

GroupWise TeamWorks 18.1

Installation and Deployment Guide

October 2018

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About This Guide

Production Deployments

To create a production-viable, best practice TeamWorks deployment, complete the sections below in the order presented.

- ♦ [Chapter 1, “Start Here,” on page 7](#)
- ♦ [Chapter 2, “Planning Is Important,” on page 9](#)
- ♦ [Chapter 3, “System Requirements,” on page 11](#)
- ♦ [Chapter 4, “Setting Up NFS Shared Storage,” on page 17](#)
- ♦ [Chapter 5, “Downloading and Preparing the TeamWorks Software,” on page 19](#)
- ♦ [Chapter 6, “Creating the TeamWorks Virtual Machines,” on page 21](#)
- ♦ [Chapter 7, “Starting and Configuring the Appliances,” on page 23](#)
- ♦ [Chapter 8, “Creating a Multiple-Appliance TeamWorks Deployment,” on page 27](#)
- ♦ [Chapter 9, “Setting Up TeamWorks Services,” on page 33](#)
- ♦ [Chapter 10, “Upgrading/Migrating an All-in-One TeamWorks Deployment,” on page 35](#)
- ♦ [Chapter 11, “Upgrading/Migrating a Multiple-appliance TeamWorks Deployment,” on page 41](#)

Test and Evaluation Deployments

To create an evaluation or test deployment, see [Appendix A, “Creating an All-in-One Deployment,” on page 59](#).

Audience

This guide is intended for TeamWorks Administrators.

Feedback

We want to hear your comments and suggestions about this manual and the other documentation included with this product. Please use the [comment on this topic](#) link at the bottom of each page of the online documentation.

Documentation Updates

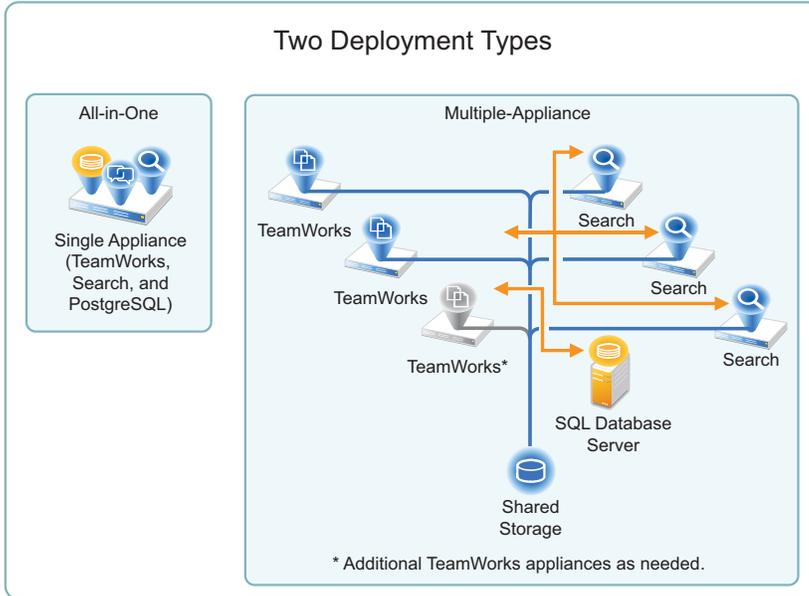
For the most recent version of this guide, visit the [TeamWorks Documentation web site \(http://www.novell.com/documentation/teamworks-18\)](http://www.novell.com/documentation/teamworks-18).

Additional Documentation

For other documentation on TeamWorks, see the [TeamWorks Documentation web site \(http://www.novell.com/documentation/teamworks-18\)](http://www.novell.com/documentation/teamworks-18).

1 Start Here

You can deploy TeamWorks in two different ways.



Micro Focus recommends multiple-appliance deployments as a best practice for the following reasons.

All-in-One	Multiple-Appliance
<ul style="list-style-type: none">◆ One All-in-One Appliance◆ No fault tolerance—Single Point of Failure◆ Not expandable beyond a single All-in-One appliance	<ul style="list-style-type: none">◆ Multiple Appliances◆ Fault-tolerant TeamWorks services◆ Expandable by adding TeamWorks appliances, disk space, or RAM as needs increase

To deploy an all-in-one appliance, follow the instructions in [Appendix A, “Creating an All-in-One Deployment,” on page 59](#).

Otherwise, continue with [Chapter 2, “Planning Is Important,” on page 9](#).

2 Planning Is Important

Creating a successful TeamWorks deployment requires that you

1. Involve pertinent stakeholders.
2. Conduct a thorough needs assessment.
3. Plan your deployment based on the needs assessment.

The sections that follow assume that you have:

1. Completed the planning processes outlined in the [TeamWorks 18.1 Planning Your TeamWorks Deployment—Best Practices](#) guide.
2. Filled in the [TeamWorks 18 Planning Worksheets](#) associated with the Planning—Best Practices guide.

3 System Requirements

Multiple-Appliance Deployments Are the Focus of This Guide

All-in-One deployments are covered in [Appendix A, “Creating an All-in-One Deployment,”](#) on page 59.

The following sections outline platform, version, and other requirements for your multi-appliance TeamWorks deployment.

- ◆ [“Administrative Workstations and Browsers”](#) on page 11
- ◆ [“Appliance Disk Space”](#) on page 11
- ◆ [“Appliance Memory and CPU”](#) on page 12
- ◆ [“Appliance Shared Storage \(/vashare Mount Point\) Platforms”](#) on page 12
- ◆ [“Web Application Access”](#) on page 13
- ◆ [“TeamWorks Software”](#) on page 13
- ◆ [“IP Addresses”](#) on page 13
- ◆ [“LDAP Directory Services \(Users and Groups\)”](#) on page 14
- ◆ [“Mobile Device Platforms”](#) on page 15
- ◆ [“SQL Database Server”](#) on page 15
- ◆ [“Virtualization Hypervisor Platform”](#) on page 15

Administrative Workstations and Browsers

Table 3-1 Administrative Workstations and Browsers

Platform	Browser	Requirement
Windows, Mac, or Linux	Mozilla Firefox	Latest version
Capable of running a listed browser	Microsoft Internet Explorer	11
	Microsoft Edge (Port 8443 tasks only)	Latest version
	Chrome	Latest version
	Safari	Latest version

Appliance Disk Space

- ◆ See [Worksheet 14—Storage Planning Summary](#)

Planning for disk space varies widely according to organization needs and the planning process is covered in the [TeamWorks 18.1 Planning Your TeamWorks Deployment—Best Practices](#) guide.

General guidelines are summarized in the following sections of the [Planning Best Practices](#) guide:

- ◆ [Using Worksheet 10 - TeamWorks Appliances](#)

- ◆ [Using Worksheet 11 - Search Appliances](#)
- ◆ [Using Worksheet 12 - SQL Database](#)

Appliance Shared Storage (/vashare Mount Point) Platforms

- ◆ See Worksheet 14—Storage Planning Summary

The TeamWorks appliances in an Multi-appliance deployment access a commonly-shared NFS storage disk that you will identify and create in [Chapter 4, “Setting Up NFS Shared Storage,”](#) on [page 17](#).

Table 3-2 Shared Storage Platforms (/vashare Mount Point)

Protocol	Requirement
NFS	Exported mount point on one of the following: <ul style="list-style-type: none"> ◆ SLES 12 ◆ SLES 15 <p>NFS on Windows is not supported.</p>

Appliance Memory and CPU

Table 3-3 Memory and CPU

Appliance	Recommended
TeamWorks	<ul style="list-style-type: none"> ◆ 8 GB RAM 1.5 GB Operating System 6.5 GB Java Heap ◆ 4 CPUs
TeamWorks Search	<p>Less than 1,000 Users</p> <ul style="list-style-type: none"> ◆ 8 GB RAM ◆ 2 CPUs <p>More than 1,000 Users</p> <ul style="list-style-type: none"> ◆ 12 GB RAM ◆ 2 CPUs

Appliance	Recommended
PostgreSQL	Less than 1,000 Users
	<ul style="list-style-type: none"> ◆ 8 GB RAM 2 GB Operating System 2 GB Memcached 4 GB Java Heap ◆ 2 CPUs
	More than 1,000 Users
	<ul style="list-style-type: none"> ◆ 12 GB RAM 2 GB Operating System 3 GB Memcached 7 GB Java Heap ◆ 2 CPUs

Web Application Access

Table 3-4 Browsers for Web Application Access

Platform	Requirement
Linux	Mozilla Firefox; Google Chrome (latest versions)
Windows	Microsoft Edge
	Microsoft Internet Explorer 11
	Mozilla Firefox; Google Chrome (latest versions)
Mac	Safari; Mozilla Firefox (latest versions)

TeamWorks Software

You will download and prepare the TeamWorks software in [Chapter 5, “Downloading and Preparing the TeamWorks Software,”](#) on page 19.

