CHAPTER 1

What is Leostream?

Leostream is a VDI/DaaS management solution which enables cloud service providers and managed service providers to create, secure and manage multi-tenant Virtual Desktop Infrastructure (VDI) environments and offer Desktop as a Service, running on top of Virtuozzo Hybrid Infrastructure Platform.

In this integration Virtuozzo Hybrid Infrastructure will act as an Infrastructure service provider (IaaS) for Leostream, which will:

- Integrate with Identity Providers such as Active Directory and LDAP to authenticate users accessing the VDI environment and provide domain authentication to your Virtual Desktops.
- Support Multi Factor Authentication (MFA) providers such as Duo, Ping ID and Okta.
- Leverage your corporate Identity Provider (IdP) for authentication into your Leostream environment, using Leostream’s support for the SAML protocol.
- Create pools of virtual desktops based on a golden image.
- Automatically scale up and scale down your virtual desktop pools.
- Automatically join provisioned virtual desktops to your Active Directory domain.
- Manage multiple virtual desktop infrastructure tenants.
- Manage the lifecycle of virtual desktops in your pools, including power state and termination.
- Manage multiple clouds or infrastructure as a service (IaaS) providers from a single console.
- Granularly define virtual desktop access control rules and assignment by leveraging, Leostream policies, plans, and assignments.
- Clientless access and multiple display protocol support for HTML5-based RDP, VNC, and SSH viewer.
Chapter 1. What is Leostream?

- Monitor Leostream environments using SMTP and get updates via e-mail.
- Manage user access based on location, for example internal vs external network.
- Generate reports for resource usage, login history, assignment, and Leostream Connection Broker metrics.

1.1 Leostream Platform Components

The Leostream Connection Broker: The backbone of the Leostream platform. From the Leostream Connection Broker you can manage and configure your virtual desktop infrastructure. The Leostream Connection Broker is also responsible for authenticating the user, offering resources (Desktops), assigning virtual desktops, and managing their lifecycle when they are returned to the pool by applying release and power policies.

The Leostream Gateway: A secure gateway that provides access to Virtual Desktops behind a secured zone. Clients, can access remote desktops via the gateway using the HTML5-based web interface which has support for SSH, RDP or VNC protocols and allows you to access remote desktops via the web interface and without the Leostream Connect App. If using the Leostream Connect App clients can connect to the remote desktops using the following protocols RDP, VNC, NoMachine or Mechdyne GTX amongst others.

The Leostream Agent: This component is installed on the Virtual Desktops and provides information to the Leostream Connection Broker about, connected users, actions such as login, reboot etc. This information is used by the Leostream Connection Broker to understand the status of a remote Virtual Desktop, also enables features such as USB device passthrough and network printer redirection. The agent is available for Linux, Windows, and MacOS Operating Systems. For more details see Leostream Agent Administrator's Guide.

The Leostream Connect App: The connect software is a client provided by Leostream that allows users to connect to Remote Desktops. For more details, see the Leostream Connect Administrator's Guide.

Database: The Leostream Connection Broker stores all the information on a Database and for large scale deployments an external Database is recommended. PostgreSQL, Azure SQL, or Microsoft SQL Server are supported.

Architectural Overview

The following figure shows a high-level architecture overview for a typical Leostream deployment on Virtuozzo Hybrid Infrastructure.
Chapter 1. What is Leostream?
2.1 Example Overview

In this integration guide, our goal will be to explain how to integrate Leostream with Virtuozzo Hybrid Infrastructure. We will be using a Windows 2019 image as a master image/blueprint to create desktops on the VDI pool. We will configure a basic pool; we'll define the concept of pools later. This pool will be in charge of automatically provisioning virtual desktops in order to meet the demand (users logging in to the Gateway). We will also define the minimum/maximum number of virtual desktops our pool will be able to deliver. Leostream, will also be configured to use Active Directory as an authentication method to grant access to our desktop pool resources, every time an Active Directory user logs in to the gateway, it will be forwarded to the Leostream Connection Broker, if the user is a valid AD user, they will be offered a floating desktop (roaming profiles will be used) from the available desktops in the pool. Every time the user logs out from the virtual desktop, the desktop will be freed and offered to another user on login, if there are not enough resources our Leostream Connection Broker will provision them until it hits the provisioning limit.

2.2 Integration Overview

This integration guide aims to explain the steps to integrate Leostream and Virtuozzo Hybrid Infrastructure. Here is an overview of the steps we will follow:

1. Check Prerequisites.
Chapter 2. Integrating Leostream with Virtuozzo Hybrid Infrastructure

2. Create the Domain, Users and Project on Virtuozzo Hybrid Infrastructure.


4. Create a Router (we will enable SNAT on the above networks).

5. Create two CentOS 7 VMs, one for the Leostream Connection Broker the other for the Leostream Gateway.

6. Create a Floating IP. We will assign a floating IP to the Gateway VM.


8. Install the Leostream Gateway and assign a floating IP.

9. Install the Leostream Connection Broker.

10. Configure the Leostream Gateway for Connection Broker forwarding.

11. Configure the Leostream Broker, including integration with Virtuozzo Hybrid Infrastructure, building pools that manage capacity in Virtuozzo Hybrid Infrastructure, defining Active Directory authentication servers, configuring plans and policies for user assignment to pools.

12. Use the Leostream Connect Client to access the remote desktops.

2.3 Prerequisites

• The Leostream Connection Broker needs to access the OpenStack API endpoint in order to manage the infrastructure.

• A user with admin rights for Virtuozzo Hybrid Infrastructure, which will be used to create a Domain, Users and Project described in the next section. The project in Virtuozzo Hybrid Infrastructure must include enough resources for the Leostream components and the VDI infrastructure.

