Deploying Horizon 7 on VMware Cloud on AWS
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“With Horizon 7 for VMware Cloud on AWS, you can easily address use cases such as on-demand capacity, disaster recovery, and cloud co-location without buying additional data center resources.”

**Introduction**

VMware Horizon® 7 for VMware Cloud™ on AWS delivers a seamlessly integrated hybrid cloud for virtual desktops and applications. It combines the enterprise capabilities of the VMware Software-Defined Data Center (SDDC), delivered as a service on AWS, with the market-leading capabilities of VMware Horizon 7 for a simple, secure, and scalable solution. You can easily address use cases such as on-demand capacity, disaster recovery, and cloud co-location without buying additional data center resources.

For customers who are already familiar with Horizon 7 or have Horizon 7 deployed on-premises, deploying Horizon 7 on VMware Cloud on AWS lets you leverage a unified architecture and familiar tools. This means that you use the same expertise you know from VMware vSphere® and Horizon 7 for operational consistency and leverage the same rich feature set and flexibility you expect. By outsourcing the management of the vSphere platform to VMware, you can simplify management of Horizon 7 deployments. For more information about VMware Horizon 7 for VMware Cloud on AWS, visit the [Horizon 7 on VMware Cloud on AWS product page](#).

The purpose of this guide is to provide IT administrators with a set of steps and best practices on how to deploy Horizon 7 on VMware Cloud on AWS. This guide is designed to be used in conjunction with [Horizon 7 documentation](#), [VMware Workspace ONE](#) and [VMware Horizon Reference Architecture guide](#), and [VMware Cloud on AWS documentation](#).

**Overview of Horizon 7 on VMware Cloud on AWS**

You can deploy Horizon 7 on VMware Cloud on AWS to scale Horizon 7 desktops and applications on an elastic cloud platform.

VMware Cloud on AWS allows you to create vSphere Software-Defined Data Centers (SDDCs) on Amazon Web Services. These SDDCs include VMware vCenter Server® for VM management, VMware vSAN™ for storage, and VMware NSX® for networking. You can connect an on-premises SDDC to your cloud SDDC and manage both from a single VMware vSphere® Web Client interface. Using your connected AWS account, you can access AWS services such as EC2 and S3 from virtual machines in your SDDC. For more information, see the [VMware Cloud on AWS documentation](#).

Once you have deployed an SDDC on VMware Cloud on AWS, you can deploy Horizon 7 in that cloud environment just like you would in an on-premises vSphere environment. This enables Horizon 7 customers to outsource the management of the SDDC infrastructure to VMware. There is no requirement to purchase new hardware, and you can use the pay-as-you-go option for hourly billing on VMware Cloud on AWS.

Cloud Pod Architecture (CPA) is a Horizon 7 feature that allows you to scale your Horizon 7 deployment across multiple pods and sites for federated management. You can deploy Horizon 7 in a hybrid cloud environment when you use CPA to interconnect on-premises data centers and VMware Cloud on AWS data centers.

Important: A single pod and the Connection Servers in it must be located within a single data center and cannot span locations. Multiple locations must have their own separate pods. These pods can be managed individually or interconnected using Cloud Pod Architecture (CPA).
Since the Horizon 7 architecture is the same on-premises and in VMware Cloud on AWS, the deployment and management experience remain the same across on-premises sites and in the cloud.

When using multiple data centers, you must use a storage replication mechanism, such as DFS-R in a hub-spoke topology, for replicating user data.

You can also stretch CPA across two or more VMware Cloud on AWS data centers. Of course, use of CPA is optional. You can choose to deploy Horizon 7 exclusively in a single VMware Cloud on AWS data center without linking it to any other data center.

For details on feature parity between Horizon 7 on-premises and Horizon 7 on VMware Cloud on AWS, as well as interoperability of Horizon 7 and VMware Cloud on AWS versions, see the VMware Knowledge Base article Horizon 7 on VMware Cloud on AWS Support (58539).

Horizon 7 Deployment Scenarios on VMware Cloud on AWS

You can deploy Horizon 7 on VMware Cloud on AWS for the following scenarios.

Data Center Expansion
Use this scenario if you have an existing on-premises Horizon 7 infrastructure and need to expand capacity but don’t want to procure additional hardware. Extend the Horizon 7 deployment to VMware Cloud on AWS by using Cloud Pod Architecture to connect on-premises pods with a pod in VMware Cloud.

With this strategy, you can use cloud capacity and still manage on-premises and private cloud deployments in a single federated space. You can also utilize the cloud platform to provide temporary capacity for contractors and seasonal workers.

The on-premises deployment is optional. Based on your needs, you can decide to consolidate and move the on-premises deployment completely to VMware Cloud on AWS.

Application Locality
Use this scenario when you want to move published applications that are latency-sensitive to VMware Cloud on AWS and need virtual desktops and RDS (Remote Desktop Session) hosts to be co-located with your published applications.

You can also have other published applications that are still on-premises. When you extend your Horizon 7 deployment to VMware Cloud on AWS, you can allow end users to connect to the nearest virtual desktop or RDS host to launch the application regardless of whether the application is on-premises or on VMware Cloud on AWS.

Business Continuity (BC) and Disaster Recovery (DR)
The cost of building an on-premises BC/DR infrastructure can be high. When you use VMware Cloud on AWS, you pay for the use of BC/DR infrastructure during those times when the primary infrastructure is down or when you require a small pilot during normal operations for a quick Recovery Time Objective (RTO) during a disaster event.

Having a unified Horizon 7 architecture across the primary site on-premises and the BC/DR site on VMware Cloud on AWS makes the failover process simple. You can also deploy Cloud Pod Architecture across multiple VMware Cloud on AWS data centers for BC/DR.
**Deployment Architecture for Horizon 7 on VMware Cloud on AWS**

**Horizon 7 Pod and Building Block On-Premises**

A typical Horizon 7 architecture design on-premises uses a pod strategy. A pod is a unit of organization determined by Horizon 7 scalability limits. Each pod has a separate management UI and therefore the typical design is to minimize the number of pods.

Customers usually include multiple building blocks in a Horizon 7 pod on-premises. A building block is a logical construct and should not be sized for more than the maximum number of desktops tested. See the VMware Knowledge Base article [VMware Horizon 7 sizing limits and recommendations](2150348).