IP Addresses

Each appliance requires the following.

Table 3-5 IP Addresses

Component	Requirement
IP Address	<ul style="list-style-type: none"> ◆ A static address that is associated with a DNS host name. <p>Example: 192.168.1.61</p>

Component	Requirement
Network Mask	<ul style="list-style-type: none"> The appropriate network mask for the IP address. <p>Example: 255.255.255.0</p>
Gateway IP Address	<ul style="list-style-type: none"> The gateway for the IP address subnet. <p>Example: 192.168.1.254</p>
DNS Host Name	<ul style="list-style-type: none"> The DNS name associated with the IP address. <p>Example: TeamWorks-1.myorg.local</p>
DNS IP Address	<ul style="list-style-type: none"> Up to three IP addresses of DNS servers for the IP address subnet. <p>Example: 192.168.1.1</p>
NTP IP Address or DNS Name	<ul style="list-style-type: none"> Up to three IP addresses or DNS names of reliable NTP servers used to coordinate time on your organization's network—especially your LDAP directory servers. <p>Example: time.myorg.local</p> <p>If using VMware, Micro Focus recommends setting up NTP in accordance with the VMware best practices guidelines (http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1006427).</p>

LDAP Directory Services (Users and Groups)

Table 3-6 LDAP Directory Services

Directory Service	Platform	Version	Support
GroupWise	All	<ul style="list-style-type: none"> 2018 	Recommended
eDirectory	Linux	<ul style="list-style-type: none"> Version 8.8 with latest patch <p>For more information, see the NetIQ eDirectory 8.8 Documentation website (http://www.novell.com/documentation/edir88).</p>	Recommended
		<ul style="list-style-type: none"> Version 9.x <p>For more information, see the NetIQ eDirectory 9.1 Documentation website (https://www.netiq.com/documentation/edirectory-91/).</p>	
	Windows	<ul style="list-style-type: none"> Version 8.8 with latest patch on standalone Windows. 	Supported
Active Directory	Windows	<ul style="list-style-type: none"> 2016 Active Directory with the latest Service Pack 	Recommended
		<ul style="list-style-type: none"> 2012 R2 Active Directory with the latest Service Pack 	Supported

Mobile Device Platforms

IMPORTANT: Accessing TeamWorks through a web browser on a mobile device is not recommended unless an app is not available for the device.

For more information about the TeamWorks mobile app, see the [TeamWorks User Help](#).

Table 3-7 Mobile Devices

Platform	Supported Versions
iOS Phones and Tablets	<ul style="list-style-type: none">◆ iOS 10.x or later <p>The native app is available as a free download in the Apple App Store.</p>
Android Phones and Tablets	<ul style="list-style-type: none">◆ Android phones and tablets for Android 7.x or later <p>The native app is available in the Android app store.</p>

SQL Database Server

Table 3-8 SQL Database Server

Database Type	Supported Platforms
PostgreSQL (10 and later)	<ul style="list-style-type: none">◆ Linux◆ Windows
Microsoft SQL Server	<ul style="list-style-type: none">◆ 2014 SP1/SP2 on Windows 2012 R2 and later.◆ 2016 on Windows 2016

Virtualization Hypervisor Platform

Table 3-9 Virtualization Hypervisor Platform

Hypervisor Type	Supported Versions
VMware	<ul style="list-style-type: none">◆ A VMware ESXi 6.x host server with the latest update for hosting the appliance VMs. For the most up-to-date compatibility matrix of supported VMware host servers, see the VMware Compatibility Guide (http://www.vmware.com/resources/compatibility/search.php?deviceCategory=software&testConfig=16) provided by VMware.◆ A VMware vSphere client 6.x or later for accessing the host server and the appliances for initial configuration. Not all versions of the vSphere client are compatible with versions of VMware ESXi. See the VMware Product Interoperability Matrixes (http://partnerweb.vmware.com/comp_guide2/sim/interop_matrix.php) provided by VMware.◆ VMware vMotion is supported when running TeamWorks on VMware ESXi.

4

Setting Up NFS Shared Storage

- ◆ See Worksheet 14—Storage Planning Summary

Table 4-1 Exporting an NFS Directory for /vashare

Page, Dialog, or Option	Do This
	1 - Verify that the server has adequate disk space.
	<ol style="list-style-type: none">1. Make sure that the Linux server that you are targeting has the available disk space you identified in “Planning Your Appliances” in the TeamWorks 18.1 Planning Your TeamWorks Deployment—Best Practices guide and recorded on Worksheet 25. If necessary, add disk space to the Linux server.
	<ol style="list-style-type: none">1. On the Linux server, launch YaST2.
YaST Control Center	<ol style="list-style-type: none">1. In the Network Services section, click NFS Server. The NFS Server Configuration dialog box displays.
NFS Server Configuration	<ol style="list-style-type: none">1. Make sure that the NFS Server is set to Start, that Open Port in Firewall is selected (running firewall required for option), and that Enable NFSv4 is <i>not selected</i> - i.e. NFS v4 is disabled.2. Click Next.
Directories to Export	<ol style="list-style-type: none">1. Click Add Directory.
YaST2	<ol style="list-style-type: none">1. Click Browse and choose the directory or share path identified on Worksheet 25 that has the required disk space. You can add a directory name, such as <code>/shared</code> to the path if desired. IMPORTANT: The directory path must not be located in the <code>/var</code> directory structure on the NFS server, as explained in “NFS Mount Point Must Not Point to /var on Target Server” in the TeamWorks 18.1 Release Notes.2. Click OK. As your first TeamWorks appliance is deployed, a directory named <code>TeamWorks</code> will be created within the directory path you have specified.3. If you added to the directory path, click Yes to confirm directory creation.4. Leave the asterisk (*) in the Host Wild Card field.5. Click the Options field to edit it and change the following options:<ul style="list-style-type: none">◆ <code>ro</code> to <code>rw</code> (read-only to read-write)◆ <code>root_squash</code> to <code>no_root_squash</code>.6. Click OK.
Directories to Export	<ol style="list-style-type: none">1. Click Finish.2. Skip to Chapter 5, “Downloading and Preparing the TeamWorks Software,” on page 19.

5 Downloading and Preparing the TeamWorks Software

After [planning your deployment](#) and making sure you have the necessary [system requirements](#) in place, you are ready to download and prepare the TeamWorks software that applies to your virtualization platform.

- 1 [Download the TeamWorks software](#) shown below to your management workstation.

IMPORTANT: Registration with Micro Focus is required to receive an email with a download link.

Appliance Type	Filename
TeamWorks	TeamWorks-18. <i>version</i> .ovf.zip
Search	TeamWorks-Search-18. <i>version</i> .ovf.zip
PostgreSQL (only if no in-house SQL server is available)	PostgreSQL-1. <i>version</i> .ovf.zip

- 2 Extract each `.ovf.zip` file on your management workstation until an `ApplianceType-version` folder appears.
- 3 Continue with [“Creating the TeamWorks Virtual Machines”](#) on page 21.