• You will also need an image for CentOS 7 available on your Virtuozzo Hybrid Infrastructure project.

• A VM with Active Directory Configured, we will be using Active Directory as the authentication method.
to access Virtual Desktops.

- A golden Virtual Desktop image (a Windows Desktop image with the Leostream Agent installed) ensure this image is created after installing the Leostream Connection Broker, as we will need the IP of the Leostream Connection Broker for the agent). This image will be used as a base for the creation of the Pools.

- A Leostream Serial Number to generate the License.
CHAPTER 3

Creating Virtuozzo Hybrid Infrastructure Resources

Create the necessary resources on your Virtuozzo Hybrid Infrastructure (Domain, Project, and User) to host the Leostream VDI workloads and access them securely.

1. Login to the Virtuozzo Hybrid Infrastructure admin panel.

2. Go to Settings > Projects and users in Virtuozzo Hybrid Infrastructure and click on Create domain.
3. In the **Create domain** form, shown in the following figure, enter a **Name** and **Description** for the Domain you will use to host our users and projects (tenants), and click **Create**.

4. Select your new domain on the **Settings > Project and users** page and go to the **Domain** users tab. Click **Create user** to create a **Domain administrator**. Specify the **Login**, **Password**, and optionally email address and description. As we are creating a **Domain administrator**, please ensure that you select **Domain administrator** from the **Role** drop-down menu.
5. Select your new domain on the **Settings > Project and users** page and go to the **Projects** tab. Click **Create project** to create a new project to host the Leostream Platform and Virtual Desktop Infrastructure resources. Enter a **Name** and optionally a **Description** for the project, and set any compute quotes, as shown in the following figure.

6. Select your new domain on the **Settings > Project and users** page and go to the **Domain** users tab. Click **Create user** to create a **Project member** from the Role drop-down menu, as shown in the following figure.
7. To assign the project user to your project, select your new domain on the **Settings > Project and users** page and go to the **Projects** tab. Click the ellipses at the far right of the project's row then click **Assign members**.

8. Go to the **Compute > Networks** page to enable your project to access the external network and a pool of Floating IP addresses.

   • select your external network  
   • from the panel right, click **Edit** in the **Network** access section  
   • ensure your new project is selected in the **Edit network access** form, as shown in the following figure
CHAPTER 4

Creating Networks for Leostream

After creating the domain, project, and users for your Leostream environment, use the self-service portal to configure the required network. The self-service portal is typically available at:

https://<admin_panel_virtual_IP_address>:8800

1. Log in to the self-service portal, with the credentials for the project user.

2. Go to the Networks page to create four networks for your deployment:
• VDI-network
• AD-Network
• Gateway-Network
• Broker-Network.

Click the Create virtual network button and proceed through the wizard to configure the networks as per your requirements. For more info on how to create networks check here Creating Compute Networks and look for the steps to create a virtual network.

If you are integrating with Active Directory, add your Active Directory IP as your DNS Server for the VDI-network as shown in the following figure.

3. Go to the Routers page to create a Virtual Router. Ensure that you enable SNAT, as shown in the following figure, in order to allow the VMs access to the internet. For more information, see Creating virtual routers.
When completed, your virtual router appears similar to the example shown in the following figure. Security groups can be created in order to restrict and isolate the networks if needed. Later in this document we will enumerate the ports that must be allowed between the Leostream Connection Broker, the Leostream Gateway and the virtual desktops.
CHAPTER 5

Installing Leostream in Virtuozzo Hybrid Infrastructure

The Leostream Connection Broker must be installed in a location where it has network access to the Leostream Agents installed on your VDI instances. The following procedure covers installing a single instance of the Leostream Connection Broker and Leostream Gateway. For information on creating clusters of Connection Brokers for large-scale production environments, see the Leostream Scalability Guide.

5.1 Security Groups Requirements

Before creating your Connection Broker and Leostream Gateway instances, ensure that you have the appropriate security groups configured in Virtuozzo Hybrid Infrastructure. Leostream requires the following ports be open for incoming traffic to the specified component. Consider three separate security groups:

- Connection Broker
- Leostream Gateway
- VDI instances

<table>
<thead>
<tr>
<th>Port</th>
<th>Required By</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Connection Broker, Leostream Gateway</td>
<td>For SSH access to the Connection Broker or Leostream Gateway, if required.</td>
</tr>
</tbody>
</table>

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Table 5.1.1 -- continued from previous page

<table>
<thead>
<tr>
<th>Port</th>
<th>Required By</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>443</td>
<td>Connection Broker, Leostream Gateway</td>
<td>For access to the Connection Broker Web interface, and communications from the Leostream Agents and Leostream Connect. On the Leostream Gateway, for communication from Leostream Connect and to use the Leostream HTML5 viewer.</td>
</tr>
<tr>
<td>20001-22000</td>
<td>Leostream Gateway</td>
<td>The Leostream Gateway uses this default port range to forward display protocol traffic from the user's client device to an instance isolated in a private VHI network. You may optionally change this port range using the Leostream Gateway CLI. <strong>NOTE:</strong> You do not need to open this range if you use the display protocol port for forwarding desktop connection traffic. For that scenario, open the display protocol port in the Leostream Gateway security group, instead.</td>
</tr>
<tr>
<td>8080</td>
<td>VDI instances</td>
<td>Port for communications from the Connection Broker to the Leostream Agent. * The Leostream Agent port may be changed using the Leostream Agent Control Panel dialog. If you change the default Leostream Agent port, ensure that you open the associated port in the security group</td>
</tr>
<tr>
<td>3389**</td>
<td>VDI instances, Leostream Gateway</td>
<td>For RDP access to the VDI/DaaS instances ** This port is dependent on the display protocol you plan to use. If you use a display protocol other than RDP, ensure that you open the ports required by that display protocol.</td>
</tr>
</tbody>
</table>

5.2 Creating Leostream Infrastructure VMs (Broker and Gateway)

The Connection Broker and Leostream Gateway install on the latest 64-bit CentOS 7 or Red Hat Enterprise Linux 7. Each component requires a unique VM.
Chapter 5. Installing Leostream in Virtuozzo Hybrid Infrastructure

**Note:** Neither the Connection Broker nor the Leostream Gateway can be deployed on CentOS 8, Red Hat Enterprise Linux version 8, or any other Linux distribution.

