ORACLE E-BUSINESS FAILOVER USING VMWARE CLOUD ON AWS AND PROTECTED BY LICENSEFORTRESS

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VLSS

Contents

Introduction

VLSS® is a VMware® solution partner and as such, had the opportunity to use the VMware Solutions Lab to set up an on-premises Oracle E-Business Suite (EBS) instance that fails over to VMware Cloud™ on Amazon Web Services® (AWS). While developing a disaster recovery (DR) strategy in the cloud is not novel in and of itself, this Proof of Concept (POC) demonstrates that VMware Cloud on AWS is a viable, modern approach that makes it a simple and cost-effective solution to support disaster recovery.

This POC brief provides a step-by-step approach that describes how to develop a VMware cloud-based DR solution by extending your Oracle EBS, which currently runs on VMware on-premises Virtual Machines (VMs), using VMware Cloud on AWS. VMware Cloud on AWS is a great solution for disaster recovery as it effectively replicates and protects Oracle EBS applications from disaster. In addition, VLSS deployed LicenseFortress to monitor and manage Oracle compliance across the environment.

Why You Need a Disaster Recovery Solution

Disaster comes in many forms, from a hardware/software failure, to a ransomware attack, to a natural disaster such as a flood, fire, hurricane, or tornado, and the risks are growing. For example, industry experts agree that ransomware attacks are on the rise — events that businesses didn't worry about 10 years ago. We won't quote here the disaster recovery statistics you find on the web, because the validity of these stats is all in question. However, it is safe to say that your business assumes a high level of risk that can bring your company to its knees if you do not have a disaster recovery solution in place.

Disaster Recovery in the Cloud

As the types of disasters have increased over the last few years, data protection strategies have also evolved to embrace modern technologies and infrastructures such as the cloud.

The cloud offers your business an opportunity to achieve a 3-2-1 data protection strategy: maintain three copies of your data (including production data), on two different mediums, with one copy offsite. The offsite copy can be stored in the cloud, which offers a more efficient and cost-effective way to store offsite data, so it is ideal for both backup and disaster recovery. In fact, according to the 2017 Executive Cloud Survey developed by Cito Research in partnership with CommVault®, data protection and disaster recovery are among the top five "cloud projects that are most impactful on your business" as rated by 100 IT professionals (see Figure 1).

WHAT CLOUD PROJECTS DO YOU SEE AS MOST IMPACTFUL ON YOUR BUSINESS?

Data protection and backup	75%
Data storage	73%
SaaS apps: uptime, backup and recovery	68%
Disaster recovery	67%
Application databases moving to the cloud	41%

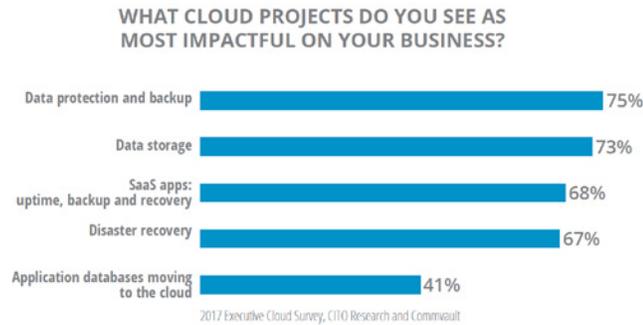2017 Executive Cloud Survey, CITO Research and Commvault

Figure 1. Most Impactful Cloud Projects

Oracle E-Business Suite

Oracle E-Business Suite is an integrated set of business applications for automating customer relationship management (CRM), enterprise resource planning (ERP), and supply chain management (SCM) processes within organizations of any size. The suite includes financial, human resource management, logistics, and other supply chain management applications. Second to SAP in terms of revenue, Oracle EBS has a 13.9 percent market share.

In 2014 and 2016 studies conducted by Database Trends and Analysis of the Independent Oracle Users Group (IOUG), over 70 percent of that group's membership uses vSphere as a platform for Oracle implementations. In addition, VMware studies show that over 40 percent of the VMware customer base is using vSphere as the platform of choice for Oracle databases. Given the large number of Oracle EBS users running on VMware VMs, it makes sense to provide an easy path for these organizations to use VMware Cloud on AWS for disaster recovery.