6 Creating the TeamWorks Virtual Machines

Referring to the following Worksheets, complete the steps in [Table 6-1](#) for each appliance you have planned to deploy:

- ♦ Worksheet 10 - TeamWorks Appliances
- ♦ Worksheet 11 - Search Appliances
- ♦ Worksheet 12 - SQL Database (if you are not using an in-house SQL database server)

Table 6-1 *Creating an appliance VM on VMware*

Page, Dialog, or Option	Do This
1 - Launch the vSphere Client, name the VM, and choose the datastore.	
vSphere Client	<input type="checkbox"/> On your management workstation, start the vSphere Client. <input type="checkbox"/> Click File > Deploy OVF Template .
Deploy OVF Template	<input type="checkbox"/> Click Browse .
Open	<input type="checkbox"/> Navigate to the contents of the folder extracted in Step 2 on page 19 . <input type="checkbox"/> Select the <code>.ovf</code> file. <input type="checkbox"/> Click Open .
Deploy OVF Template	<input type="checkbox"/> Click Next > Next . <input type="checkbox"/> In the Name field, type the name of the appliance as planned on the applicable worksheet. <input type="checkbox"/> Click Next . <input type="checkbox"/> Choose the datastore and click Next to accept the default disk format. <input type="checkbox"/> Do not select Power on after deployment . <input type="checkbox"/> Click Finish . <p>The boot disk is created and the appliance is deployed as specified to this point.</p>
2 - Edit the VM settings.	
vSphere Client	<input type="checkbox"/> In the vSphere Client, right-click the VM and select Edit Settings .
Virtual Machine Properties	<input type="checkbox"/> Adjust the Memory and CPU settings according to the calculations and settings on the applicable worksheet. <p>Of course if needed, you can adjust them later for performance tuning purposes.</p>
3 - Add and configure a second disk (/vastorage)	

Page, Dialog, or Option	Do This
Virtual Machine Properties	<input type="checkbox"/> Click Add .
Add Hardware	<input type="checkbox"/> Select Hard Disk , then click Next > Next (create a new virtual disk). <input type="checkbox"/> Adjust the Disk Size field value as planned for the appliance you are deploying. <input type="checkbox"/> Under Disk Provisioning , select either: <ul style="list-style-type: none"> ◆ Thick Provision Eager Zeroed or ◆ Support clustering features such as Fault Tolerance Depending on the VMware version that you are running. <input type="checkbox"/> Under Location , select Specify a datastore or Datastore cluster <input type="checkbox"/> Click Browse , select a datastore, then click OK > Next . <input type="checkbox"/> Under Virtual Device Node section, select SCSI (1:0) . <input type="checkbox"/> Under Mode , select Independent and Persistent . <input type="checkbox"/> Click Next > Finish .
4 - Add and Configure a third disk (/var)	
Virtual Machine Properties	<input type="checkbox"/> Click Add .
Add Hardware	<input type="checkbox"/> Select Hard Disk , then click Next > Next (create a new virtual disk). <input type="checkbox"/> Adjust the Disk Size field value a planned for your product. <input type="checkbox"/> Under Disk Provisioning , select either: <ul style="list-style-type: none"> ◆ Thick Provision Eager Zeroed or ◆ Support clustering features such as Fault Tolerance Depending on the VMware version that you are running. <input type="checkbox"/> Under Location , select Specify a datastore or Datastore cluster <input type="checkbox"/> Click Browse , select a datastore, then click OK > Next . <input type="checkbox"/> Under Virtual Device Node section, select SCSI (2:0) . <input type="checkbox"/> Click Next > Finish . The appliance should shut down at this point. <input type="checkbox"/> Return to the beginning and deploy the next appliance. When all of the planned appliances are deployed, continue with Chapter 7, "Starting and Configuring the Appliances," on page 23.

7 Starting and Configuring the Appliances

After the VMs are deployed with the necessary disks added and other settings adjusted according to your worksheets, it is time to start and configure the appliance software on each appliance. When this section is completed, all of the appliances will be running and ready to be deployed as an integrated TeamWorks infrastructure.

Table 7-1 Starting and Configuring the Appliances

Page, Dialog, or Option	Do This
	1 - Before you deploy the first VM.
	<ol style="list-style-type: none">(Multi-appliance deployments only) If you have not already done so, before you begin this process, you must set up shared storage for your TeamWorks appliances by:<ul style="list-style-type: none">Exporting an NFS directorySee the “Network-Based Shared Disk Space for /vashare” section of <i>Worksheet 14</i> and complete the instructions in Section 4, “Setting Up NFS Shared Storage,” on page 17 before continuing.
	2 - Select an appliance.
	<ol style="list-style-type: none">Choose one of the appliances that you deployed in Chapter 6, “Creating the TeamWorks Virtual Machines,” on page 21 and refer to its planning worksheet as you start and configure it.<p>NOTE: You can complete the instructions in this section for all of your TeamWorks appliances in whatever order works best for you.</p><p>When you finish, the appliances will all be running, but TeamWorks <i>will not yet be deployed.</i></p><p>CAUTION: (Multi-appliance deployment only) In contrast to the flexibility that you have in starting and initially configuring your appliances, there is a strict order for creating your multi-appliance TeamWorks deployment.</p><p>You must deploy the appliances in the exact order that is specified in Chapter 8, “Creating a Multiple-Appliance TeamWorks Deployment,” on page 27.</p>
	3 - Start the appliance.
	<ol style="list-style-type: none">After you have downloaded the TeamWorks software and configured your appliances, you must start and configure each appliance in turn.<ul style="list-style-type: none">VMware: In the vSphere Client, power on the first appliance, then click the Console tab.
	4 - Accept the license and specify the keyboard layout.
	<ol style="list-style-type: none">After the appliance boots, the License Agreement screen displays.

Page, Dialog, or Option	Do This
License Agreement	<ol style="list-style-type: none"> 1. Select your preferred keyboard layout in the Keyboard Language drop-down. 2. (Optional) use the License Language drop-down to change the license language. 3. (Optional) use the Keyboard Language drop-down to change the keyboard layout. 4. Accept the license agreement.
Passwords and Time Zone	<ol style="list-style-type: none"> 1. On the configuration page, specify the following information: <p data-bbox="618 499 1446 556">IMPORTANT: Keep a confidential record of the passwords you set for the root and vaadmin users below.</p> <p data-bbox="618 583 1446 667">Root password and confirmation: The root password provides root access to the appliance terminal prompt. Do not access appliances as the root user unless specifically requested by TeamWorks support personnel.</p> <p data-bbox="618 695 1446 751">Vaadmin password and confirmation: The preferred user for accessing the appliance as requested by TeamWorks support personnel.</p> <p data-bbox="618 779 1446 806">Consider using a different password for each appliance for enhanced security.</p> <p data-bbox="618 833 1446 890">NTP Server: The IP address or DNS name of the reliable external Network Time Protocol (NTP) server for your network.</p> <p data-bbox="618 917 927 945">Example: time.example.com.</p> <p data-bbox="618 972 1446 1047">For the best results, set up NTP in accordance with the VMware best practices guidelines (http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1006427).</p> <p data-bbox="618 1075 894 1102">Region: Your local region.</p> <p data-bbox="618 1129 1446 1186">Time Zone: The time zone of all file servers that TeamWorks will provide access to.</p> 2. Click Next.

Page, Dialog, or Option Do This

Network Settings

1. Specify the Hostname:

Hostname: The fully qualified DNS host name associated with the appliance's static IP address.

Example: TW-Search-1.mynetwork.example.com.

2. Specify the following:

IP Address: The static IP address for the appliance.

Example: 172.17.2.3.

Network Mask: The network mask associated with the appliance's IP address.

Example: 255.255.255.0.

Gateway: The IP address of the gateway on the subnet where your TeamWorks virtual appliance is located.

Example: 172.17.2.254.

IMPORTANT: TeamWorks appliances do not tolerate latency and should be installed in the same subnet or a near-subnet.

DNS Servers: The IP address of a primary DNS server for your network.

Example: 172.17.1.1.

Domain Search: The domain that is associated with the TeamWorks host name. The first is derived from the hostname. If your deployment is located in multiple domains, be sure to include the other domains as well.

3. Click **Next**.
-

Additional LAN Card Configuration

1. (Conditional) If you configured multiple network adapters for this appliance, select from the following options, then click **Next**:

- ◆ **Do Not Configure:** Select this option to configure this network at a later time as described in "Changing Network Settings" in the [TeamWorks 18.1: Administrative UI Reference](#).
 - ◆ **DHCP Dynamic Address:** Select this option to have an IP address assigned dynamically on the secondary network.
 - ◆ **Statically Assigned IP Address:** Select this option to assign a static IP address on the secondary network. Then specify the IP address, network mask, and host name.
-

Data Store Location

1. Hard Disk 2 is automatically detected and the disk designation is displayed in the hard drive drop-down.

Accept the defaults for the other options on this page by clicking **Next**.