When creating a virtual machine for the Connection Broker installation, ensure that the VM has, at least, the following resources:

- 4 vCPUs
- 8.0 GB of RAM
- At least 20 GB of hard drive space
- One NIC, ideally with internet connectivity

At a minimum, create a virtual machine for your Leostream Gateway with the following resources.

- 2 or more CPUs or vCPUs at 2.5GHz or higher
- 4 GB of RAM, more if using the built-in Leostream HTML5 viewer.
- 4 GB of swap space
- 20 GB of free disk

To create virtual machines using the VM creation wizard. Go to **Compute > Virtual Machines** and click **Create Virtual Machine**. For complete instructions, see **Creating virtual machines**. The following figure shows an example creating a VM for the Connection Broker from your CentOS 7 image and using a large flavor.
When creating the VMs ensure that the Connection Broker VM has access to the Broker-Network and the Gateway VM has access to the Gateway-Network by attaching the network during the VM creation wizard. If you forget to do so, you can attach the network once the VM has been created.
CHAPTER 6

Adding Floating IP to Gateway VM (DNAT Access)

The Leostream Gateway provides access to the private virtual desktops and forwards traffic to the Connection Broker, which is behind a firewall. To make the Leostream Gateway publicly accessible, associate a floating IP address with the Leostream Gateway's private IP, as follows.

1. From the self-service portal, go to Compute > Floating IPs and click Add to allocate a new floating IP to your project.

2. Click the ellipses icon at the far right of the row for your new floating IP, and select Assign. In the Assign floating IP address window, select the Leostream Gateway VM network interface with a fixed private IP address.

The following figure shows a floating IP assigned to a VM IP address.
CHAPTER 7
Installing and Configuring Leostream Gateway

After building and updating your base operating system, run the following command to install your Leostream Gateway.

```
curl http://downloads.leostream.com/gateway.sh | bash
```

The installation script downloads and installs any dependencies required by the gateway.
Prior to installing your Connection Broker or Leostream Gateway, install the latest updates on both operating systems. After the updates are applied, if your Connection Broker instance has access to the internet, you can install the Connection Broker by logging into the instance's console and executing the following command:

```bash
curl http://downloads.leostream.com/broker.prod.sh | bash
```

If your Connection Broker instance does not have internet access, download the Connection Broker package from the following location and copy the file into the Connection Broker instance.

https://www.leostream.com/resource/leostream-connection-broker-9-0/

After the installation is complete, ensure that your Connection Broker can access the OpenStack API endpoint in order to manage Virtuozzo Hybrid Infrastructure. You can do this by running the following command, and shown by example in the following figure.
The Connection Broker uses the private IP address assigned by Virtuozzo Hybrid Infrastructure on the network you selected when creating the VM. To access the Connection Broker Administrator Web interface, you must be able to access the Connection Broker from a Web browser, which you can do by enabling Connection Broker forwarding on the Leostream Gateway, as described in the following section.
CHAPTER 9

Configuring Leostream Connection Broker

9.1 Enabling Connection Broker Forwarding

The Leostream Gateway can be used to forward user login traffic from Leostream client devices to the Leostream Connection Broker. With Connection Broker forwarding enabled, the Connection Broker does not need to be accessible from the user’s client device and, instead, can be isolated in the same network as your desktops.

To enable Connection Broker forwarding, log into your Leostream Gateway and execute the following command:

```
sudo leostream-gateway --broker <your-broker-address>
```

The following figure shows an example of enabling Connection Broker forwarding:
You can now access the Connection Broker Administrator Web interface using the public floating IP address of your Leostream Gateway.

9.2 Licensing Leostream Connection Broker

Your Connection Broker license is derived from the serial number you received from Leostream Sales. If you do not have a Leostream 9 serial number, please contact sales@leostream.com. To obtain your license key:

1. Point a web browser at the IP address of the machine running the Connection Broker. The Connection Broker Sign In page opens.

2. Log into your Connection Broker using the following default administrator credentials:

   username=admin
   password=leo

3. On the Leostream License page, select Enter manually from the How do you want to enter your license key drop-down menu.

4. Below the drop-down, click the link to go to https://license.leostream.com. The installation code for your Connection Broker is automatically populated.

5. Enter the serial number you obtained from Leostream sales.

6. Enter the email address associated with that serial number.

7. Click Generate a license.

8. Click the Apply to the broker button above the generated license key. The browser returns to the Leostream License page.

9. Select the I have read and accept the License Agreement check box.

10. Click Save.

Important: The generated license key is linked to this Connection Broker installation or cluster. If you rebuild your Connection Broker or create a second Leostream environment, contact sales@leostream.com to obtain a new serial number for that environment.

After you license your Connection Broker, you arrive at the Dashboard > Pool Statistics page, shown in the following figure.
There are six main management pages accessible from the menu along the left side:

- **Signed in** indicates who is logged in and contains tools for logging out and resetting the Administrator Password.