Why VMware Cloud on AWS for Oracle EBS DR?

There are three cloud options to consider when selecting an Oracle EBS disaster recovery solution.

Private Cloud Environment

If you already have a VMware environment and choose a private cloud environment, you can leverage your existing VMware scripts, tooling, automation, and management systems, which eliminates the costs and time required to train IT staff on new tools. However, you will need to make a capital investment in hardware/software and pay ongoing operating expenses to set up and manage a second data center that is dedicated to disaster recovery. You can also have scalability issues. As your production environment grows, so grows your DR environment.

Hybrid Cloud Environment

In 2017, VMware announced VMware Cloud on AWS, an integrated cloud offering jointly developed by AWS and VMware. This offering provides your organization with an easy way to migrate or extend your on-premises VMware vSphere-based environment — such as a VMware environment running Oracle EBS — to the AWS Cloud running on Amazon Elastic Compute Cloud (Amazon EC2) bare-metal infrastructure and enjoy the scalability, flexibility, and security of the AWS Cloud.

VMware Cloud on AWS is an excellent option for creating a hybrid cloud environment. Delivered as a service from VMware and Amazon, VMware Cloud on AWS provides simple and consistent operations, enterprise-grade capabilities, and flexible consumptions options. Because the service is built on vSphere with ESXi underneath, you can leverage much of your existing automation, scripting, and tools. In addition, Amazon and VMware are responsible for the infrastructure.

Other key benefits include:

- **No training required:** Because VMware Cloud on AWS looks just like it would in the VMware on-premises environment, it does not require your system and virtualization administrators to learn and use different tools other than what they use today.
- **Easily start working in the cloud:** VMware Cloud on AWS makes it easy to start working in the cloud without having to learn how AWS (or any other cloud infrastructure, e.g., Azure) works.
- **Eliminate CapEx:** A cloud solution provides a "pay-as-you-go" pricing model, eliminating the capital investment necessary to buy hardware to support DR and the on-going hardware maintenance costs.
- **Reduce maintenance costs:** While Amazon supports the hardware whether you are using VMware Cloud on AWS or AWS natively, VMware performs much of the infrastructure maintenance with VMware Cloud, unlike AWS native.
- **Easily migrate to the cloud:** With the latest version, you can easily set up a DR scenario in an on-premises environment and migrate it via VMware vMotion® into the cloud.

VMware Site Recovery (VSR) is an add-on feature to VMware Cloud on AWS. It extends VMware Cloud on AWS to provide managed disaster recovery, disaster avoidance, and non-disruptive testing capabilities for VMware customers without the need for a secondary site or complex configuration. VMware Site Recovery utilizes VMware Site Recovery Manager (SRM) servers to coordinate the operations of the VMware SDDC. As virtual machines at the protected site are shut down, copies of these virtual machines at the recovery site start up. By using the data replicated from the protected site, these virtual machines assume responsibility for providing the same services.

VSR can be used to provide complete disaster recovery of your EBS application in a VMware hybrid environment. It also works seamlessly with other technologies to provide custom Service Level Agreements (SLAs), so you can use VSR for the application tier combined with Oracle Data Guard for the database tier. For this POC, VSR was not enabled in the environment, so this project used alternative disaster recovery technologies.

Proof of Concept: Project Parameters

This project is a standard disaster recovery setup. If you have implemented EBS before, you just follow the same steps as you did previously. There is no difference when you go into the VMware Cloud on AWS versus an on-premises environment. For this project, VLSS:

• Implemented EBS in an on-premises environment

• Created replica Virtual Machines (VMs) in the cloud

• Set up Oracle Data Guard for the database disaster recovery

• Used rsync for the application disaster recovery

• Performed switchover and failover testing

• Configured LicenseFortress to ensure Oracle license compliance

Proof of Concept: Project Details

Oracle E-Business Suite Setup

The Oracle E-Business Suite has a three-tiered architecture, which includes the client tier, application tier, and database tier (see Figure 2). The client tier provides the user interface via a standard web browser. The application tier — also known as the middle tier — supports and manages the various Oracle E-Business Suite components. The database tier supports and manages the Oracle database.
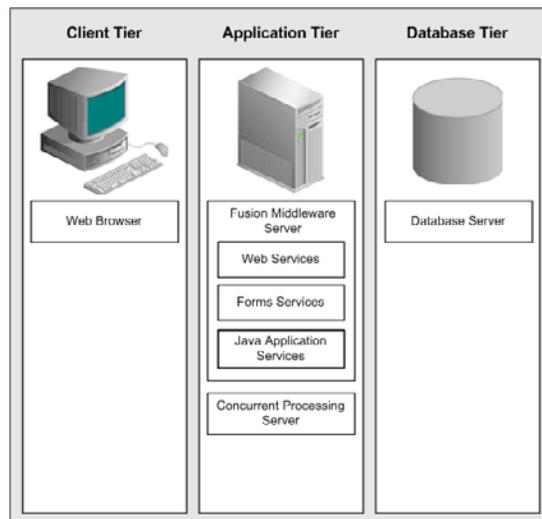
Figure 2. Oracle EBS Three-Tier Architecture

With these tiers being separated logically, you can deploy in a virtual or physical environment in a variety of ways.

• For test and demo purposes, you can deploy the application on a single Virtual
Machine (VM). In fact, you can go to Oracle's website and download templates
for how to deploy this on just one VM (https://www.oracle.com/technetwork/
server-storage/vm/ebs-093153.html).

• For a production ERP system, one VM is not practical. More often, organizations
split the solution across two VMs: the application tier on one VM and the
database tier on another.

• For high-production, high-performance environments, organizations use
multiple VMs for each tier. With this configuration, you can run multiple instances
of the application server — clustered or separate — and/or multiple instances of
the database.

For purposes of this POC, VLSS chose the second scenario, where the solution sits
across just two VMs (see Figure 3).

Figure 3. Two-VM Environment Scenario

The POC was deployed both on-premises and on VMware Cloud on AWS. The first
step: deploy an on-premises infrastructure, then deploy on VMware Cloud on AWS
and switch between the environments.

The on-premises Oracle EBS POC environment was built in the VMware Solutions
Lab. The lab leverages VMware and partner resources to build application solutions
and POCs. The POC consisted of a four-node vSphere cluster with the following
physical server specifications needed to host the Oracle EBS components:

• Dell PowerEdge R720 server (44 cores/88 threads)

• 1TB RAM

• 4 x 10Gbps network adapters

• 2 x 16Gbps Fibre Channel ports

• Block storage backed by a Brocade 16Gbps Fibre Channel fabric attached
to a Pure Storage FlashArray//M50

This configuration provides plenty of horsepower and is comparable to what many organizations deploy in their own on-premises private cloud.

ORACLE E-BUSINESS SUITE (EBS) R12.2 POC

• **Setup two virtual machines (vlss-ebs-app01 and vlss-ebs-db01) using a previously created Oracle Linux 6.9 template**

• **Configure OS parameters, kernel, settings, etc., using yum packages**

• **Download and stage the software distribution from edelivery.oracle.com**

• **Configure Virtual Hosts Per Business Continuity for EBS Release 12.2 using Virtual Hosts with Oracle 12c Physical Standby (2088692.1)**

• **Perform New Install (Standard) with separate machine configuration**

• **Apply latest technology stack updates**

• **Upgrade to latest EBS code (12.2.7)**

Figure 4. Configuration Steps

VLSS used Oracle E-Business Suite R12.2.7, using the demo environment that is available through the installer and a previously configured Oracle Linux 6.9 template. VLSS performed a new standard EBS install using Rapid Install, downloading and staging the software distribution from edelivery.oracle.com.

