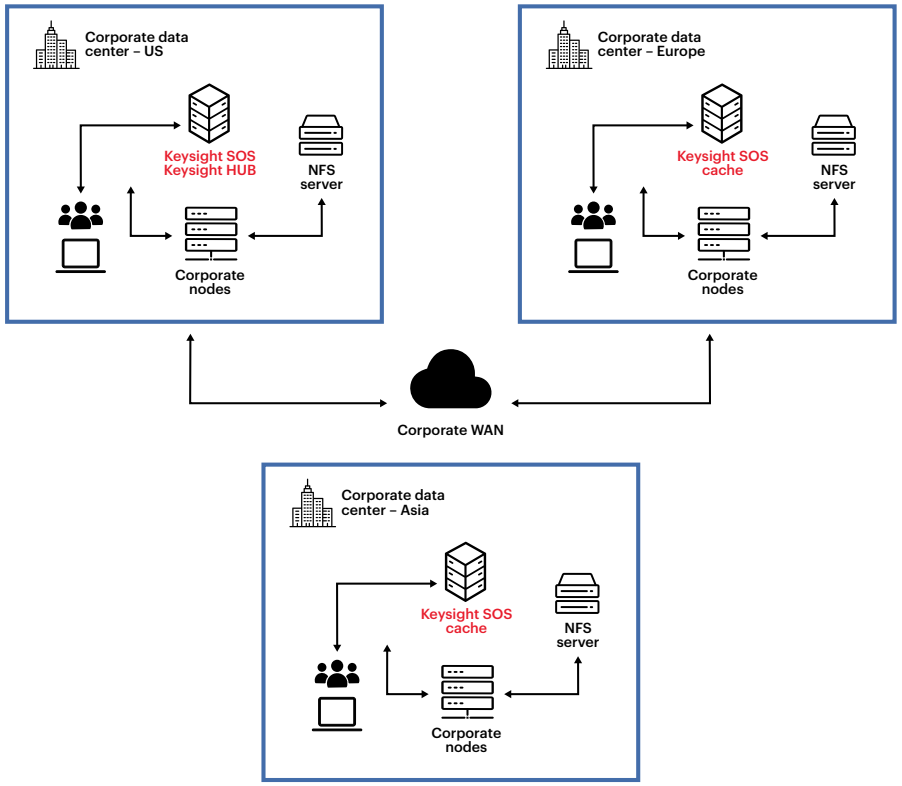


Figure 8. Enterprise deployment with Keysight SOS and HUB

Enterprise Collaboration

A growing trend in the IC design industry is the need to collaborate between multiple teams from various locations. This collaboration often involves sharing IP over the cloud under strict security and compliance regulations. This takes significant work, considering the geographic, managerial, and technological diversity.

Keysight SOS and HUB can work together to facilitate the following:

- Governance and oversight through Keysight HUB, managing IP revisions and data sharing between organizations.
- Automated data synchronization with Keysight SOS, tailored to meet each partner's security and governance requirements, ensuring seamless collaboration despite diverse requirements.