- **Dashboard** provides information about pool statistics, reports, and Leostream component downloads.

- **Setup** integrates with external systems, such as Authentication Servers, MFA providers, Virtuozzo Hybrid Infrastructure, and Leostream Gateways.

- **Configuration** defines VDI workflows, including pools, protocol plans, power control plans, release plans policies, locations, and assignments.

- **Resources** lists all managed resources, including virtual machines imported from or generated on Virtuozzo Hybrid Infrastructure.

- **System** configures system parameters, such as SNMP, Alerts, Backups, add SSL certificates.

### 9.3 Changing Default Admin Password

For security reasons, change the default administrator password the first time you use your Connection Broker. To change the administrator password, log in to the Connection Broker as the default administrator and go to the **Sign in > My Options** page, shown in the following figure.
1. Enter a new password in the **Password** edit field.

2. Reenter the new password in the **Re-type password** edit field.

3. Click **Save**.

**Important:** The Connection Broker cannot remind you of your password. If you forget your administrator password, reset it using the Connection Broker virtual machine console. See “Resetting the Default admin Password” in the *Connection Broker Security Review* document for complete instructions.
Leostream can manage connections to existing virtual machines and provision new virtual machines from existing Virtuozzo Hybrid Infrastructure images.

**Important:** Currently, you cannot create new images within the Leostream interface. All images must be created using native Virtuozzo Hybrid Infrastructure tools.

### 10.1 Supported Operating Systems

The Leostream Connection Broker can manage connections to virtual machines running any of the following operating systems:

1. Any Microsoft Windows operating system version currently covered by Mainstream Support under the Microsoft Fixed Lifecycle Policy, or in service under the Microsoft Modern Lifecycle Policy.

2. Any of the following operating systems when running a Java Runtime Environment version 1.7, or later:
   - CentOS
   - Debian
   - Fedora
   - SUSE Linux Enterprise
   - Red Hat Enterprise Linux
   - Ubuntu
When creating instances within Virtuozzo Hybrid Infrastructure, ensure that you install the appropriate Leostream Agent onto the virtual machine and register that agent with your Leostream Connection Broker, as described in the following section.

To upload an existing image, consult the Virtuozzo documentation.

10.2 Installing Leostream Agent

When installed on a desktop, the Leostream Agent provides the Connection Broker with additional information about the user's session, including:

- When the user logs into the remote desktop
- When the user disconnects from the remote session
- When the user logs off of the remote desktop
- When the user locks or unlocks their remote desktop
- When the user’s session is idle

In addition, the Connection Broker requires the Leostream Agent to enforce certain role and policy options, including:

- Adding Local Users or adding users to the Remote Desktop Users group
- Taking actions when the user disconnects from their remote session
- Using release plan options to lock, disconnect, or log out the user after their session is idle
- Attaching network printers specified by Connection Broker printer plans
- Using registry plans to modify or create registry keys on the remote desktop
- Changing the hostname and joining newly provisioned Windows virtual machines to an Active Directory domain

Leostream provides a Leostream Agent version for Windows operating systems and a Java version of the Leostream Agent for Linux operating systems. Ensure that you download the appropriate Leostream Agent from the Leostream Downloads page. Consult the Leostream Installation Guide for instructions on how to install the Leostream Agent on your Virtuozzo Hybrid Infrastructure virtual machines.
The Connection Broker address can be specified when you install the Leostream Agent. If you need to specify or change the Connection Broker address after the Leostream Agent is installed, you can use the Leostream Control Panel dialog in Windows or set the address in the leostreamagent.conf file on Linux. See the Leostream Agent Administrator’s Guide for more information.

10.3 Requirements for Performing Domain Joins

If you plan to use Leostream to provision new Windows instances in Virtuozzo Hybrid Infrastructure and to have Leostream update and hostname and join these new Windows instances to your Microsoft Active Directory domain, please adhere to the following guidelines when building the master image to use for provisioning.

- The instance used to create the image must not be joined to the domain. Leostream only joins instances to a domain if they are currently part of a Workgroup.

- The instance must have an installed Leostream Agent that is registered with your Connection Broker. If the Leostream Agent cannot communicate with the Connection Broker, new instances will not be joined to the domain.
CHAPTER 11

Integrating External Systems

11.1 Connecting to Authentication Servers

The Connection Broker can authenticate users against Microsoft Active Directory and OpenLDAP authentication servers. To authenticate users, you first register your domain with your Connection Broker.

1. Go to the **Setup > Authentication Servers** menu.

2. Click the **Add Authentication Server** link.

3. In the **Add Authentication Server** form, select **Active Directory** from the **Type** drop-down list.

4. Enter the name for this server in the Connection Broker in the **Authentication Server name** edit field, as shown in the below image.

5. In the **Domain** edit field, enter the domain name associated with this Active Directory server.

6. In the **Connection Settings** section, shown in the following figure, use the following procedure to integrate with your Active Directory authentication server.
6.1. From the Specify address using drop-down menu, select Hostname or IP address.

6.2. Enter the authentication server hostname or IP address in the Hostname or IP address edit field.

6.3. Enter the port number in the Port edit field.

6.4. Check the Encrypt connection to authentication server using SSL (LDAPS) checkbox if you need a secure connection to the authentication server.

7. In the **Search Settings** section, shown in the following figure, enter the username and password for an account that has read access to the user records. Leostream does not need full administrator rights to your Active Directory authentication server.

8. In the **User Login Search** section, ensure that the **Match Login name against this field** edit field is set to **sAMAccountName**. This is the attribute that the Connection Broker uses to locate the user in the authentication server, based on the information the user enters when logging into Leostream.