The VLSS team configured virtual hosts because it wanted to make this transparent to users. This meant the VLSS team needed to perform a few additional steps to ensure failover between disparate environments and the e-business area and that users connected to the virtual host instead of the VM itself.
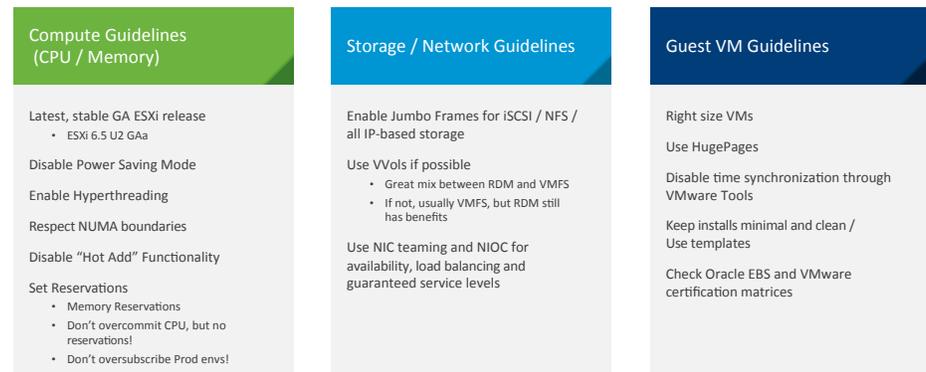
Oracle on VMware — Best Practices

An important aspect of any project is to be sure to align with best practices. Fortunately, the VMware Solutions Lab is maintained by an internal VMware team, which handles all the VMware best practices. This meant VLSS only needed to focus on Oracle best practices for deploying the environment for demo purposes.

However, if you are configuring Oracle EBS or an Oracle database or any applications that are supporting critical, performance-intensive environments, you will want to read VMware's best practices guide. As an aid, Figure 5 lists some of the most important best practices to follow whether you are configuring a demo or a production system.

Best Practices
Oracle on VMware best practices

Compute Guidelines (CPU / Memory)	Storage / Network Guidelines	Guest VM Guidelines
Latest, stable GA ESXi release • ESXi 6.5 U2 GAa Disable Power Saving Mode Enable Hyperthreading Respect NUMA boundaries Disable "Hot Add" Functionality Set Reservations • Memory Reservations • Don't overcommit CPU, but no reservations! • Don't oversubscribe Prod envs!	Enable Jumbo Frames for iSCSI / NFS / all IP-based storage Use VVols if possible • Great mix between RDM and VMFS • If not, usually VMFS, but RDM still has benefits Use NIC teaming and NIOC for availability, load balancing and guaranteed service levels	Right size VMs Use HugePages Disable time synchronization through VMware Tools Keep installs minimal and clean / Use templates Check Oracle EBS and VMware certification matrices

https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/solutions/vmware-oracle-databases-on-vmware-best-practices-guide.pdf

Figure 5. Highlights of VMware Best Practices

Compute Guidelines

• While many businesses prefer to wait until a full release is available before upgrading, it is best to use the latest GA release because it typically includes bug fixes.

• Disable the power saving mode. Many times, customers complain about how their performance randomly dips. The problem: the customer has their configuration set so that the ESXi starts cutting power to mission-critical applications when the VMs are idle.

• Enable hyperthreading so you can execute multiple operations at the same time. This can provide a 20 to 30 percent performance boost.

• Respect NUMA boundaries. If you are setting up your VMs and you are not using the entire ESXi host, keep those VMs within the sockets on that host. If you do not respect NUMA boundaries, it can kill performance. Line up your VMs to stay within a socket — so if you are in a dual socket, half the CPUs and half the memory are available. This provides the best performance.

• Do not overcommit CPU on production systems. You never want your VMs competing for physical resources. However, do not use CPU reservations to enforce this. CPU reservations will disable NUMA awareness, which can lead to performance problems.

• Disable "Hot Add" functionality. "Hot Add" functionality will disable the NUMA boundaries. Also, with Oracle and other databases, "Hot Add" functionality doesn't work without a restart of the application. Furthermore, by disabling this functionality, CPU memory reservations will not get swapped out.

• If you have memory reservations in place, this issue goes away, but don't overscribe your environments. One hundred VMs running on an ESXi host with four CPUs and 16 gigs of RAM will not deliver the performance you need for a mission-critical application.

Storage and Network Guidelines

• Enable Jumbo Frames for iSCSI, NFS, and all IP-based storage. This lets you move large amounts of data and boosts performance. Be sure that you enable Jumbo Frames throughout the entire stack: if you turn it on in just a part of the stack, resizing will impact your performance more than if you had not it enabled at all.