A building block consists of:

- Physical servers
- 1 vCenter Server and vSphere infrastructure
- Horizon 7 servers
- Shared storage
- Virtual desktops and/or RDS hosts for end users

**Architecting Horizon 7 Cloud Pod Architecture for VMware Cloud on AWS**

Cloud Pod Architecture (CPA) is a standard Horizon 7 feature that allows you to connect your Horizon 7 deployment across multiple pods and sites for federated management. It can be used to scale up your deployment, to build hybrid cloud, and to provide redundancy for business continuity and disaster recovery. CPA introduces the concept of a global entitlement (GE) that spans the federation of multiple Horizon pods and sites. Any users or user groups belonging to the global entitlement are entitled to access virtual desktops and RDS published apps on multiple Horizon 7 pods that are part of the CPA.

Important: CPA is not a stretched deployment; each Horizon 7 pod is distinct and all Connection Servers belonging to each of the individual pods are required to be located in a single location and run on the same broadcast domain from a network perspective.

Here is a logical overview of a basic two site/two pod CPA implementation. For VMware Cloud on AWS, Site 1 and Site 2 may be different AWS AZs or Regions, or Site 1 may be on-prem and Site 2 may be on VMware Cloud on AWS.
Deploying Horizon 7 on VMware Cloud on AWS

For the full documentation on how to set up and configure CPA, refer to *Administering View Cloud Pod Architecture* in the *Horizon 7 documentation* and *VMware Workspace ONE and VMware Horizon Reference Architecture*.

Understanding Key Components of Horizon 7 on VMware Cloud on AWS

Here are the key components of a Horizon 7 on VMware Cloud on AWS deployment. Note that this document describes NSX-T components.

Management Component
The management component for the network includes vCenter Server.

Compute Component
The compute component includes the following Horizon infrastructure components:

- Unified Access Gateway appliances
- Load balancer
- Horizon Connection Servers
- Virtual machines
- App Volumes

NSX-T Components
VMware NSX Data Center is the network virtualization platform for the Software-Defined Data Center (SDDC), delivering networking and security entirely in software, abstracted from the underlying physical infrastructure.

The maximum number of ports per logical network is 1000. And since multiple VLANs are not supported on NSX with Horizon, the maximum size of the Horizon 7 pool is limited to 1000. Of course, you can create multiple pools using different logical networks.

- Tier-0 router – Handles Internet, route or policy based IPSEC VPN, AWS Direct Connect and also serves as an edge firewall for the Tier-1 Compute Gateway (CGW).
- Tier-1 Compute Gateway (CGW) – Serves as a distributed firewall for all customer internal networks.
- The Tier-1 Management Gateway (MGW) – Serves as a firewall for the VMware maintained components like vCenter and NSX.

Deploying Horizon 7 Pod on VMware Cloud on AWS

Resource Pools
A resource pool is a logical abstraction for flexible management of resources. Resource pools can be grouped into hierarchies and used to hierarchically partition available CPU and memory resources.

Within a Horizon 7 pod on VMware Cloud on AWS, you can use vSphere resource pools to separate management components from virtual desktops or published applications workloads to make sure resources are allocated correctly.

After an SDDC instance on VMware Cloud on AWS is created, two resource pools exist:
A Management Resource Pool with reservations that contains vCenter Server plus NSX, which is managed by VMware

A Compute Resource Pool within which everything is managed by the customer

We recommend creating two sub-resource pools within the Compute Resource Pool for your Horizon 7 deployments:

A Horizon Management Resource Pool for your Horizon 7 management components, such as connection servers

A Horizon User Resource Pool for your desktop pools and published apps

See the following picture for schematics of the recommended architecture. Because the management components of Horizon 7 are shared among all virtual machines, you can avoid having any single virtual machine affect overall performance by deploying the management components in a separate resource pool with reservations. Alternatively, you can use different clusters to separate these components.

Figure 1: Horizon 7 Pod Architecture on VMware Cloud on AWS

Memory Reservations
Because physical memory cannot be shared between virtual machines, and because swapping or ballooning should be avoided at all costs, be sure to reserve all memory for all Horizon virtual machines, including management components, virtual desktops, and RDS hosts.

CPU Reservations
CPU reservations are shared when not used, and a reservation specifies the guaranteed minimum allocation for a virtual machine. For the management components, the reservations should equal the number of vCPUs times the CPU frequency (currently 2300 with VMware Cloud on AWS). Any amount of CPU reservations not actively used by the management components will still be available for virtual desktops and RDS hosts when they are not deployed to a separate cluster.
Virtual Machine–Level Reservations
As well as setting a reservation on the resource pool, be sure to set a reservation at the virtual machine level. This ensures that any VMs that might later get added to the resource pool will not consume resources that are reserved and required for HA failover. These VM-level reservations do not remove the requirement for reservations on the resource pool. Because VM-level reservations are taken into account only when a VM is powered on, the reservation could be taken by other VMs when one VM is powered off temporarily.

Leveraging CPU Shares for Different Workloads
Because RDS hosts can facilitate more users per vCPU than virtual desktops can, a higher share should be given to them. When desktop VMs and RDS host VMs are run on the same cluster, the share allocation should be adjusted to ensure relative prioritization.

As an example, if an RDS host with 8 vCPUs facilitates 28 users and a virtual desktop with 2 vCPUs facilitates a single user, the RDS host is facilitating 7 times the number of users per vCPU. In that scenario, the desktop VMs should have a default share of 1000, and the RDS host VMs should have a vCPU share of 7000 when not deployed to a separate cluster. This number should also be adjusted to the required amount of resources, which could be different for a VDI virtual desktop session versus a shared RDSH-published desktop session.