WARNING: If you have not already created additional disks 2 and 3 for each of your VMs and prepared a shared storage location for your TeamWorks appliances as described in early sections of this guide and in [Planning Your Appliances](#) in the [TeamWorks 18.1 Planning Your TeamWorks Deployment—Best Practices](#) guide, power off the virtual machine and make sure you have the required disk space in place for your deployment before proceeding. Otherwise, there is a substantial risk that your deployment will not meet your organization's needs.

Page, Dialog, or Option	Do This
Data Log Location	<ol style="list-style-type: none"> 1. Hard Disk 3 is automatically detected and the disk designation is displayed in the hard drive drop-down. <p>TeamWorks: Accept the defaults for the other options on this page by clicking Next.</p> <p>Search and PostgreSQL: Accept the defaults for the other options on this page by clicking Configure.</p>
Shared Storage Type (TeamWorks and Search)	<ol style="list-style-type: none"> 1. If you are configuring a PostgreSQL appliance, this page doesn't appear. Go to "Configuring Password, Time, and Network Settings" on page 26. 2. If you are configuring a TeamWorks or Search appliance in a multi-appliance deployment, click Next.
Shared Storage NFS Location	<p>Referring to the work you did in Table 4-1, "Exporting an NFS Directory for /vashare," on page 17, do the following:</p> <ol style="list-style-type: none"> 1. For the NFS Server Hostname field, click Browse and select the NFS server that you identified. <p>If the NFS server is not found, type its IP address or DNS name in the field.</p> <ol style="list-style-type: none"> 2. For the Remote Directory field, click Browse and select the directory that you exported. <p>It is important to use the browse feature for this step to ensure that the path is correct.</p> <ol style="list-style-type: none"> 3. Click Configure. 4. Go to "Configuring Password, Time, and Network Settings" on page 26.
Configuring Password, Time, and Network Settings	<ol style="list-style-type: none"> 1. The settings you have specified are configured, storage is verified, and the appliance starts. <p>Continue as indicated for your deployment type:</p> <p>Multi-appliance Deployment: Repeat the above steps starting with "2 - Select an appliance." on page 23 until all of your appliances are started, configured, and running. Only then should you go to Chapter 8, "Creating a Multiple-Appliance TeamWorks Deployment," on page 27.</p> <p>All-in-one (Small) Deployment: Return to Creating an All-in-One Deployment > "Setting Up an All-in-One (small) TeamWorks Appliance" on page 60.</p>

8

Creating a Multiple-Appliance TeamWorks Deployment

- ♦ [“If You Need to Use a PostgreSQL Appliance Instead of a Server” on page 27](#)
- ♦ [“Setting Up the SQL Database” on page 27](#)
- ♦ [“Setting Up Three Search Appliances” on page 29](#)
- ♦ [“Setting Up the TeamWorks Appliances” on page 31](#)

If You Need to Use a PostgreSQL Appliance Instead of a Server

IMPORTANT: Micro Focus recommends using an existing SQL database if one is available. Instructions are provided in [“Setting Up the SQL Database” on page 27](#).

However, if you need to use a PostgreSQL appliance, do the following:

1. Prepare the PostgreSQL appliance now by completing the instructions in [Appendix B, “Configuring the PostgreSQL Appliance to Provide the SQL Database \(Alternate Practice\),” on page 61](#)
 2. After the appliance is installed, configured, and running, skip to [“Setting Up Three Search Appliances” on page 29](#).
-

Setting Up the SQL Database

Prepare your in-house SQL server by completing the steps in one of the following sections:

- ♦ [“Configuring a PostgreSQL Server” on page 27](#)
- ♦ [“Configuring a Microsoft SQL Server” on page 28](#)

Configuring a PostgreSQL Server

IMPORTANT: Do not create the TeamWorks database on your PostgreSQL server manually.

Let the TeamWorks configuration wizard create the database to ensure the correct configuration.

Table 8-1 Configuring PostgreSQL for TeamWorks

File	Do This
	1 - Edit the configuration file.

File	Do This
PostgreSQL server > / etc/my.cnf file	<ol style="list-style-type: none"> 1. Edit the file as follows: <pre> [client] default-character-set = utf8 [PostgreSQLd] character-set-server = utf8 max_connections = 900 transaction-isolation = READ-COMMITTED expire_logs_days = 7 </pre> <p>The <code>expire_logs_days</code> setting is optional, but is recommended because it cleans up PostgreSQL-bin-* files.</p> <p>Unless this is done regularly, the files will consume significant disk space in the <code>vastorage</code> directory.</p> 2. Uncomment the InnoDB tables section. 3. Increase the buffer pool size to approximately 60 percent of the amount of RAM that has been allocated to the dedicated server. <p>For example, a dedicated server with 4 GB of RAM should have a buffer pool size of 2560 MB, as follows:</p> <pre>innodb_buffer_pool_size = 2560M</pre> 4. Identify or create a user account with sufficient rights to create and manage the TeamWorks database.
Worksheet 12	<ol style="list-style-type: none"> 1. Record the username and password on Worksheet 12. 2. Continue with "Setting Up Three Search Appliances" on page 29.

Configuring a Microsoft SQL Server

IMPORTANT: Do not create the TeamWorks database on your MS SQL server manually.

Let the TeamWorks configuration wizard create the database to ensure the correct configuration.

Table 8-2 Configuring Microsoft SQL Server for TeamWorks

File	Do This
1 - Configure the server.	
Server management console	<ol style="list-style-type: none"> 1. Enable remote access to the Microsoft SQL database server. 2. Open port 1433 on the Windows firewall where the database server is running. 3. Identify or create a user account that is configured with SQL Server Authentication and has sufficient rights to create and manage the TeamWorks database. IMPORTANT: TeamWorks supports only SQL Server Authentication. Windows Authentication and Windows Domain User Authentication to Microsoft SQL are not supported.
Worksheet 23	<ol style="list-style-type: none"> 1. Record the username and password on Worksheet 23.
Server management console	<ol style="list-style-type: none"> 1. Run the following queries against the database: <pre>ALTER DATABASE <i>database-name</i> SET READ_COMMITTED_SNAPSHOT ON ALTER DATABASE <i>database-name</i> COLLATE Latin1_General_CI_AS_KS_WS</pre> 2. Continue with “Setting Up Three Search Appliances” on page 29.

Setting Up Three Search Appliances

TeamWorks best practices require that every multi-appliance deployment have three Search appliances. There are no advantages to having more than three.

Best practices allow for operating TeamWorks with fewer than three search appliances, but only under special circumstances, such as when reindexing is required. One appliance focuses on rebuilding the search index while the other two continue to service user requests and provide the Messaging services that TeamWorks requires.

Setting Up the First Search Appliance

Table 8-3 Setting Up the First Search Appliance

Page, Dialog, or Option	Do This
	<ol style="list-style-type: none"> 1. Open a management browser on your administrative workstation and access the Port 9443 Appliance Console on the first Search appliance using the following URL: <pre>https://IP_Address:9443</pre> <p style="text-align: center;">Where <i>IP_Address</i> is the IP address of the first Search appliance.</p>
TeamWorks Search Appliance Sign In	<ol style="list-style-type: none"> 1. Log in as the vaadmin user with the password that you set for the appliance in “Vaadmin password and confirmation:” on page 24.
TeamWorks Search Tools	<ol style="list-style-type: none"> 1. Click the Configuration button  to launch the TeamWorks Search Configuration Wizard.

Page, Dialog, or Option	Do This
TeamWorks Search Configuration Wizard	<ol style="list-style-type: none"> 1. Read the information to be sure that you're ready to proceed. 2. Click Next.
Database	<ol style="list-style-type: none"> 1. Select the database type for this TeamWorks deployment. 2. Type the DNS name or IP address of the database server or appliance. 3. The standard port for the database type is shown. You can adjust this if required. 4. Enter a name for the database. The name must not contain a dash. 5. Type the name of the database user/role that you created when preparing the database for TeamWorks. 6. Type the password for the database user/role. 7. If you have prepared your appliances for SSL communications, leave the option selected. Otherwise, deselect it before continuing. 8. Click Next. The credentials are validated and the process continues.
Passwords	<ol style="list-style-type: none"> 1. Type and confirm a password for the Search and Messaging services administrator. Make a note of the password in case a support technician needs it later to resolve a support issue. 2. Type and confirm a password for service clients, such as Tomcat, to use for accessing the Search and Messaging services. 3. Click Next.
Locale	<ol style="list-style-type: none"> 1. Select a Default Locale. 2. Click Finish. Services configuration can take a few minutes. Do not proceed until the process finishes. 3. After the process finishes, best practice dictates setting up the other two Search appliances before setting up the TeamWorks appliances. However, this is not enforced in case your circumstances dictate a different setup order. You can deploy a TeamWorks appliance when the database and at least one Search appliance are running.