• VLSS highly recommends VMware's Virtual Volumes (VVols). They are a good mix between Raw Device Mapping (RDM) and VMware Virtual Machine File System (VMFS). VVols realigns your VMs through your storage array. Storage operations, such as snapshots, are natively executed, providing substantial performance improvements and eliminating complex processes. "One of the VVol partners ran a short test comparing VMFS and VVol snapshots with an Oracle workload and discovered that snapshot removal was over 150 times faster with VVols."[1] If you decide to use VVols, you will need support from your storage vendor.

• On the network side, use Network Interface Card (NIC) teaming and VMware vSphere Network I/O Control (NIOC) if you are using VMware vSphere Enterprise Plus. By using NIC teaming and IO control, you get improved redundancy. And, the network and storage layers are provided with more granularity, avoiding noisy neighbor issues and ensuring a high quality of service.

Guest VM Guidelines

• Right-size your VMs. Use the tools available, such as Oracle HugePages or Windows® Large Pages. Inspect your workloads and identify the capacity you need. Right-sizing is important because it optimizes the VM that you right-size and it relieves the contention on the ESXi host, improving performance for all your VMS.

• If you are running an Oracle Real Application Clusters (RAC) environment, disable time synchronization using VMware Tools. If you have a Network Time Protocol (NTP) server in your environment, build time synchronization into your templates and into vRealize Automation® blueprints. Have the guest itself do the time synchronization instead of forcing updates from VMware tools.

• Keep installs minimal, clean, and use templates. Do not install software that you do not need, as it eats up the operating system (OS) memory, introduces security issues, and wastes IT time with patches and updates.

• Be sure to review Oracle E-Business and VMware certification matrices that are available through the support links. This ensures that the hardware, software, and OS version you plan to use is certified.

• All Oracle vSphere white papers, including Oracle on VMware vSphere/VMware vSAN/VMware Cloud on AWS, best practices, deployment guides, and workload characterization guides can be found here.

Disaster Recovery Setup

Once the VLSS team had the POC environment up and running, they needed to develop a disaster recovery solution to ensure business continuity. Disaster recovery (DR) is the ability to restore all your systems, applications, and data when your data centers, servers, network, or other critical parts of your IT infrastructure are damaged or destroyed. Business continuity (BC) planning is the overall strategy

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[1] https://blogs.vmware.com/virtualblocks/2016/10/20/3-key-reasons-customers-move-to-virtual-volumes/

that keeps your entire business up and running with minimal or no downtime.[2] With ERP environments — whether SAP, EBS, People Software — downtime can be expensive. Some organizations have lost hundreds of thousands — if not millions — of dollars per hour. If you are running a global business, you cannot afford any IT downtime.
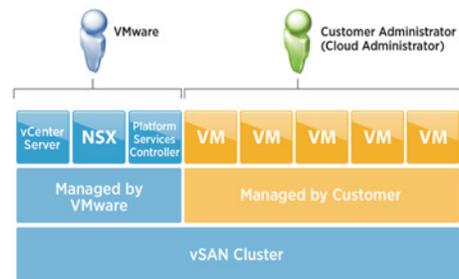
VMware Cloud on AWS

Custom-built servers with Intel Xeon Processors (36 cores / 72 threads)

512GB RAM

Amazon Elastic Network Adapter (ENA) supporting 25Gbps capacity with NSX

vSAN all-flash array via 8 NVMe devices with 10TB of raw capacity

Figure 6. Four-Node VMware Cloud on AWS Cluster

The same POC was deployed on VMware Cloud on AWS. Powered by VMware Cloud Foundation™, this service integrates vSphere, vSAN, and VMware NSX®, along with VMware vCenter Server® management, and is optimized to run on a dedicated, elastic, bare-metal AWS infrastructure.

A four-node VMware Cloud on AWS cluster was used for the tests. Each of the servers had 36 cores, 72 threads each, and 512 GBs of RAM. An Amazon Elastic Network Adapter (ENA) supporting 25 GBs per second with NSX, and vSAN with eight all-flash NVMe devices, was used for storage (see Figure 6).

Details of the VMware Cloud on AWS infrastructure can be found in the VMware Cloud on AWS Technical Overview. The VM configuration for all Oracle EBS components was identical to that of the on-premises use case.