<table>
<thead>
<tr>
<th>TABLE 1: RESERVATIONS AND SHARES OVERVIEW</th>
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<tbody>
<tr>
<td>Resource Pool Reservation</td>
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<tr>
<td>Memory</td>
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<td>Management</td>
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<td>VDI</td>
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<td>RDSH</td>
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Sizing Horizon 7 on VMware Cloud on AWS
Similar to deploying Horizon 7 on-premises, you will need to size your requirements for deploying Horizon 7 on VMware Cloud on AWS to determine the number of hosts you will need to deploy. Hosts are needed for the following purposes:
- Your virtual desktop or RDS workloads.
- Your Horizon 7 infrastructure components, such as connection servers, Unified Access Gateways, App Volumes managers.
- SDDC infrastructure components on VMware Cloud on AWS. These components are deployed and managed automatically for you by VMware, but you will need capacity in your SDDC for running them.
Deploying Horizon 7 on VMware Cloud on AWS

The methodology for sizing Horizon 7 on VMware Cloud on AWS is exactly the same as for on-premises deployments. What is the different (and simpler) is the fixed hardware configurations on VMware Cloud on AWS. Work with your VMware sales team to determine the correct sizing.

Minimum SDDC Size
At the time of this update, the minimum number of hosts required per SDDC on VMware Cloud on AWS for production use is 3 nodes (hosts). For testing purposes, a 1-node SDDC is also available. However, since a single node does not support HA, we do not recommend it for production use. Horizon 7 can be deployed on a single-node SDDC or a multi-node SDDC. If you are deploying on a single-node SDDC, be sure to change the FTT policy setting on vSAN from 1 (default) to 0.

Network Configuration for Horizon 7 Deployment on VMware Cloud on AWS
After you deploy an SDDC instance on VMware Cloud on AWS, two isolated networks exist, a management network and a compute network. Each has its own NSX Edge Gateway and an NSX Distributed Logical Router for extra networks in the compute section.

The recommended network architecture consists of a double DMZ and a separation between Horizon management components and the RDSH and VDI virtual machines.

Figure 2: Network Diagram (Subnets are for Illustrative Purposes Only)

Because the Horizon Connection Server must communicate with the vCenter Server, traffic must be allowed on the MGW Edge Firewall.

A third-party load balancer such as F5 LTM or AWS Elastic Load Balancer (ELB) must be deployed to allow multiple Unified Access Gateway appliances and Connection Servers to be implemented in a highly available configuration.

When direct external access is required, configure a public IP address with Network Address Translation towards the Unified Access Gateway virtual IP of the load balancer.

For external management or access to external resources, create a VPN or direct connection to the tier 0 router (illustrated as a light-grey line in the diagram). You can configure a route-based IPsec VPN or a policy-based IPsec VPN.
• Route-based VPN uses the routed tunnel interface as the endpoint of the SDDC network to allow access to multiple subnets within the network. Local and remote networks are discovered using BGP advertisements.

• Policy-based VPN allows access to a subnet of the SDDC network.

AWS Direct Connect (DX) is a cloud service solution that makes it easy to establish a dedicated network connection from your premises to AWS. Using AWS Direct Connect, you can establish private connectivity between AWS and your data center, office, or co-location environment, which in many cases can reduce your network costs, increase bandwidth throughput, and provide a more consistent network experience than Internet-based connections.

AWS Direct Connect lets you establish a dedicated network connection between your network and one of the AWS Direct Connect locations. Using industry standard 802.1q VLANs, this dedicated connection can be partitioned into multiple virtual interfaces. This allows you to use the same connection to access public resources such as objects stored in Amazon S3 using public IP address space, and private resources such as Amazon EC2 instances running within an Amazon Virtual Private Cloud (VPC) using private IP space, while maintaining network separation between the public and private environments. Virtual interfaces can be reconfigured at any time to meet your changing needs.

Using CPA to Build Hybrid Cloud and Scale for Horizon 7
You can deploy Horizon 7 in a hybrid cloud environment when you use CPA to interconnect Horizon 7 on-premises and Horizon 7 pods on VMware Cloud on AWS. You can easily entitle your users to virtual desktop and RDS published apps on-premises and/or on VMware Cloud on AWS. You can configure it such that they can connect to whichever site is closest to them geographically as they roam.

You can also stretch CPA across Horizon 7 pods in two or more VMware Cloud on AWS data centers with the same flexibility to entitle your users to one or multiple pods as desired.

Of course, use of CPA is optional. You can choose to deploy Horizon 7 exclusively in a single VMware Cloud on AWS data center without linking it to any other data center.

Using CPA to Provide BC and DR for Horizon 7
Unlike traditional BCDR (business continuity and disaster recovery) solutions for apps, where replication of all data from the primary site to the secondary site is needed, we recommend a different approach for Horizon 7, using CPA. Since the majority of VDI and RDS deployments use non-persistent and stateless virtual machines that can be created and recreated very quickly, it is senseless to replicate them across sites. CPA can be used across on-premises Horizon 7 pods (primary site) and Horizon 7 pods on VMware Cloud on AWS (secondary site) for the purpose of BCDR. By using VMware Cloud on AWS as a secondary site for BCDR, you can take advantage of the hourly billing option and the pay-as-you-go benefit.

During normal operations, keep a small host footprint on VMware Cloud on AWS where you will deploy your Horizon 7 instance, store your updated golden images, and create a small pool of VMs. Note that there is a minimum number of hosts requirement per SDDC. When the primary site goes down, you can simply create the new virtual desktops as well as new hosts on the secondary site from the very same golden image. Use Global Entitlements to ensure that your end users can access desktops on the secondary site.
You will need to keep persistent data such as user profiles, user data, and golden images synced between the two sites by using a storage replication mechanism, such as DFS-R in a hub-spoke topology or another third-party file share technology. If you also use App Volumes and User Environment Manager, AppStacks and file share data will also need to be replicated from the primary site to the secondary site.

An important consideration in leveraging VMware Cloud on AWS as a secondary site for BCDR involves host availability at the AWS data center when you need your BCDR capacity. While there are usually spare hosts available that can be used to expand your secondary site, depending on your RTO (Recovery Point Objective) and growth requirement, you may not be able to reach your target number right away. The only way to guarantee the number of hosts you need right away is to reserve them ahead of time, but the tradeoff is the high cost. There are things you can do to optimize your availability and cost:

- Segment end-user populations into tiers in terms of RTO (recovery time objective). Some user segments may require a secondary desktop right away. You should have desktops created and on standby for them. Other user segments may be able to tolerate longer RTO and may require a secondary desktop within hours rather than minutes. In this case, you can wait for new hosts and desktops to be created. Each new host takes about 10 minutes to create, assuming the data center has an available physical server.