9. Click **Save**.
11.2 Integration with Virtuozzo Hybrid Infrastructure

To integrate with Virtuozzo Hybrid Infrastructure, you create an OpenStack center in Leostream for each project you want to manage in your Connection Broker.

**Important:** Leostream defines centers as the external systems that inform the Connection Broker about desktops and other resources that are available for assignment to end users.

Leostream uses the OpenStack APIs to inventory the instances and images in your Virtuozzo Hybrid Infrastructure project.

To integrate with Virtuozzo Hybrid Infrastructure:

1. Go to the Setup > Centers page.
2. Click the Add Center link.
3. In the Add Center form, select OpenStack from the Type drop-down menu (the Leostream license controls if OpenStack is available as a center).
4. Enter the name for the center in the Name edit field.
5. In the Auth URL: VHI OS_AUTH_URL e.g. https://virtuozzo.admin.panel.ip:5000/v3.
6. Enter the default Virtuozzo Hybrid Infrastructure region (VHI region = RegionOne) in the Region edit field.
7. Enter the domain you created for your project in the Project Domain edit field.
8. Enter the name of the project you created in the Project edit field.
9. Enter the domain, username, and password of the user you created in the previous steps into the User Domain, Username and Password edit fields, respectively.
10. Click Save to create the center. The following figure shows an example of a saved OpenStack center for Virtuozzo Hybrid Infrastructure.
The instances in the Virtuozzo Hybrid Infrastructure project appear in the Resources > Desktops page. The Connection Broker inventories all images and displays them on the Resources > Images page, for example.

11.3 Adding Leostream Gateway

You add your Leostream Gateway to your Connection Broker, as follows.

1. Go to Setup > Gateways page.
2. Click the Add Gateway link.
3. In the Add Gateway form, enter a name for the Gateway in the Name edit field.
4. For this example, enter the publicly accessible IP address or hostname for your Leostream Gateway. If you are placing the Leostream Gateway behind your corporate firewall, enter the public address of your firewall.
5. In the IP address or FQDN used for Connection Broker communications to this Gateway field, enter the private address of your Leostream Gateway. This address is optional. If provided, the Connection Broker communicates with the Leostream Gateway using a private address. This address is
never used for forwarding display protocol traffic.

6. If this gateway is used to forward client-based display-protocol traffic, use the Method for routing display protocol traffic through this Leostream Gateway drop-down menu to indicate which method the gateway uses to configure the firewall rule for routing traffic.

   Note that the option you select here has ramifications on the ports you must open in the Security Group assigned to your Leostream Gateway virtual machine. The method for routing display protocol influences which ports should be open on your Leostream Gateway.

7. Click Save. After saving the form, the Connection Broker registers with the Leostream Gateway and you can now use the gateway in your protocol plans.
CHAPTER 12
Pooling and Provisioning in Virtuozzo Hybrid Infrastructure

After you create your centers and the Connection Broker inventories your desktops, you can logically group the desktops into **pools**.

The Leostream Connection Broker defines a pool as any group of desktops. Pools can be nested within one another, to create sub-pools. Pools and sub-pools have three distinct functions in Leostream.

1. Organizing desktops on the **Resources > Desktops** page.
2. Provisioning new instances in your Virtuozzo Hybrid Infrastructure project.
3. Indicating the desktops that a user may connect to and how the Connection Broker manages the user’s connection to those desktops.

12.1 Creating Pools

When using Leostream to provision new instances in Virtuozzo Hybrid Infrastructure, the key is to construct your pool in a way that ensures that newly provisioned desktops become members of that pool. One method is to set the pool to contain all instances in the Virtuozzo Hybrid Infrastructure project associated with the center you created in the previous chapter.

If that pool definition is too broad, another easy way to ensure that new desktops become part of a pool is to define the pool based on the instance name, which you set during provisioning, for example:

1. Go to the **Configuration > Pools** page.
2. Click the **Create Pool** link. The **Create Pool** form opens.
3. Enter a name for the pool in the **Name** edit field.

4. In the first row of the **Desktop Attribute Selection** section:
   
   4.1. Select **Name** from the **Desktop attribute** drop-down menu.
   
   4.2. Select **begins with** from the **Conditional** drop-down menu.
   
   4.3. In the **Text value** field, enter the name you will use for all the instances in this pool. For example, the following form looks for virtual machines with a name that contains the text desktop.

5. Click **Save** to save the pool.
For a complete description of creating pools, see the “Creating Desktop Pools” chapter in the Connection Broker Administrator’s Guide.

12.2 Provisioning New Instances

Provisioning allows you to generate new Virtuozzo Hybrid Infrastructure instances when the number of desktops in a pool reaches a specified lower threshold.

**Note:** Your Connection Broker license determines if provisioning is enabled in your Connection Broker.

The **Provisioning** section of the **Edit Pool** page allows you to configure when and how the Connection Broker creates new instances in your Virtuozzo Hybrid Infrastructure project. To begin, check the **Provisioning enabled** checkbox, as shown in the following figure.

The Connection Broker determines when to create new instances by comparing the thresholds specified in the **Provisioning Limits** section to the current contents of the pool. If you edit an existing pool, the Connection Broker displays the current contents of the pool size to the right of the **Edit Pool** form, for example:
The number entered into the **Start provisioning when unassigned desktops in pool drops below** field specifies a lower bound on the number of unassigned desktops in the pool, where the number of unassigned desktops is the total number of desktops minus the number of assigned desktops.

For example, the previous figure shows one assigned desktop and 46 total desktops. Therefore, there are 45 unassigned desktops. An unassigned desktop can have a desktop status of either available or unavailable.