VMWARE HYBRID CLOUD EXTENSION

• **Presents on-premises and cloud resources as one hybrid cloud**

• **Allows for live migration between on-premises and VMware Cloud on AWS**

  – **Requires AWS Direct Connect**

  – **Requires sustained bandwidth of 250 Mbps+**

Figure 7. Benefits and Requirements of VMware Hybrid Cloud Extension

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2 https://blog.dell.com/en-us/the-difference-between-disaster-recovery-and-business-continuity/

During the POC, AWS Direct Connect was not enabled, so VLSS could not leverage the VMware Hybrid Cloud Extension. If you have AWS Direct Connect and sustained bandwidth of over 250 Mbps per second, you can use the hybrid extension. By doing so, your AWS environment shows up in your on-premises environment so you can treat it like any another cluster in your AWS environment. You can vMotion your machines from your on-premises clusters right into the cloud.

VLSS copied the 6.9 templates into the VMware on AWS environment and provisioned two new VMs (using Oracle Enterprise Linux 6.9 VMs) for the application and the database tiers.

VLSS then created a physical standby database using the Oracle script, used virtual hosts to switchover and failover without the end user knowing, and configured Oracle data guard broker to automate switchover and failover. You can go to the Oracle support link (2088692.1) to learn how to set up a physical standby database in an Oracle EBS environment.

VLSS configured the application tier using the file system clone and set up rsync to keep everything in sync: the on-premises environment was active, the business continuity environment was passive, and rsync was scheduled to run every five minutes. There are many ways to keep the application tier in sync, including rsync and vSphere replication.

Disaster Recovery Setup

Copied Oracle Linux 6.9 template into VMware on AWS environment

Provisioned two new VMs from template (vlss-ebs-app02 and vlss-ebs-db02)

Created physical standby database
- Used virtual hosts
- Configured Oracle data guard broker

Configured application tier using file system clone

Configured rsync for application tier in active-passive mode
  ! Could use database triggers on primary / standby to change rsync configuration for fully-automated environment

Tested switchover / failover of environment

Figure 8. Disaster Recovery Setup

On the application tier, you can put different triggers in the database to automate the entire switchover/failover process. What you use depends on your environment and your SLAs. Whatever you choose, you want to be sure that you don't lose data and can quickly recover.

Finally, VLSS tested the switchover failover of the environment to make sure everything worked. You can see a demo of the setup and switchover online at https://vimeo.com/273942970.

LicenseFortress Reduces Oracle EBS Licenses

Over the course of the POC, LicenseFortress Oracle License Management + Audit Protection Service monitored and controlled license usage in both environments. LicenseFortress for Oracle is the first and only license management service that guarantees you won't pay back-license, back-support, or audit fees, saving you thousands, even millions of dollars.

With LicenseFortress, a technical team reviews your Oracle license contract and inventories and analyzes your environment to validate your use of Oracle licenses, helping you eradicate expensive audit liabilities, optimize your software assets, and better manage and prevent compliance issues.

Integrating LicenseFortress into this project was important, as it demonstrated how to reduce licensing costs for Oracle EBS customers. By default, Oracle EBS includes licensing for the middleware and database tiers. However, it does not include any high-availability or disaster recovery options. That functionality requires separate Oracle core technology licensing. Additionally, customizations can invalidate the restricted use licenses, which will require additional licensing.

If licensing is required in both the VMware Solutions Lab and the VMware Cloud on AWS, a customer is required to obtain 88 and 72 processor licenses respectively to license the full cluster. However, customers can reduce the licensing burden by licensing an individual host or hosts within that cluster and LicenseFortress can guarantee compliance.

For example, a customer may only need the capacity of one ESXi host in the VMware Solution Lab to run their Oracle EBS environment. LicenseFortress can help maintain and guarantee that compliance on just 22 licenses — a 75 percent reduction!

Conclusion

The POC has demonstrated that:

• VMware Cloud on AWS has the power to easily manage failover from an on-premises Oracle EBS configuration. Whether you are using Oracle EBS or another ERP solution, such as SAP, PeopleSoft, or a homegrown application, VMware Cloud on AWS is a great solution for disaster recovery

• Since there are Oracle workloads running, VLSS deployed License Fortress — the first easy-to-use Oracle software license and audit protection service to monitor and manage Oracle licenses across both production and disaster recovery platforms.

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Acknowledgements

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