- New hosts in the same cluster are created serially, whereas hosts in different clusters are created in parallel. For faster host availability, it is better to have more clusters. Note: the current cluster limit recommended by VMware Cloud on AWS is 16 hosts per cluster.

Work with your VMware sales representative to ensure that you will have adequate BCDR capacity when you need it.

Below is an example of how you can set up and configure a BCDR site on VMware Cloud on AWS to protect your primary site. This works similarly regardless of whether the primary site is on-premises or on VMware Cloud on AWS.

In this example, our customer has a 1,600-user VDI pod / site on-premises and wants to set up a secondary pod/site on VMware Cloud on AWS for the purpose of BCDR. They have determined that they will need 16 hosts on VMware Cloud on AWS for when the entire 1,600 users are all using the secondary site. Our customer has also worked with the VMware Cloud on AWS team to ensure that there is likely enough spare capacity in the desired region / AZ for the scale up.

They have segmented their users into 2 tiers by their RTO:

- Tier 1 users – These users are essential personnel and need a secondary desktop right away when the primary pod/site goes down. There are 400 of them.

- Tier 2 users – These users will require a secondary desktop within about 2 hours after the primary pod/site goes down. There are 1200 of them.

First, create a secondary pod on VMware Cloud on AWS with 4 hosts, and pay the reserve instance price. On the 4 hosts, they can deploy 2 Connection Servers, 2 Unified Access Gateways, an AD Domain Controller, and an event database. Be sure to provision enough infrastructure components for the full BCDR capacity. They also need to store a copy of their golden images in the secondary pod.
Then initialize CPA between the primary pod and secondary pod. Put the primary pod in site 1 and the secondary pod in site 2.

During normal operations, create 2 pools on the primary pod/site, one for each tier of users, with names of primary_pool_tier1 and primary_pool_tier2. On the secondary pod/site, create 2 pools, one for each tier of users, with names of secondary_pool_tier1 and secondary_pool_tier2. Secondary_pool_tier1 is created with 400 VMs. Secondary_pool_tier2 is created with 1 VM.

Then create 2 global entitlements:

- GE1 consists of primary_pool_tier1 and secondary_pool_tier1, and all of the Tier 1 users.
- GE2 consists of primary_pool_tier2 and secondary_pool_tier2, and all of the Tier 2 users.

When they experience a site-wide outage of the primary site, all users will be automatically logged off. As they try to log back in, the administrator has configured a pre-authentication message to inform them when each tier of users should expect to be able to get a desktop. This prevents users from repeatedly trying to log in to the secondary site before it has a desktop ready for them. This message must be configured at the pod-level (rather than globally) at this time.

As instructed, the Tier 1 users will try to log back in to their desktops right away. Since there’s already a pool of 400 VMs ready for these users, they will be transparently connected to their secondary desktops.

In order to accommodate the 1,200 Tier 2 users, the administrator will first have to create 12 hosts, which will take roughly 120 minutes, since hosts in the same cluster are created serially. For faster creation, you can deploy on two clusters (hosts across multiple clusters are created in parallel). The downside of more clusters is that each cluster requires a 3-host minimum.

Once the hosts have been created, the administrator can then expand secondary_pool_tier2 from 1 VM to 1,200 VMs. And since these are instant clones, the pool expansion would take only 30 minutes or so. At the specified time, Tier 2 users will start logging in to their desktops and be transparently connected to a desktop on the secondary site.

The creation process is manual for now, as the automated creation of new hosts based on increased demand is currently under development.

Once the primary site is back online again, users will be automatically connected to their primary desktop the next time they log in. The administrator can simply delete the secondary desktops on the secondary site, and then delete the unused hosts on the secondary site.

Note: The workflow above currently only works with global entitlements involving 2 sites, a primary site and a secondary site. If you have a scenario where you want to use the same DR site for two different primary sites, you still need to create two separate sets of global entitlements, one set for primary site 1 and the secondary site, and another for primary site 2 and the secondary site.

You can optionally configure a global load balancer (GSLB) between the two sites and your end users (such as F5, AWS Route 53, or others). The global load balancer provides a single-namespace capability that allows the use of a common global namespace when referring to CPA. Using CPA with a global load balancer provides your end users with a single connection method and desktop icon in their Horizon Client or Workspace ONE console. Without the global load balancer and the ability to have a single
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namespace for multiple environments, end users will be presented with two different icons (corresponding to the number of pods on which desktops have been provisioned for them), which may potentially get confusing.

BC and DR for Horizon 7 Full-Clone Desktops
The BCDR (business continuity and disaster recovery) workflow recommended in the previous section works well for non-persistent instant clones. There are some additional considerations for protection of persistent full-clone desktops.

First, consider whether your users require the mirror image desktops after a primary site failure? If the answer is yes, you will need to replicate your primary full-clone desktops periodically to the secondary site. This is the most expensive type of protection for every primary full-clone desktop, you will need an equivalent secondary full-clone desktop on VMware Cloud on AWS, running at all times. You will also need to script the import of secondary desktops into the Connection Servers on the secondary site as a manual full-clone pool.

Most customers find that, given the cost of providing a fully mirrored desktop, it is acceptable to give their persistent full-clone desktop users a secondary desktop that is a pristine copy of same golden image. Any user customization or data not saved in a file share and replicated to the secondary site will be lost, so you will need to ensure that all important user data resides on a file share. You can then use the sample workflow above to provision either an instant-clone desktop or a full-clone desktop on the secondary site for BCDR purposes.

Configuring VMware Cloud on AWS for Horizon 7 Deployment
The recommendation for a production environment is to use a minimum of three hosts in a cluster. Using a single host is recommended only for testing because with a single host, there is no HA. By default, a single-node SDDC gets deleted after 30 days.

To deploy Horizon 7 on VMware Cloud on AWS:
1. Create an SDDC instance on VMware Cloud on AWS. See the VMware Cloud on AWS documentation.
2. Deploy Horizon 7.5 or later on VMware Cloud on AWS. See the Horizon 7 documentation.
3. Set up the Horizon 7 environment on VMware Cloud on AWS.