Setting Up Subsequent Search Appliances

Table 8-4 Setting Up Subsequent Search Appliance

Page, Dialog, or Option	Do This
	<ol style="list-style-type: none"> 1. Open a management browser on your administrative workstation and access the Port 9443 Appliance Console on a subsequent Search appliance using the following URL: <code>https://IP_Address:9443</code> Where <i>IP_Address</i> is the IP address of a second or third, etc. Search appliance.

Page, Dialog, or Option	Do This
TeamWorks Search Appliance Sign In	1. Log in as the <code>vaadmin</code> user with the password that you set for the appliance in “Vaadmin password and confirmation:” on page 24.
TeamWorks Search Tools	1. Click the Configuration button  to launch the TeamWorks Search Configuration Wizard .
TeamWorks Search Configuration Wizard	1. Read the information to be sure that you are ready to proceed. 2. Click Next .
Search Clustering and Messaging Services	1. Best practices dictate that two Search appliances have Messaging services enabled. You can enable this on the second or third Search appliance. The configuration wizard prevents you from disabling the Messaging service when it is the only instance in the deployment. 2. Click Finish . Services configuration can take a few minutes. Do not proceed until the process finishes. 3. Repeat the process until three Search appliances are running—two of them with Messaging services enabled.

Setting Up the TeamWorks Appliances

Table 8-5 Logging in and Starting the Configuration Wizard

Page, Dialog, or Option	Do This
	1. Open a management browser on your administrative workstation and access the Port 9443 Appliance Console on a TeamWorks appliance using the following URL: <code>https://TeamWorks_IP_Address:9443</code> Where <i>IP_Address</i> is the IP address of the first TeamWorks appliance.
TeamWorks Appliance Sign In	1. Log in as the <code>vaadmin</code> user with the password that you set for the appliance in “Vaadmin password and confirmation:” on page 24.
TeamWorks Appliance Tools	1. Click the Configuration icon  to launch the TeamWorks Configuration Wizard .
TeamWorks Configuration Wizard	The installation wizard accesses the shared storage specified for the appliance and verifies that the deployment is prepared for a TeamWorks appliance. It then displays the Search appliances added earlier and prompts you to add this appliance to the deployment. 1. Click Finish to add the TeamWorks appliance to the TeamWorks deployment. 2. Repeat this process for all of the TeamWorks appliances. 3. After adding all of the appliances planned for the initial deployment, continue with “Chapter 9, “Setting Up TeamWorks Services,” on page 33.”

9 Setting Up TeamWorks Services

Complete the following steps to prepare your TeamWorks deployment and make it available to users.

NOTE: As you complete the steps in this section, refer to any Worksheets indicated to make sure that you follow your plans and have an accurate record of your TeamWorks deployment's configurations.

- 1 Changing some settings in the [Port 9443 Appliance Console](#) requires restarting TeamWorks. For example,



- ◆ All modifications to settings accessed through the Configuration Icon
- ◆ Changes to the appliance's Network settings.

We recommend that you change these settings before users begin accessing TeamWorks services. For example:

- 1a Install Your TeamWorks License:** Using the [Port 9443 Appliance Console > Configuration Icon > License](#) dialog, install the same license on each TeamWorks appliance in your system.
- 1b Configure Port Redirection:** If you are enabling port redirection so that users don't need to include :8443 in the TeamWorks access URL, configure that now.

Worksheet - Network Support

1. **Path:** [Port 9443 Appliance Console > Configuration > Network](#)

- 2 Using the settings in the [Port 9443 Appliance Console > Firewall](#) dialog as a reference, make sure that your network's port and firewall settings are configured to support TeamWorks.
- 3 Add users and groups to your TeamWorks deployment and set up the LDAP synchronization processes.

Worksheet 4 - Users and Groups

1. Configure your TeamWorks system to connect to an existing LDAP source, such as eDirectory or Active Directory, to control user access to the system.

Path: [Port 8443 TeamWorks Admin Console](#) > **System** > **LDAP**

IMPORTANT: For initial access to the Port 8443 console, use `admin` as both the username and password. You are then prompted to change the password for user `Admin` before proceeding.

2. Manually create any non-LDAP users and groups that need access to TeamWorks services.

For more information, see “[the New User button](#)” in the *TeamWorks 18.1: Administrative UI Reference*.

Worksheet 5 - LDAP Synchronization

1. Configure the TeamWorks system to synchronize with your LDAP servers.

For assistance, see “[LDAP Servers and Synchronization](#)” in the *TeamWorks 18.1: Administrative UI Reference*.

4 Enable additional TeamWorks Users for Administrative Access.

Worksheet 8 - Administrative Access

1. Configure users for administrative access to TeamWorks.

For more information, see “[Assigning and Managing Port 8443 Designated Administrators](#)” in the *TeamWorks 18.1: Administrative UI Reference*.

- 5 If your TeamWorks deployment needs to support multiple languages, configure the site as described in “[Language and Locale Settings](#)” in the *TeamWorks 18.1: Maintenance Best Practices Guide*.

- 6 After you have completed all of the topics in this list that are relevant to your TeamWorks environment, you can invite users to use the TeamWorks deployment. For information about how to use the TeamWorks deployment, see the *TeamWorks User Help*.

10 Upgrading/Migrating an All-in-One TeamWorks Deployment

Before You Upgrade!

Failure to comply with the following critical points could result in a non-functional TeamWorks system.

- ♦ **Verify the Appliance Version:** Make sure that the appliance being upgraded is running TeamWorks 18.0.1 with the latest updates applied.
- ♦ **Review the Release Notes:** Check “Upgrade” in the [TeamWorks 18.1 Release Notes](#) before you start the upgrade process.
- ♦ **Ensure that the VM host has enough unformatted disk space:**
 - ♦ **System Disk (/):** A 20 GB disk is created automatically.
 - ♦ **Disk 2 (/vastorage):** You make a copy of the appliance’s Disk 2.
 - ♦ **Each Disk 3 (/var):** You create this disk. The recommended size is 4 GB plus 3 times the appliance’s RAM allocation.
- ♦ **Remove VMware Snapshots:** Before copying Disk 2, make sure to remove all VMware snapshots so that the /vastorage disk has the correct disk file and latest configuration settings.
- ♦ **If the appliance has two network adapters:** Do the following:
 1. Download the `networkprep.zip` file from the TeamWorks software downloads page.
 2. Enable SSH on the appliance, as described in “[Managing System Services](#)” in the [TeamWorks 18.1: Administrative UI Reference](#).
 3. Using an SSH client (such as WinSCP), log in to the appliance as the `root` user.
 4. Copy the `networkprep.zip` file that you downloaded to the `/root/` directory on the appliance.
 5. Unzip the `networkprep.zip` file:

```
unzip networkprep.zip
```

The `networkprep` folder is created.
 6. Change to the `network prep` folder:

```
cd /root/networkprep
```
 7. Run the script:

```
sh run-networkprep.sh
```
 8. Close the remote SSH connection to the appliance.

After ensuring that you have met the prerequisites and cautions above, complete the instructions in the following sections in order.