The Connection Broker checks the provisioning limits, and creates new instances, at the following times:

- When the pool is saved
- When a user is assigned to a desktop in this pool
- When any pool_stats or pool_history_stats job runs

The Connection Broker continues to provision new desktops whenever the lower threshold is crossed, until the upper threshold specified in the **Stop provisioning when total desktops in pool reaches** field is reached, indicated by the **Total** value in the pool size information.

Use the Provisioning Parameters section to configure how Leostream provisions new instances in your Virtuozzo Hybrid Infrastructure project, as follows.

1. Select the center associated with your Virtuozzo Hybrid Infrastructure project from the **Provision in center** drop-down menu. The remainder of the form updates based on the contents of your selection. The following figure shows an example of the **Provisioning Parameters** section.
2. Enter a name for the virtual machine in the **Virtual Machine Name** edit field. If the pool is defined using names that begin with a certain string, ensure that the **Virtual Machine Name** field starts with that string, as shown in the previous figure for a pool that is composed of all desktops with a name that contains the string desktop.

3. Optionally enter a user-friendly display name into the **Display name** edit field. You can specify in the user’s policy if the Connection Broker should display the desktop to the user with its display name instead of virtual machine name.
4. If either of the names contains a {SEQUENCE} dynamic tag, enter the starting number for the sequence in the Optional sequence number for virtual machine name edit field. The Connection Broker starts naming virtual machines at this number and increments the number for each machine created.

5. Select the availability zone to provision the new instance into from the Availability zone drop-down menu. When using Virtuozzo Hybrid Infrastructure, set the Availability zone to nova.

6. Select the instance size from the Flavor drop-down menu. This selection determines the resources allocated to the newly created virtual machines in the pool in regards to vCPU, RAM and Swap. Check your Virtuozzo Hybrid Infrastructure project to view your available flavors or create new flavors that suits your needs.

7. Select the master image to use from the Deploy from image drop-down menu. This menu contains all the images available in the Virtuozzo Hybrid Infrastructure project associated with the selected center.

8. By default, the Connection Broker creates an instance with ephemeral storage. When provisioning into Virtuozzo Hybrid Infrastructure, indicate that the Connection Broker should create a new volume from the image by selecting the Create new volume checkbox. The form expands to show the fields in the following figure.

8.1. If you are provisioning non-persistent virtual machines, select the Delete volume on instance delete checkbox to have the Connection Broker delete the volume along with the instance, when instructed to do so by the user’s Release Plan.

8.2. In the Volume size edit field, Indicate the size of the volume to create if different than that of the selected flavor.

8.3. Select the default volume type from the Volume type drop-down menu.

9. Select the network for the new instance from the Network drop-down menu. This example adds virtual machines to the VDI-Network.

This example adds virtual machines to a private network without associating a public IP.
address. The Leostream Gateway provides connections to the VMs from clients that are outside of the private network.

10. In the Available security groups field, select the security groups to assign to the new instance. Click the Add item button to place them into the Selected security groups field.

11. If you are provisioning non-persistent virtual machines, select the Initialize newly provisioned desktops as deletable option to indicate that the Connection Broker is allowed to delete these instances. When this option selected, the Edit Desktop page for the newly provisioned VM has the Allow this desktop to be deleted from disk option selected. Use release plans to schedule VM deletion.

For more information on using release plans to terminate virtual machines, see the example on deleting virtual machines see Chapter 11 of the Connection Broker Administrator’s Guide.

12. Click Save.

As soon as you save the pool, the Connection Broker checks the Provisioning Limits and will launch virtual machines as required to meet the minimum threshold. You can see the virtual machines in the Virtuozzo Hybrid Infrastructure self-service portal, as shown in the following figure.

12.3 Disable Provisioning

If you've set non-zero provisioning limits in your pool and need to temporarily disable provisioning, uncheck the Provisioning enabled check box, shown in the following figure.
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The Connection Broker may automatically disable provisioning in cases where provisioning is failing due to configuration errors in your pool. If this occurs, please check and correct your provisioning parameters before enabling provisioning.

12.4 Joining Instances to Domain

You can use Leostream to join Windows virtual machines to an Active Directory domain. When enabled, the Connection Broker attempts to join the desktop to the domain any time the Leostream Agent on the desktop registers with the Connection Broker, for example, when a desktop is provisioned or when you reboot the desktop.

Before configuring a pool to join desktops to a domain, you must define the Active Directory domain on the Setup > Authentication Servers page.

To enable domain joining for a pool:

1. Select the **Join virtual machine to a domain** option in the **Domain Join** section, shown in the following figure.
2. Select the domain from the **Domain** drop-down menu.

3. Optionally, from the **Organizational Unit** drop-down menu, select an OU for the desktops.

4. To reset the desktops hostname when joining it to the domain, select the **Set desktop hostname to virtual machine name** check box. With this option selected, the Leostream Agent attempts to set the hostname to the value shown in the **Name** column on the **Resources > Desktops** page.

   If the pool provisions new desktops, this is the name found in the **Virtual machine name** edit field. The **Name** field must contain a valid hostname, as follows:

   4.1. The name uses only the standard character set for Computer Name, which includes letters, numbers, and the following symbols: ! @ # $ % ^ & ' ) ( . - _ { } ~.

   4.2. Then Name cannot be longer than 15 characters.

Leostream performs the domain join for any desktop in the pool that is not already joined to a domain. Leostream does not have to provision the desktop to perform the domain join.
13.1 Defining Pool-Based Plans

After you separate your desktops into pools, define the rules that control how the Connection Broker manages the user's connection to the desktops in those pools. To perform this step, ask yourself the following questions.