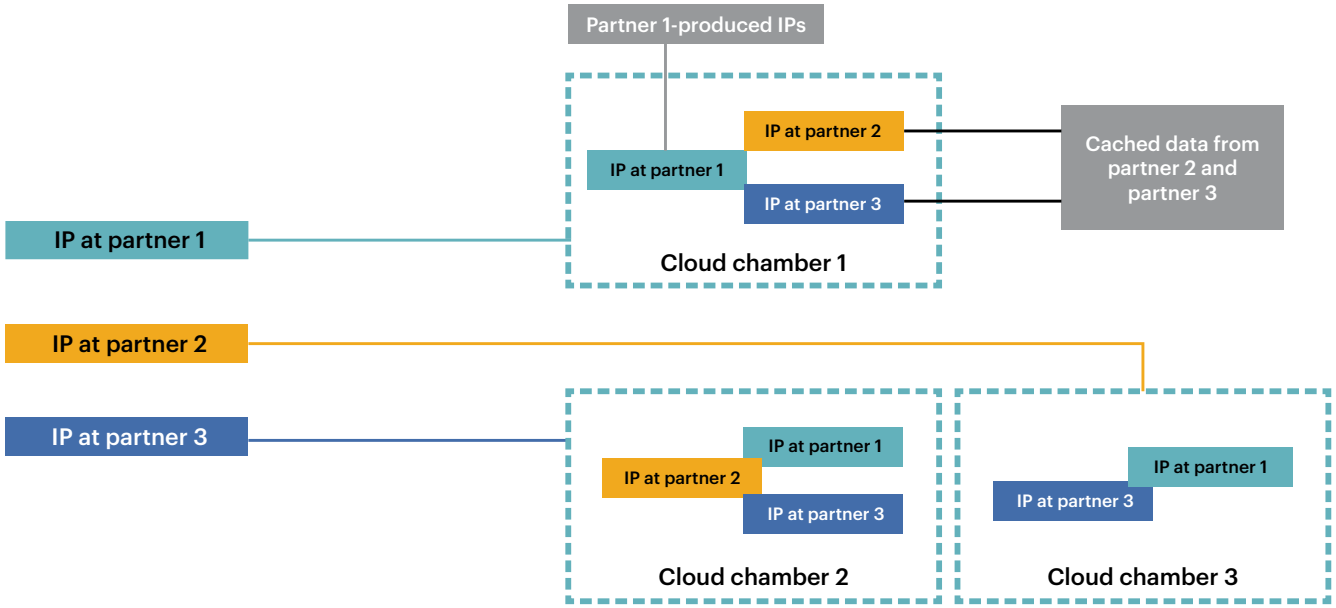


Figure 9. Enterprise collaboration

Conclusion

As capacity needs and design complexity grow, leveraging clouds affordably and reliably becomes essential for accelerating EDA workflows. With robust design data and IP management in a hybrid cloud model, semiconductor companies can achieve high scalability, availability, and reliability, which may be difficult and costly in an on-premises environment.

Keysight Design Data Management (SOS) offers a solution with a surgical, design-aware approach tailored for diverse cloud usage models to achieve the following:

- Efficient synchronization with a more responsive system to ensure that data across the enterprise syncs swiftly and accurately.
- Optimal network storage to minimize unnecessary data transfer, leading to cost savings and smaller file sizes (gigabytes instead of terabytes).
- Automated storage optimization that frees engineers from manually removing unused data from the cloud and enhances overall productivity.

In parallel, Keysight IP Management (HUB) strengthens governance and ensures traceability across data repositories, helping organizations meet high security and compliance standards.

Explore how Keysight can transform your design workflows across cloud, on-premises, or hybrid models. Request a demo today to see the change firsthand.

> Get a free demo of Keysight SOS.

> Get a free demo of Keysight HUB.

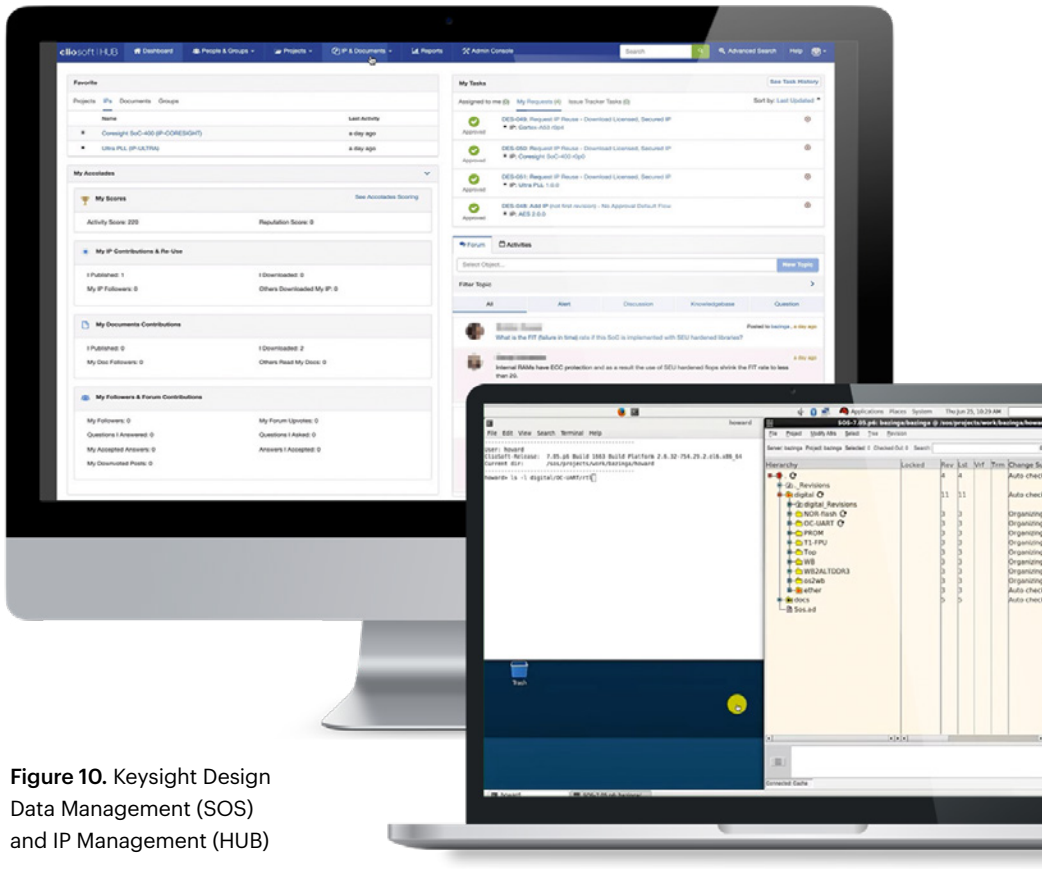


Figure 10. Keysight Design Data Management (SOS) and IP Management (HUB)

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