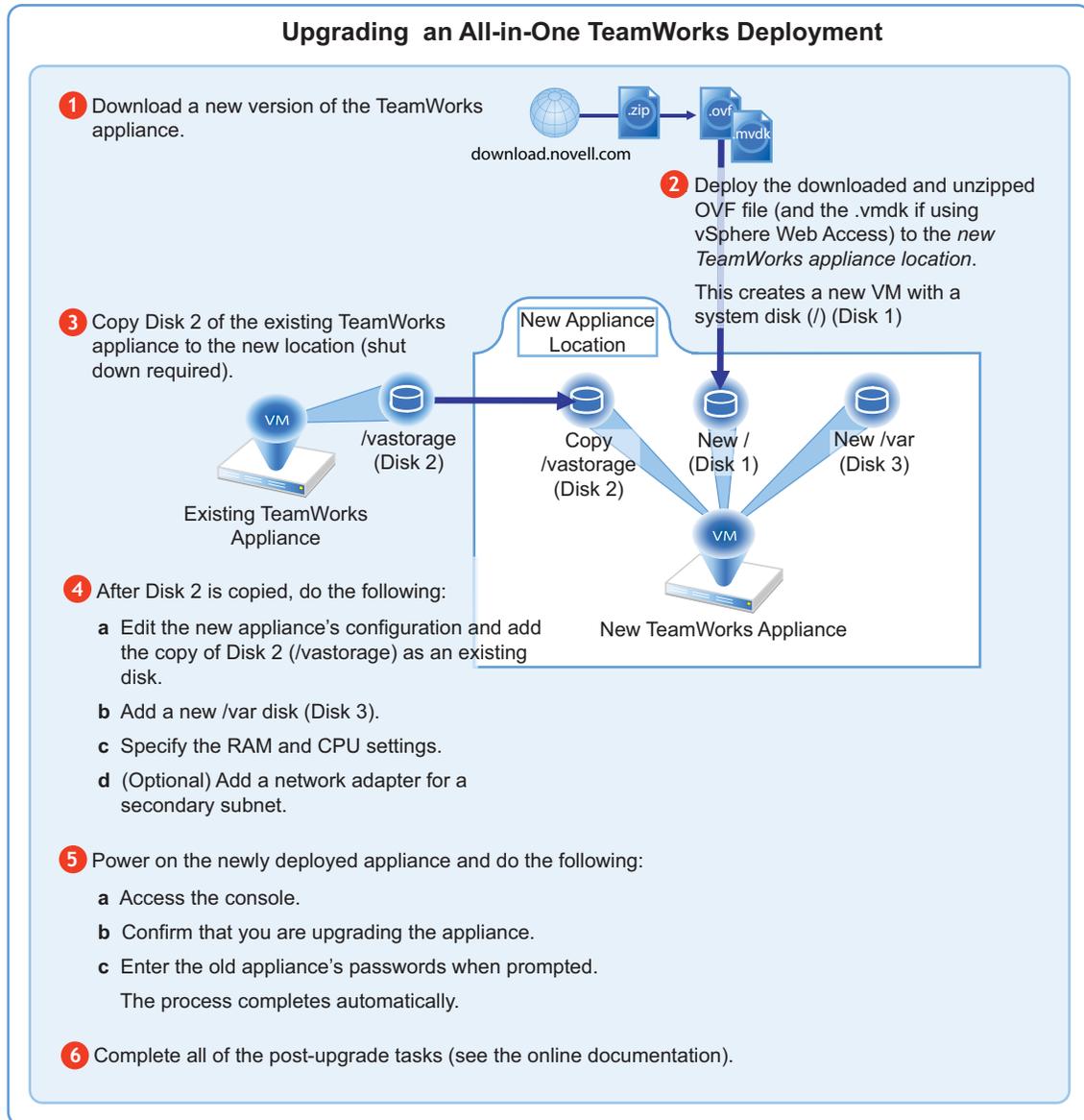
- ♦ “[Small TeamWorks Upgrade Process Overview](#)” on page 36
- ♦ “[Downloading the Software and Preparing for the Upgrade/Migration](#)” on page 37
- ♦ “[Upgrading The TeamWorks All-in-One VM](#)” on page 37

- “Deploying the Upgraded All-in-One TeamWorks VM” on page 39
- “Performing TeamWorks Post-Upgrade/Migration Tasks” on page 40

Small TeamWorks Upgrade Process Overview

If you have upgraded a small TeamWorks deployment before, the following reminder might be all you need.

Figure 10-1 Overview of the Small TeamWorks Appliance Upgrade Process



Downloading the Software and Preparing for the Upgrade/Migration

Download and prepare the software as described in the following steps:

- 1 Download the TeamWorks software (<https://www.microfocus.com/products/enterprise-messaging/teamworks/trial/>) to your management workstation.

IMPORTANT: Registration with Micro Focus is required to receive an email with a software-download link.

- 2 Extract the .ovf .zip file on your management workstation until a TeamWorks-version folder appears.
- 3 Continue with “Upgrading The TeamWorks All-in-One VM” on page 37

Upgrading The TeamWorks All-in-One VM

Complete the steps in [Table 10-1](#).

Table 10-1 Upgrading the TeamWorks VMware VM

Page, Dialog, or Option	Do This
1 - Deploying the OVF Template and naming the VM.	
vSphere Client	<ol style="list-style-type: none"> 1. In the vSphere Client, click File > Deploy OVF Template. <p>IMPORTANT: The instructions that follow assume usage of the traditional vSphere Client.</p> <p>However, significant differences with vSphere Web Client usage are noted.</p>
Deploy OVF Template	<ol style="list-style-type: none"> 1. Click Browse.
Open	<ol style="list-style-type: none"> 1. Navigate to the contents of the folder that you downloaded and extracted in Step 1 on page 37. 2. Select and open the .ovf file. <p>IMPORTANT: The vSphere Web Client requires that you select (or drag/drop) both the .ovf and .vmdk files rather than simply deploying the .ovf.</p> <p>Also, when selecting the deployment options, you must manually deselect Power on Automatically.</p>
Deploy OVF Template	<ol style="list-style-type: none"> 1. Name the replacement appliance with a name that reflects the appliance you are replacing. 2. Click Next. 3. Click Next to accept the default for the disk format. 4. Do not select Power on after deployment. (In the vSphere Web Client, manually deselect Power on Automatically.) 5. Click Finish. <p>The boot disk is created and the appliance is deployed as specified to this point.</p>

Page, Dialog, or Option	Do This
2 - Copying Disk 2	
	<ol style="list-style-type: none"> 1. Shut down the TeamWorks appliance that you are upgrading/migrating using the Port 9443 Console. 2. Navigate to the datastore where you created the new replacement VM. 3. Copy the /vastorage (second disk) of the old appliance to the folder that contains your upgraded appliance.
3 - Editing the VM settings.	
vSphere Client	<ol style="list-style-type: none"> 1. In the vSphere Client, right-click the VM and select Edit Settings. <p>The Virtual Machine Properties dialog displays.</p>
Virtual Machine Properties	<ol style="list-style-type: none"> 1. Set the Memory and CPU settings to match the appliance you are replacing, or increase them as planned.
4 - Configuring Disk 2 (/vastorage)	
Virtual Machine Properties	<ol style="list-style-type: none"> 1. Click Add.
Add Hardware	<ol style="list-style-type: none"> 1. Select Hard Disk, click Next and select Use an existing Virtual disk. 2. Click Next > Browse, then navigate to and select the copy of disk 2 that you made for this appliance. 3. Click Next > Next > Finish.
5 - Adding and Configuring Disk 3 (/var)	
Virtual Machine Properties	<ol style="list-style-type: none"> 1. Click Add.

Page, Dialog, or Option	Do This
Add Hardware	<ol style="list-style-type: none"> 1. Select Hard Disk. 2. Click Next > Next. 3. Adjust the Disk Size to the same size as disk 3 (/var) on the appliance you are replacing. 4. Under Disk Provisioning, select either: <ul style="list-style-type: none"> ◆ Thick Provision Eager Zeroed or ◆ Support clustering features such as Fault Tolerance <p>Depending on the VMware version that you are running.</p> 5. Under Location, select Specify a datastore or Datastore cluster 6. Click Browse. 7. Select the datastore and folder for this appliance. 8. Click OK. 9. Click Next. 10. Under the Virtual Device Node section, select SCSI (2:0). 11. Click Next. 12. Click Finish. 13. If you need to add network adapters, continue with 6 - (Optional) Adding a Network Adapter. Otherwise, click OK and skip to continue with “Deploying the Upgraded All-in-One TeamWorks VM” on page 39.
6 - (Optional) Adding a Network Adapter	
<p>You can add a network adapter if your TeamWorks deployment accesses a separate network for one or more of the following reasons:</p> <ul style="list-style-type: none"> ◆ Appliance administration. ◆ Security of memcached. <p>IMPORTANT: Bonding or teaming NICs is not supported with TeamWorks.</p>	
Virtual Machine Properties	<ol style="list-style-type: none"> 1. Click Add.
Add Hardware	<ol style="list-style-type: none"> 1. Select Ethernet Adapter. 2. Click Next. 3. Under Network Connection, select the secondary network associated with the TeamWorks installation. 4. Click Next > Finish > OK.
vSphere Client	<ol style="list-style-type: none"> 1. Continue with “Deploying the Upgraded All-in-One TeamWorks VM” on page 39.