- What display protocols do I want to use to connect users to their desktops?
- How do I want to manage the power state of each desktop, for example, should it be powered off when the user logs out?
- How long can users remain assigned to a particular desktop? For example, if the user logs out, should they remain assigned to that desktop, or should another user be able to log in?

**Important:** The Leostream Connection Broker defines a **pool-based plan** as a set of rules that determine how the Connection Broker manages the connection to a desktop in a pool. This step describes three types of pool-based plans. 1) Protocol, 2) Power Control, and 3) Release. The Connection Broker also provides **location-based plans** for setting registry keys and attaching network printers to the remote desktop. See the Connection Broker Administrator’s Guide for information on using location-based plans.
13.1.1 Protocol Plans

Protocol plans determine the display protocol the Connection Broker uses to connect a user to their desktop. The Connection Broker provides one default protocol plan, which is shown on the Configuration > Protocol Plans page, shown in the following figure.

The Default Protocol Plan instructs the Connection Broker to connect to the remote desktops using Microsoft RDP. For this example, edit the Default protocol plan and use the Gateway drop-down menu in the RDP and RemoteFX section to indicate that the RDP connection should go through your Leostream Gateway, as shown in the following figure.
If needed, you can create a new Protocol Plan by clicking the Create Protocol Plan link. The Create Protocol Plan form is divided into sections based on the type of client device used to log into Leostream, for example, Leostream Connect or the Leostream Web client.

Note that your Connection Broker license determines which display protocols your Connection Broker can use.
In each section, indicate which protocol the Connection Broker should use to connect users to their desktops by selecting 1 from that protocol's Priority drop-down menu. Then, use the Configuration file and Command line parameters to determine how that connection is launched. For example, for RDP, the Configuration file is a list of RDP-file parameters that determine if, for example, the connection is launched in full screen.

For a complete description of protocol plans, see “Building Pool-Based Plans” in the Connection Broker Administrator's Guide.

### 13.1.2 Power Control Plans

Power control and release plans allow you to take actions on the user’s remote session based on different events, such as:

- When the user disconnects from their desktop
- When the user logs out of their desktop
- When the desktop is released to its pool
- When the user’s session has been idle for a specified length of time

The remote desktop must have an installed and running Leostream Agent to allow the Connection Broker to distinguish between user logout and disconnect and to perform actions based on idle time.

Power control plans define the power control action to take on a desktop. Available power control plans are shown on the Configuration > Power Control Plans page, shown in the following figure.

New Connection Broker installations contain one default power control plan, called Default, which leaves the
virtual machine running at all times. You can edit the Default power control plan or create as many additional power control plans as needed for your deployment. To build a new power control plan:

1. Click the Create Power Control Plan link on the Configuration > Power Control Plans page. The Create Power Control Plan form, shown in the following figure, opens.

![Create Power Control Plan form](image)

Enter a descriptive name. You’ll refer to this name when assigning the plan to a pool.

Select the amount of time to wait before changing the desktop’s power state. A wait time of zero tells the Connection Broker to immediately execute the selected power control action.

Select the power control action to take after the wait time elapses. For the Connection Broker to take actions based on disconnect or idle-time events, you must install the Leostream Agent on that desktop.

2. Enter a unique name for the plan in the Plan name edit field.

3. For each of the remaining sections:
   
   3.1. From the Wait drop-down menu, select the time to wait before applying the power action.
   
   3.2. From the then drop-down menu, select the power control action to apply. Selecting Do not change power state renders the setting in the Wait drop-down menu irrelevant, as no action is ever taken.

4. Click Save to store the changes or Cancel to return to the Configuration > Power Control Plans page without creating the plan.

### 13.1.3 Release Plans

Release plans determine how long a desktop remains assigned to a user. When the assignment is released, the desktop returns to its pool, making it available for other users. Available release plans are shown on the Configuration > Release Plans page, shown in the following figure.
**Note:** When a desktop is **assigned** to a user, the Connection Broker always offers that desktop to that user, regardless of where the user logs in, and to no other users. Desktops can be policy-assigned or hard-assigned. For a description of hard-assigned desktops, see the Connection Broker Administrator's Guide.

New Connection Broker installations contain one default release plan. The default release plan is designed to keep the user assigned to their desktop until they log out. When the user logs out, the Connection Broker releases the desktop back to its pool. You can create as many additional release plans as needed for your deployment, using the **Create Release Plan** form shown in the following figure.
For example, to build a release plan that schedules a logout one hour after the user disconnects from their desktop and then deletes the virtual machine from your Virtuozzo Hybrid Infrastructure project:

1. Enter a unique name for the plan in the **Plan name** edit field.

2. To build the Release Plan for our example, in the **When User Disconnects from Desktop** section, select **after 1 hour** from the **Forced Logout** drop-down menu.

3. In the **When Desktop is Released** section, select **Immediately** from the **Delete virtual machine from disk** option.

4. Click **Save**.

In this release plan, the Connection Broker forcefully logs the user out an hour after they disconnect from their desktop. The logout event then triggers the **When User Logs Out of Desktop** section of the release plan, which releases the desktop back to its pool. The release action then triggers the **When Desktop is Released** section of the plan, which deletes the VM.
For more details on creating and using release plans, see the “Release Plans” section in Chapter 11 of the Connection Broker Administrator’s Guide.

13.2 Building User Policies

After you define pools and plans, you can then build policies.

**Note:** The Leostream Connection Broker defines a **policy** as a set of rules that determine how desktops are offered, connected, and managed for a user, including what specific desktops are offered, which power control and release plans are applied to those desktops, what USB devices the user can access in their remote desktop, and more.