Horizon 7 Environment on VMware Cloud on AWS
When you set up the Horizon 7 environment on VMware Cloud on AWS, you must install and configure the following components:

• Install Active Directory, DNS, DHCP, and KMS servers.
• Optionally, install RDS license servers.
• Install Horizon Connection Server and replica server version 7.5 or later.

Use cloudadmin@vmc.local for the vCenter Server credentials and select VMware Cloud on AWS when adding the vCenter Server to Horizon.
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For a single-node cluster, modify the vSAN VM storage policy to “No data redundancy.”

Deploy a Unified Access Gateway appliance and connect it to the Connection Server if your deployment supports remote users.

- Use Unified Access Gateway version 3.3 or later.
- Only deploy a single NIC with the OVF Deploy wizard. For multiple NICs, use the PowerShell script to include the password and encode special characters in the .INI configuration file. For more information, see the Unified Access Gateway documentation.
- Deploy the NICs to the Compute-ResourcePool, WorkloadDatastore, and Workloads folder.
- Specify netmask0-2 for the NICs.
- Deploy a load balancer if you are using two or more Connection Servers.
- Optionally, install a Horizon event database on Microsoft SQL Server 2016.

Install Horizon Agent on the master images for RDS hosts and VDI virtual desktop VMs. This agent communicates with the Connection Servers.

Deploying Horizon 7 over Hybrid Cloud

You might already have Horizon 7 environments on-premises. The Horizon 7 pod on-premises and your Horizon 7 pod on VMware Cloud on AWS can be managed separately. Alternatively, you can extend your on-premises Horizon 7 environment to the cloud by linking it with your Horizon 7 on VMware Cloud on AWS environment using Cloud Pod Architecture (CPA). Deploying your Horizon 7 over hybrid cloud enables you to manage your on-premises deployment and your cloud deployment in a single federated space.

For hybrid cloud deployment, follow these steps.

1. Configure VPN and firewall rules to enable the Connection Server instance on VMware Cloud on AWS to communicate with the Connection Server instance on-premises.
2. Prepare Microsoft Active Directory (AD) and choose to set up a one-way trust or a two-way trust.
3. Ensure that your on-premises Horizon 7 version is 7.0 or later.
   - Note: The Horizon 7 version deployed on-premises does not have to match the Horizon 7 version deployed on VMware Cloud on AWS. However, you cannot mix a Horizon 6 pod (or lower) with a Horizon 7 pod within the same CPA.
4. Use Cloud Pod Architecture to connect the Horizon 7 pod on-premises with the Horizon 7 pod on VMware Cloud on AWS.
5. For easy sharing of VM images and ISO images, you can use the vCenter Content Library on each vCenter Server.

Connection and Firewall Configuration
To set up a successful hybrid cloud deployment, you must follow these connection and firewall rules.

Connection Rules
Use the VMC Console in VMware Cloud on AWS to create a VPN in the SDDC management network to connect to your on-premises management network. Next, configure the management gateway with firewall rules. Finally, specify DNS server addresses for the management network. Your networking team can configure the on-premises VPN using information you download from the SDDC.

You must configure the following VPN connections between components in the logical network:

- From the management component to the on-premises component
- From the compute component to the on-premises component
- From the compute component to the management component

You can also use AWS Direct Connect to set up a connection between Horizon 7 and VMware Cloud on AWS. For more information on configuring VPNs or using AWS Direct Connect, see the VMware Cloud on AWS Getting Started document.

Firewall Rules
You can run the Firewall Rule Accelerator in VMware Cloud on AWS for all VPNs to create all the required firewall rules.

The following table describes firewall rules for the Management Gateway on VMware Cloud on AWS.

<table>
<thead>
<tr>
<th>Rule Name</th>
<th>Service Name</th>
<th>Ports</th>
<th>Action</th>
<th>Source</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any SSO</td>
<td>SSO (TCP 7444)</td>
<td>7444</td>
<td>Allow</td>
<td>Any</td>
<td>vCenter</td>
</tr>
<tr>
<td>vCenter (ANY) to Management-On-Prem</td>
<td>Any (All Traffic)</td>
<td>Any</td>
<td>Allow</td>
<td>vCenter</td>
<td>Compute/On-prem subnet</td>
</tr>
<tr>
<td>ESXi (ANY) to Management-On-Prem</td>
<td>Any (All Traffic)</td>
<td>Any</td>
<td>Allow</td>
<td>ESXi</td>
<td>Compute/On-prem subnet</td>
</tr>
<tr>
<td>Management-On-Prem to vCenter (HTTPS)</td>
<td>HTTPS (TCP 443)</td>
<td>443</td>
<td>Allow</td>
<td>Compute/On-prem subnet</td>
<td>vCenter</td>
</tr>
<tr>
<td>Management-On-Prem to vCenter (ICMP)</td>
<td>ICMP (All ICMP)</td>
<td>Any</td>
<td>Allow</td>
<td>Compute/On-prem subnet</td>
<td>vCenter</td>
</tr>
<tr>
<td>Management-On-Prem to ESXi (Provisioning)</td>
<td>Provisioning (TCP 902)</td>
<td>902</td>
<td>Allow</td>
<td>Compute/On-prem subnet</td>
<td>ESXi</td>
</tr>
</tbody>
</table>
Deploying Horizon 7 on VMware Cloud on AWS

<table>
<thead>
<tr>
<th>Rule Name</th>
<th>Service Name</th>
<th>Ports</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management-On-Prem to ESXi (Remote Console)</td>
<td>Remote Console (TCP 903)</td>
<td>903</td>
<td>Allow</td>
</tr>
<tr>
<td>Management-On-Prem to ESXi (ICMP)</td>
<td>ICMP (All ICMP)</td>
<td>Any</td>
<td>Allow</td>
</tr>
<tr>
<td>Default Deny All</td>
<td>Any (All Traffic)</td>
<td>Any</td>
<td>Deny</td>
</tr>
</tbody>
</table>

The following table describes firewall rules for the Compute Gateway needed to install on VMware Cloud on AWS.

<table>
<thead>
<tr>
<th>Rule Name</th>
<th>Service Name</th>
<th>Ports</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compute (ANY) to Internet and VPN</td>
<td>Any (All Traffic)</td>
<td>Any</td>
<td>Allow</td>
</tr>
<tr>
<td>Management-On-Prem (ANY) to Backend</td>
<td>Any (All Traffic)</td>
<td>Any</td>
<td>Allow</td>
</tr>
</tbody>
</table>

For stricter control and external access, see the Ports and Services chapter in the VMware Horizon 7 Security guide.