Deploying the Upgraded All-in-One TeamWorks VM

- 1 Power on the new all-in-one appliance.
- 2 Access the appliance's console.

- 3 When prompted, enter the root and vaadmin passwords for the appliance.
The upgrade process proceeds automatically.
- 4 When the appliance displays the final screen in the console window, open your management browser and log in to the appliance on port 9443 as the vaadmin user.
- 5 Check the following:
 - ♦ **PostgreSQL :**
 - ♦ Click the phpPgAdmin icon.
 - ♦ Verify that the database is populated as expected.
 - ♦ **TeamWorks:**
 - ♦ Click the TeamWorks configuration icon.
 - ♦ Ensure that all of the settings are in place as expected.
 - ♦ If the configuration wizard displays, there was a problem with the configuration.
 - ♦ Resolve the configuration issues, then click Finish to reconfigure the system.
Common configuration issues include:
 - ♦ If your system is not using DNS, the most likely problem is unresolvable DNS names and missing /etc/hosts entries.
 - ♦ If the appliance doesn't have access to the database, ensure that all of the settings are as expected.
- 6 When the appliance is running, continue with [“Performing Post-Upgrade Tasks.”](#)

Performing TeamWorks Post-Upgrade/Migration Tasks

Reindex Your Deployment After Migrating

After the upgrade/migration is completed and before users can effectively begin using TeamWorks services, you must perform a full reindexing of the system.

See [“Perform Full Reindex Now”](#) in the *TeamWorks 18.1: Administrative UI Reference*.

We recommend using the Offline option because reindexing is performed much more quickly and requires substantially fewer system resources.

Install Your New License

Upgraded TeamWorks appliances have a 60-day evaluation license installed.

To prevent a service interruption, you must install your new license by following the instructions in [“Installing/Updating the TeamWorks License”](#) in the *TeamWorks 18.1: Administrative UI Reference*.

11

Upgrading/Migrating a Multiple-appliance TeamWorks Deployment

Moving your TeamWorks deployment to version 18.1 involves two interwoven processes:

- ◆ Deploying replacement TeamWorks appliances that run TeamWorks 18.1 services on the SLES 15 operating system.
- ◆ Migrating your TeamWorks system data (users, groups, conversations, attachments, etc.) to the newly deployed appliances.

Before You Upgrade!

Failure to comply with the following critical points could result in a non-functional TeamWorks system.

Critical Point	Details
◆ Verify the appliance versions	◆ Make sure that all appliances targeted for upgrading to version 18.1 are running version 18.0.1 with the latest updates applied.
◆ Review the Release Notes	◆ Check “Upgrade” in the TeamWorks 18.1 Release Notes before you start the upgrade process.

Critical Point	Details
<ul style="list-style-type: none"> ◆ Plan the upgrade order and follow it. 	<ul style="list-style-type: none"> ◆ You must upgrade the appliances in order of dependency upon each other. <ol style="list-style-type: none"> Shut Down Order: Prepare a list of your appliances that defines the correct shut down order: <ul style="list-style-type: none"> ◆ TeamWorks: All TeamWorks appliances must be shut down first. ◆ TeamWorkssearch: Next, you shut down the TeamWorkssearch appliances. ◆ PostgreSQL (if applicable): Finally, if you are using a PostgreSQL appliance instead of an in-house SQL server, you shut it down last. Deployment Order: Prepare a second list that defines the correct upgrade and deployment order: <ul style="list-style-type: none"> ◆ PostgreSQL (if applicable): If you are using a PostgreSQL appliance instead of an in-house SQL server, you must upgrade and deploy that appliance first. ◆ TeamWorkssearch: You must upgrade and deploy all of the TeamWorkssearch appliances before the TeamWorks appliances. ◆ TeamWorks: When the upgraded PostgreSQL and TeamWorkssearch appliances are up and running, upgrade and deploy the first TeamWorks appliance. Then upgrade and deploy the additional TeamWorks appliances. 3. If there are things you need to remember about individual appliances, include those reminders in the appropriate list. 4. Use the shut down list as you complete the steps in “Upgrading the VMs.” 5. Use the upgrade list as you complete the steps in “Deploying the Upgraded (Replacement) VMs.”
<ul style="list-style-type: none"> ◆ Ensure that the VM host has enough unformatted disk space. 	<ul style="list-style-type: none"> ◆ The VM host server must have enough unallocated disk space to contain the following disks for each appliance. This is only temporary because after the upgrade completes, old appliances can be deleted and their disk space reclaimed. <ul style="list-style-type: none"> ◆ System Disk (/): This is created automatically as you deploy the downloaded software. Size is 20 GB per appliance. ◆ Disk 2 (/vstorage): You make a copy of each old appliance’s Disk 2. Size needed equals the total size of all disks to be copied. ◆ Disk 3 (/var): You create this disk for each appliance in conjunction with the upgrade process. Size recommendation for TeamWorks is 4 GB plus 3 times the RAM allocation for each appliance being upgraded. <p>NOTE: The existing <code>/vashare</code> mount point is used by the upgraded TeamWorks appliances. No new disk space is required for upgrading.</p>
<ul style="list-style-type: none"> ◆ Remove all VMware Snapshots 	<ul style="list-style-type: none"> ◆ Before copying Disk 2, make sure to remove all VMware snapshots so that the <code>/vstorage</code> disk has the correct disk file and latest configuration settings.

Critical Point	Details
<ul style="list-style-type: none"> ◆ Make sure that upgraded appliances meet TeamWorks system requirements. 	<ul style="list-style-type: none"> ◆ See Chapter 3, “System Requirements,” on page 11. ◆ RAM and CPU requirements are summarized in the following sections of the Planning Best Practices guide: <ul style="list-style-type: none"> ◆ Using Worksheet 10 - TeamWorks Appliances ◆ Using Worksheet 11 - Search Appliances ◆ Using Worksheet 12 - SQL Database
<ul style="list-style-type: none"> ◆ Do not attempt unsupported path migrations. 	<ul style="list-style-type: none"> ◆ No Cross-platform: You cannot upgrade from one virtualization platform to another. In other words, you can only upgrade VMware to VMware, and so forth. ◆ No Mixed Versions: All of the TeamWorks and TeamWorkssearch appliances in an multi-appliance deployment must be upgraded to the same version. ◆ No Cross-Deployment-Types: You can only upgrade all-in-one to all-in-one or multi-appliance to multi-appliance. If you have an all-in-one deployment, and you need a multi-appliance deployment, you must either install a new system or contact Micro Focus Consulting (http://www.novell.com/consulting) to assist you with the migration.
<ul style="list-style-type: none"> ◆ Prepare appliances with two network adapters before upgrading. 	<ul style="list-style-type: none"> ◆ For any appliances with two network adapters, do the following: <ol style="list-style-type: none"> 1. Download the <code>networkprep.zip</code> file from the TeamWorks software downloads page. 2. Enable SSH on the appliance, as described in “Managing System Services” in the TeamWorks 18.1: Administrative UI Reference. 3. Using an SSH client (such as WinSCP), log in to the appliance as the root user. 4. Copy the <code>networkprep.zip</code> file that you downloaded to the <code>/root/</code> directory on the appliance. 5. Unzip the <code>networkprep.zip</code> file: <pre>unzip networkprep.zip</pre> The <code>networkprep</code> folder is created. 6. Change to the <code>network prep</code> folder: <pre>cd /root/networkprep</pre> 7. Run the script: <pre>sh run-networkprep.sh</pre> 8. Close the remote SSH connection to the appliance.
<ul style="list-style-type: none"> ◆ Plan when to upgrade. 	<ul style="list-style-type: none"> ◆ TeamWorks services must be offline during the upgrade. <ol style="list-style-type: none"> 1. Schedule the upgrade for a block of time that is least disruptive from a production standpoint. 2. Notify TeamWorks users in advance of the upgrade so that they have time to prepare.