The Connection Broker provides a **Default** policy that applies if no other policy exists or is applicable. The **Default** policy assigns one desktop from the **All Desktops** pool. You can edit this policy to offer desktops from the pool you created in Chapter 5, as follows.

1. Go to the **Configuration > Policies** menu.

2. Click the **Edit** link next to the Default policy. The **Edit Policy** form, shown in the following figure, opens.
3. Go to the **Pool Assignments** tab, shown in the following figure.
4. Click the kabob menu on the left side of the All Desktops pool and select **Edit**.

5. In the **Edit Pool Assignment** form, use the **Pool** menu to select the pool you created previously. When a user is offered this policy, the Connection Broker sorts the desktops in the selected pool based on the other policy settings, then offers the user the top \( n \) desktops from the pool, where \( n \) is the number selected in the **Number of desktops** to offer drop-down menu.

   Scroll down to the **Plans** section and notice that the policy already uses the default protocol, power control, and release plans. If you created new plans, use the drop-down menus in this section to select your plans.

6. Click **Save**.

Use the **Create Policy** link at the top of the **Configuration > Policies** page to create new policies. You can create as many policies as you need to model the different VDI workflows in your organization, however each user is assigned to one policy. If users need access to multiple pools, add those pools to the user’s policy.

For a complete description of setting up policies, see “Configuring User Experience by Policy” in the Connection Broker Administrator’s Guide.

### 13.3 Assigning Policies to Users

When a user logs in to the Connection Broker, the Connection Broker searches the authentication servers you defined on the **Setup > Authentication Servers** page for a user that matches the credentials provided by the user.

The Connection Broker then looks on the **Configuration > Assignments** page for the assignment rules associated with the user’s authentication server. For example, if the Connection Broker authenticated the
user in the VDI.VZ domain defined on the **Setup > Authentication Servers** page, the Connection Broker would look in the VDI.VZ assignment rules.

To assign policies to users in a particular authentication server, click the **Edit** link associated with that authentication server on the **Configuration > Assignments** tab. The **Edit Assignment** form for this authentication server appears, for example as shown in the following figure.

![Edit Assignment Form](image)

By default, the Connection Broker matches the selection in the **Group** drop-down menu to the user's memberOf attribute in Active Directory.

**Note:** If you modified your groups in Active Directory after you last signed into your Connection Broker, you must sign out and sign back in to have your Connection Broker reflect the authentication server changes.

To assign policies based on the user's memberOf attribute:

1. Select the group from the **Group** drop-down menu.
2. If you are using locations, select a location from the **Client Location** drop-down menu.
3. Assign a role to this group and client location pair by selecting an item from the **User Role** drop-down menu.

In Leostream, roles are permissions that control the actions an end user can take on their desktop and the level of access the user has to the Connection Broker Administrator Web interface. A location is a group of clients defined by attributes such as manufacturer, device type, OS version, IP address, etc. For more information on building roles and locations, see Chapters 10 and 13 in the *Connection Broker Administrator’s Guide*.

4. Assign a policy to this group and client location pair by selecting an item from the **User Policy** drop-down menu.

Leostream supports various different multi-factor authentication systems. If you require MFA, visit the Support Documents tab on the Leostream *Documentation* page for more information.

If you edit the Default policy, you can leave your Assignments table at its default values and proceed with the example.

### 13.4 Testing Connection Broker Configuration

To test your Connection Broker, ensure that users are being assigned to the correct policy, and offered the correct desktops. You can test user logins before the user has ever logged into, and been loaded into, Leostream.

1. Navigate to the **Resources > Users** menu. As users log into your Leostream environment, their user information is added to this page. You do not need to load users before they can log in.

2. Click the **Test Login** link at the top of the page, shown in the following figure.
3. In the **Test Login** form that opens, enter the name of the user to test in the **User Name** edit field.

4. If you are allowing the user to specify their domain, select a domain from the **Domain** drop-down.

5. Click **Run Test**. The Connection Broker searches the authentication server for your user, and then presents a report, for example:

**Important:** Please complete a login test and ensure that your user is offered the correct policy, protocol plan, and desktop before proceeding.
Before attempting to connect to one of your virtual machines using Leostream, ensure that you are able to connect to the VM directly. For example, ensure that you can establish an RDP connection to the desktop from another VM on the same network.

You can connect to the virtual desktop using either the HTML5 client available in the Leostream Gateway or using a client-based protocol launched by either the Leostream Web client or the Leostream Connect client. This example uses the Leostream Connect client, which is available on the Leostream Downloads page. Consult the Leostream Installation Guide for information on installing Leostream Connect.

After installing and launching the client, provide the FQDN or IP of your Leostream Gateway (if your Leostream Gateway is actively forwarding to your Connection Broker, as done in this example) or enter your Connection Broker FQDN or IP. Click the Test button to ensure that the client can communicate with the Connection Broker, as shown in the following figure.
Now, go to the **Login** dialog and enter the username and password of an Active Directory user, for example:
If the user's policy offers a single desktop, the desktop connection launches automatically, for example:
CHAPTER 15

Leostream Official Documentation and FAQs

Leostream knowledge base: https://support.leostream.com/support/solutions


Leostream Connection Broker FAQ/Troubleshooting:
https://support.leostream.com/support/solutions/folders/66000395808

Leostream Gateway FAQ/troubleshooting:
https://support.leostream.com/support/solutions/folders/66000397758

Leostream Agent FAQ/troubleshooting:
https://support.leostream.com/support/solutions/folders/66000397493

Leostream Connect FAQ/troubleshooting:
https://support.leostream.com/support/solutions/folders/66000397771

Leostream Administration Guide (march 2022 version, even if it appears under the 2018 folder):