Preparing Active Directory for Hybrid Cloud Deployment

If you are deploying Horizon 7 in a hybrid cloud environment by linking the on-premises pod with the VMware Cloud on AWS pod, you must prepare the on-premises Microsoft Active Directory (AD) to access the AD on VMware Cloud on AWS.

If you are deploying the Horizon 7 pod on VMware Cloud on AWS as a standalone (that is, not part of a hybrid cloud deployment), you can skip the preparation of the on-premises AD. Use the following guidelines to prepare AD for your hybrid cloud deployment if you want the on-premises AD domain controllers to service the Horizon 7 pod on VMware Cloud on AWS.

Note: The access time might be slow due to the latency between the on-premises pod and VMware Cloud on AWS.

On VMware Cloud on AWS, deploy a read-only AD domain controller, as follows: Configure a trust from the domain running on VMware Cloud on AWS to your existing domain. When you allow the domain running on VMware Cloud on AWS to access the on-premises domain, the domain running on VMware Cloud on AWS can serve as a resource domain. Configuring a trust enables your users to sign in with single sign-on (SSO), using their existing corporate credentials, to services running within VMware Cloud on AWS.
Linking Horizon 7 Pods on VMware Cloud on AWS
You can use the Cloud Pod Architecture feature to connect Horizon 7 pods regardless of whether the pods are on-premises or on VMware Cloud on AWS. When you deploy two or more Horizon 7 pods on VMware Cloud on AWS, you can manage them independently or manage them together by linking them with Cloud Pod Architecture.

• On one Connection Server, initialize Cloud Pod Architecture and join the Connection Server to a pod federation.

• Once initialized, you can create a global entitlement across your Horizon 7 pods on-premises and on VMware Cloud on AWS.

• Optionally, when you use Cloud Pod Architecture, you can deploy a global load balancer (such as F5, AWS Route 53, or others) between the pods. The global load balancer provides a single-namespace capability that allows the use of a common global namespace when referring to Horizon CPA. Using CPA with a global load balancer provides your end users with a single connection method and desktop icon in their Horizon Client or Workspace ONE console.

Without the global load balancer and the ability to have a single namespace for multiple environments, end users will be presented with a possibly confusing array of desktop icons (corresponding to the number of pods on which desktops have been provisioned for them). For more information on how to set up Cloud Pod Architecture, see the Administering Cloud Pod Architecture in Horizon 7 document.

Use Cloud Pod Architecture to link any number of Horizon 7 pods on VMware Cloud on AWS. The maximum number of pods must conform to the limits set for pods in Cloud Pod Architecture. See, the VMware Knowledge Base article VMware Horizon 7 Sizing Limits and Recommendations (2150348).

When you connect multiple Horizon 7 pods together with Cloud Pod Architecture, the Horizon 7 versions for each of the pods can be different from one another. The only limitation is that they all be Horizon 7 v7.0 or higher (that is, no mixing of Horizon 6 pods).

Shared Content Library
Content Libraries are container objects for VM, vApp, and OVF templates and other types of files, such as templates, ISO images, text files, and so on. vSphere administrators can use the templates in the library to deploy virtual machines and vApps in the vSphere inventory. Sharing golden images across multiple vCenter Server instances, between multiple VMware Cloud on AWS and/or on-premises SDDCs guarantees consistency, compliance, efficiency, and automation in deploying workloads at scale.

For more information, see Using Content Libraries in the vSphere Virtual Machine Administration guide in the VMware vSphere documentation.

Licensing
Enabling Horizon 7 to run on VMware Cloud on AWS requires two separate licenses: a capacity license for VMware Cloud on AWS and a Horizon subscription license.

For a POC or pilot deployment of Horizon 7 on VMware Cloud on AWS, you may use a temporary evaluation license or your existing perpetual license. However, to enable Horizon 7 for production deployment on VMware Cloud on AWS, you must purchase the new Horizon subscription license. To obtain the new Horizon subscription license or for more information on how to upgrade your existing
Deploying Horizon 7 on VMware Cloud on AWS

perpetual license to a subscription license and associated discounts, please contact your VMware representative.

Different Types of Horizon Subscription Licenses
Horizon subscription licenses come in the following major flavors:

• Horizon Apps Universal Subscription – deploying RDSH apps and shared desktops only. A single license can be used for deploying on-premises, on VMware Cloud on AWS, on Microsoft Azure, or on IBM Cloud. An on-premises vSphere license is included.

• Horizon Apps Subscription Add-on – deploying RDSH and shared desktops apps only. A single license can be used for deploying on VMware Cloud on AWS only. No on-premises vSphere license is included.

• Horizon Universal Subscription – deploying RDSH apps and VDI. A single license can be used for deploying on-premises, on VMware Cloud on AWS, on Microsoft Azure, or on IBM Cloud. An on-premises vSphere license is included.

• Horizon Subscription Add-on – deploying RDSH apps and VDI. A single license can be used for deploying on VMware Cloud on AWS only. No on-premises vSphere license is included.

• Workspace ONE Enterprise Subscription – deploying Horizon RDSH apps as well as the Workspace ONE mobility solution.

• Workspace ONE Enterprise for VDI Subscription – deploying Horizon RDSH apps and VDI, as well as the Workspace ONE mobility solution.

All licenses above offer Concurrent User or Named User options, with the exception of Workspace ONE, which only offers Named User licensing.

You can use different licenses (including perpetual licenses) on different Horizon pods, regardless of whether the pods are connected by CPA. You cannot mix different licenses within a pod because each pod only takes one type of license. For example, you cannot use both a perpetual license and a subscription license for a single pod. You also cannot use both the Horizon Apps Universal Subscription license and the Horizon Universal Subscription license in a single pod.

You can, however, use different licenses on different pods even if they are connected by CPA. Suppose you have two pods deployed—pod A is deployed on-premises and pod B is deployed on VMware Cloud on AWS—and the two pods are connected by CPA. You can use a different license type on each pod. For example, you can use the Horizon Enterprise perpetual license for pod A, and the new Horizon Universal Subscription license for pod B.

The best subscription license you need for your Horizon 7 on VMware Cloud on AWS deployment will depend on your use case. Here are some examples:

• You are setting up a new Horizon 7 deployment for 2,000 VDI users on VMware Cloud on AWS. There are no on-premises components. Purchase 2,000-user Horizon Subscription Add-on license in this case.

• You have an existing Horizon 7 pod on-premises for 2,000 users, and you want to deploy a pod on VMware Cloud on AWS for an addition 1,000 users for full time VDI use. The best license type is the Horizon Subscription Add-on for your Horizon 7 pod on VMware Cloud on AWS. You would keep your
perpetual license for the on-premises pod until renewal and then decide whether to move to Horizon Universal Subscription license for your on-premises pod.

- You have an existing Horizon 7 pod on-premises for 2,000 users, and you want to deploy a pod on VMware Cloud on AWS as BCDR capacity for the 2,000 users on-premises. The best license type is to upgrade your existing 2,000-user perpetual license to 2,000-user Horizon Universal Subscription license. This new license would allow these 2,000 users to connect to virtual desktops either on-premises or on VMware Cloud on AWS.

License Enablement

Regardless of whether you are deploying Horizon 7 on-premises or on VMware Cloud on AWS, if you are using any of the subscription licenses, you must install the Horizon Cloud Connector to enable subscription license management for Horizon 7. The Horizon 7 Cloud Connector is a virtual appliance that connects a Horizon 7 pod with Horizon Cloud Service features.

A MyVMware account from https://my.vmware.com is required for Horizon 7 subscription license. Once you purchase the subscription license, a record will be created in the Horizon Cloud Service using your MyVMware email address, and your subscription license information will be visible to the Horizon Administrator console.

As part of the subscription license fulfillment process, you will receive email with a link to download the Horizon 7 Cloud Connector as an OVA (open virtual appliance) file. Follow the instructions in the email to deploy the Cloud Connector, using the vSphere web client, alongside your new or existing Horizon 7 pods. Once deployed, the Cloud Connector is paired with a Connection Server in the Horizon 7 pod, and this pod is connected to the Horizon Cloud Service. The Horizon Cloud Service manages the Horizon 7 subscription license between connected Horizon 7 pods.

Unlike the Horizon 7 perpetual license, with a subscription license, you do not need to retrieve or manually enter a license key for Horizon 7 product activation. However, supporting component license keys, such as the license keys for vSphere, App Volumes, and others, will be delivered separately, and the administrator must manually enter them to activate the product.

Review the Horizon 7 documentation for more details on how to deploy the Horizon 7 Cloud Connector Virtual Appliance. You will need a separate Cloud Connector for each pod.

Deploying Desktops on VMware Cloud on AWS with Instant Clone, App Volumes, and User Environment Manager

Instant Clone

In addition to using full clones, you can also leverage Instant Clone Technology (starting with Horizon 7.7) coupled with App Volumes (starting with App Volumes 2.15) to accelerate the delivery of user-customized and fully personalized desktops. Dramatically reduce infrastructure requirements while enhancing security by delivering a brand-new personalized desktop and application services to end users every time they log in:

- Reap the economic benefits of stateless, nonpersistent virtual desktops served up to date upon each login.
- Deliver a pristine, high-performance personalized desktop every time a user logs in.
• Improve security by destroying desktops every time a user logs out.

When you install and configure Horizon 7 for instant clone for deployment on VMware Cloud on AWS, do the following:

When adding VMware Cloud on AWS vCenter Server to the Horizon configuration, be sure to select the VMware Cloud on AWS check box.

• CBRC is not supported or needed on VMware Cloud on AWS. CBRC has been disabled by default.

• On the master image, add the domain’s DNS to avoid customization failures.

• When creating Horizon instant-clone pools on VMware Cloud on AWS, use the following settings in the provisioning wizard:
  • Compute-ResourcePool resource pool
  • Workloads folder
  • WorkloadDatastore datastore

Multi-VLAN is not yet supported when creating Horizon instant-clone pools on VMware Cloud.

App Volumes
App Volumes provides real-time application delivery and management, now for on-premises and on VMC:

• Quickly provision applications at scale.

• Dynamically attach applications to users, groups, or devices, even when users are already logged in to their desktop.

• Provision, deliver, update, and retire applications in real time.

• Provide a user-writable volume, allowing users to install applications that follow them across desktops.

• Provide end users with quick access to a Windows workspace and applications, with a personalized and consistent experience across devices and locations.

• Simplify end-user profile management by providing organizations with a single and scalable solution that leverages the existing infrastructure.

• Speed up the login process by applying configuration and environment settings in an asynchronous process instead of all at login.

• Provide a dynamic environment configuration, such as drive or printer mappings, when a user launches an application.

For more information on how to configure, see Configuring App Volumes Manager for VMware Cloud on AWS in the App Volumes Administration guide.

Transfer App Volumes from vSphere to VMware Cloud on AWS
For migration or BCDR purposes, you can transfer your AppStacks or user-writable volumes from on-premises to the VMware Cloud on AWS environment using your vSphere client in a two-step process.

From the vSphere Client:
1. Create a VM with thin provisioning and attach the volume that you want to transfer to the VM.
2. Select the VM and export it as an OVF template from File > Export to OVF Template.
From the VMware Cloud on AWS web client:

1. Click Actions > Deploy OVF Template.
2. Follow the on-screen instructions and when prompted to select the storage format, select Thin provision.

Once the VM is created, browse the datastore where the OVF was exported and move the VMDK file with its metadata to the cloudvolumes directory.

Ensure that you change the template location in the metadata file to point to the new datastore.

User Environment Manager
Use VMware User Environment Manager for application personalization and dynamic policy configuration across any virtual, physical, and cloud-based environment. Install and configure User Environment Manager on VMware Cloud on AWS just like you would install it on-premises.

Deploying External Storage for User Data
User data is an important consideration when thinking about deploying Horizon 7 on VMware Cloud on AWS. For storing user profiles and user data, you can either deploy a Windows file share on VMware Cloud on AWS (and use DFS-R to replicate data across multiple sites) or use external storage, such as Dell EMC Unity Cloud Service.

Dell EMC Unity Cloud Edition provides a ready-made solution for storing file data such as user home directories and can be easily deployed alongside Horizon 7 on VMware Cloud on AWS. Dell EMC Unity Cloud Edition also supports Cloud Sync for replicating data between Dell EMC Unity systems on premises and VMware Cloud on AWS.

For deployment details please refer to Dell EMC Unity Cloud Edition with VMware Cloud on AWS Whitepaper and video.

Estimating Data Egress Cost
Unlike on-premises deployments, deploying Horizon 7 on VMware Cloud on AWS incurs data egress costs based on the amount of data egress traffic your environment will generate. It is important to understand and estimate the data egress traffic.

Understanding Different Types Data Egress Traffic
Depending on your deployment use case, you may be incurring costs for some or all of the following types of data egress traffic:

- End-user traffic via the Internet – You have configured your environment where your end users will connect to their virtual desktops on VMware Cloud on AWS remotely via the Internet. Any data leaving the VMware Cloud on AWS data center will incur egress charges. Egress data consists of the following components: outbound data from Horizon 7 protocols and outbound data from remote experience features (for example, remote printing). While the former is typically predicable, the latter has more variance and depends on the exact activity of the user.

- End-user traffic via the on-premises data center – You have configured your environment where your end users will connect to their virtual desktops on VMware Cloud on AWS via your on-premises data
Deploying Horizon 7 on VMware Cloud on AWS

center. In this case, you will have to link your data center with the VMware Cloud on AWS data center using VPN or Direct Connect. Any data traffic leaving the VMware Cloud on AWS data center and traveling back to your data center will incur egress charges. And if you have Cloud Pod Architecture (CPA) configured between the on-premises environment and the VMware Cloud on AWS environment, you will incur egress charges for any CPA traffic between the two pods (although CPA traffic is typically fairly light).

• External application traffic – You have configured your environment where your virtual desktops on VMware Cloud on AWS must access applications hosted either in your on-premises environment or in another cloud. Any data traffic leaving the VMware Cloud on AWS data center and traveling to these other data centers will incur egress charges.

Note: Data traffic within your VMware Cloud on AWS organization or between the organization and AWS services in that same region is exempt from egress charges. However, any traffic from the organization to another availability zone or to another AWS region will be subject to egress charges.

Data ingress (that is, data flowing into the VMware Cloud on AWS data center) is free of charge.

Estimating Data Egress Traffic with SysTrack from Lakeside

Since the data egress cost is priced per GB, the best way to estimate your data egress cost is to estimate your likely data egress traffic by using a monitoring tool in your existing on-premises environment (whether it’s already virtualized or not). Make sure you estimate the different types of data egress traffic listed above separately as applicable. One such monitoring tool is SysTrack from Lakeside Software.

Lakeside’s SysTrack workplace analytics solution contains an extensive set of tools to provide relevant planning information for desktop transformation. Best of all, this is available at no cost to VMware customers via the SysTrack Desktop Assessment (SDA). Through the SDA, customers can collect detailed environmental information, including recommendations for deployment options and resource requirements, with only the need to deploy the SysTrack agent to systems being considered for transformation. For advanced cases, the on-premises version of SysTrack can be used as well. In this guide, we make the assumption that such a deployment is already in place. For additional setup details or questions about the SDA, the Quick Start Guide is a good resource.

Once SysTrack is deployed in the environment, it will immediately begin collecting relevant information from devices on which it’s installed. For this guide, we will focus on the most interesting facets of data collection for the network:

• Per-device network usage
• Per-session protocol bandwidth usage
• Per-application (and destination) bandwidth usage

The key is thinking about how best to combine these pieces of information into something that is useful for planning costs. Because the ingress data is free on VMware on AWS, we will focus on the egress data as observed from the devices in the collection. That will take the form of “transmitted” data from that device to other destinations, and you will see more details about this as we go into the methodology we suggest.
With SysTrack you can make use of two different styles of calculation, depending on the level of detail you would like to see. We have created several dashboards that customers can use to easily visualize this information in SysTrack.

Note: All figures in these dashboards are measured in bits, not bytes.

1. Basic Network Egress Bandwidth Calculation
   The Horizon Sizing Tool dashboard provides some basic numbers to help you plan your migration to the VMware cloud. The table below breaks users down into categories based on egress bandwidth consumption. Resource consumption metrics are supplied for each category as well as egress bandwidth consumption for applications and three remote display protocols: ICA, Blast Extreme, and PCoIP.

   The resource consumption metrics can be fed into some of the VMware sizing tools (Horizon Sizing Tool & Horizon Sizing Estimator). These tools provide guidance on how to plan for the number and size of systems you will be deploying.

2. Advanced Network Egress Bandwidth Calculation
   The Advanced Horizon Sizing Tool offers advanced sizing calculations, which can be used to estimate costs around migrating to the VMware cloud. VMware cloud pricing is based around the level of data transmitted from the cloud back to the client (namely, egress bandwidth consumption).

   Within the dashboard, each user is put into a category based on egress bandwidth consumption. This can be based on actual SysTrack data, if you are migrating from an existing virtual environment, or estimated if migrating from a physical environment.

   You can select the protocol you would like to use to estimate values for users on physical machines, as well as the type of egress data displayed: protocol, application, or a combination of both.

   A summary table shows these categories and tells you the total and average for egress bandwidth consumption.
Deploying Horizon 7 on VMware Cloud on AWS

This same data is also presented in graph form for a more visual presentation:

You can also see more detail on a per-user basis, depending on the category selected in the summary table. The table below shows total and average bandwidth consumption as well as calculation type, which indicates which data source was used to generate the consumption values.
Here is an example of how to determine monthly egress bandwidth per VM in gigabytes.

If you want to simply calculate the egress bandwidth for an average VM, you can take the “Total Tb 30 Days” and “Users” values in the advanced dashboard summary table and perform the following calculation:

\[
\text{Monthly GB egress bandwidth per VM} = \frac{((\text{Total Tb 30 Days})/8) \times 1024}{\text{Users}}
\]

From the data in the screenshot below, the calculation would become this:

\[
\text{Monthly GB egress bandwidth per VM} = \frac{(9.67/8) \times 1024}{92} = 13.5 \text{ GB}
\]