After ensuring that you have met the prerequisites and cautions above, complete the instructions in the following sections in order.

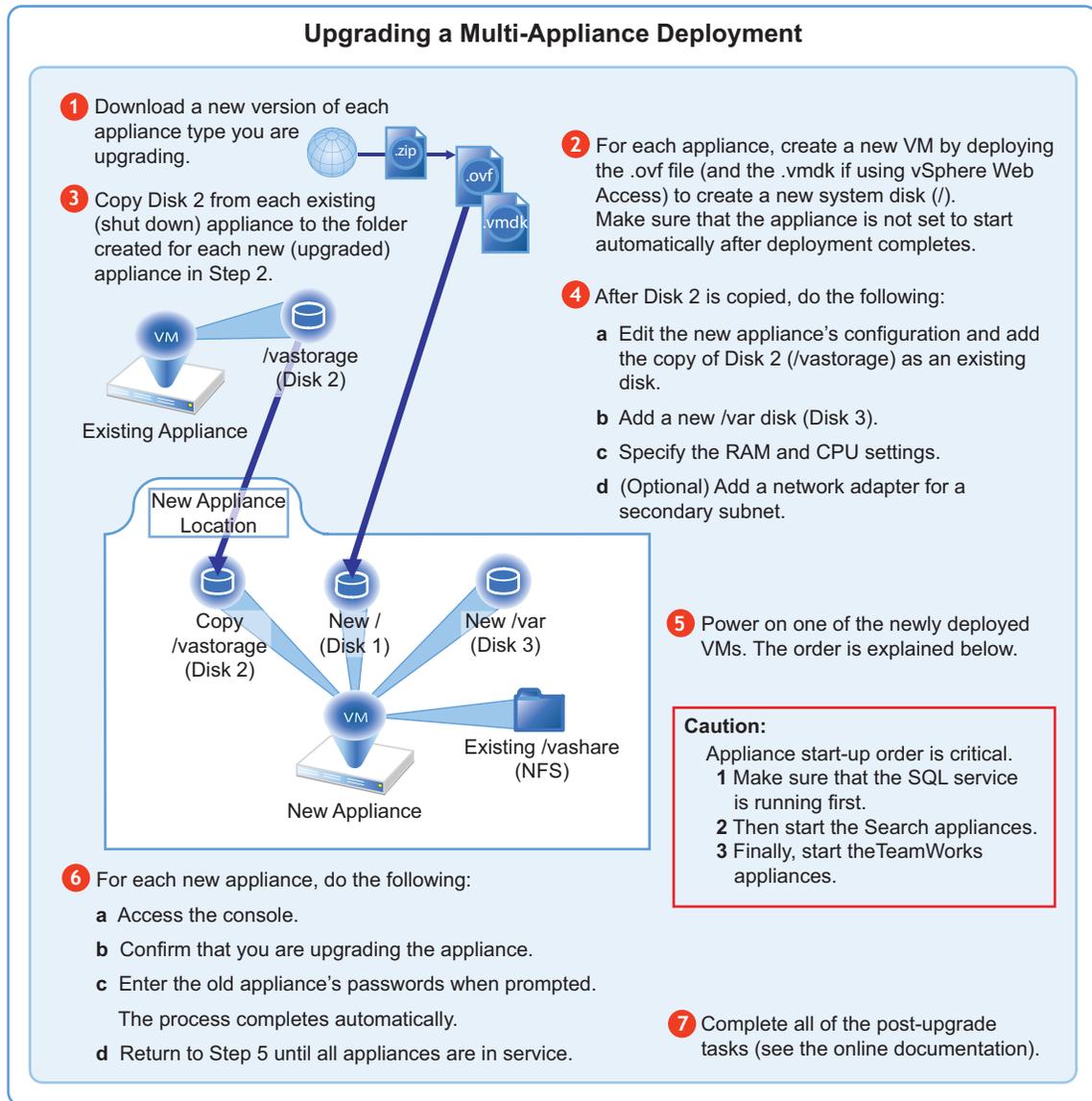
- ◆ “Understanding the Appliance Upgrade Process” on page 44
- ◆ “Downloading and Preparing Software for the Upgrades” on page 45
- ◆ “Upgrading the VMs” on page 46
- ◆ “Shutting Down the Old Deployment” on page 49
- ◆ “Deploying the Upgraded (Replacement) VMs” on page 49
- ◆ “Performing Post-Upgrade Tasks” on page 50

Understanding the Appliance Upgrade Process

The process of upgrading Micro Focus appliances is illustrated in [Figure 11-1 on page 45](#).

NOTE: If you are unsure about any part of the upgrade process, the sections that follow the graphic should provide the guidance you need.

Figure 11-1 Overview of the Appliance Upgrade Process



Downloading and Preparing Software for the Upgrades

- 1 Download the TeamWorks software (<https://www.microfocus.com/products/enterprise-messaging/teamworks/trial/>) shown below to your management workstation.

IMPORTANT: Registration with Micro Focus is required to receive an email with a software-download link.

Appliance Type	Filename
TeamWorks	TeamWorks.x86_64-version.ovf.zip

Appliance Type	Filename
Search	TeamWorkssearch.x86_64-version.ovf.zip
PostgreSQL (only if no in-house SQL server is available)	PostgreSQL.x86_64-version.ovf.zip

- 2 Extract each .ovf.zip file on your management workstation until an *ApplianceType-version* folder appears.
- 3 Continue with “Upgrading the VMs” on page 46.

Upgrading the VMs

- 1 Complete the steps in [Table 11-1](#) for each appliance that you are upgrading

Table 11-1 Upgrading a VMware VM

Page, Dialog, or Option	Do This
	<p>1 - Launching vSphere.</p> <ol style="list-style-type: none"> 1. On your management workstation, start the vSphere Client (or for ESXi 6.7 or later, open the vSphere Web Client). <p>IMPORTANT: The instructions that follow assume usage of the traditional vSphere Client.</p> <p>However, significant differences with vSphere Web Client usage are noted.</p>
vSphere Client	<p>2 - Deploying the OVF Template and naming the VM.</p> <p>IMPORTANT: The vSphere Web Client requires that you select (or drag/drop) both the .ovf and .vmdk files rather than simply deploying the .ovf.</p> <p>Also, when selecting the deployment options, you must manually deselect Power on Automatically.</p> <ol style="list-style-type: none"> 1. Click File > Deploy OVF Template.
Deploy OVF Template	<ol style="list-style-type: none"> 1. Click Browse.
Open	<ol style="list-style-type: none"> 1. For the appliance type you are deploying, navigate to the contents of the folder that you downloaded and extracted in “Downloading and Preparing Software for the Upgrades” on page 45. 2. Select and open the .ovf file. (Web Client - select both the .ovf and the .vmdk files.)

Page, Dialog, or Option Do This

Deploy OVF Template

1. Name the appliance with a name that is easily associated with (but not the same as) the VM name of the associated appliance being upgraded

Consider including information in the names that easily identifies the appliance type and other information, such as the IP address.

For example,

- ◆ v18-1-TeamWorks-1-192.168.1.61
- ◆ v18-1-TeamWorks-2-192.168.1.62
- ◆ v18-1-Search-1-192.168.1.71
- ◆ v18-1-Search-2-192.168.1.72
- ◆ v18-1-Search-3-192.168.1.73

2. Click **Next**.
3. Choose the datastore and folder where you copied the appliance's Disk 2.
4. Click **Next** to accept the default for the disk format.
5. Do not select **Power on after deployment**.
(Web Client - Deselect **Power on Automatically**.)
6. Click **Finish**.

The boot disk is created and the appliance is deployed as specified to this point.

3 - Copy Disk 2 to the New Appliance.

vSphere Client

Copying each appliance's disk is at the heart of the upgrade process because it uses the corresponding "old" appliance's configuration settings on Disk 2 to create an upgraded version of the appliance with minimal input on your part.

Disk copying can take a while, depending on disk size and the VM host environment.

Therefore, we recommend keeping service downtime to a minimum by making the copies while the TeamWorks system is still running.

1. Shutdown the appliance from which you need to copy Disk 2.
2. Copy Disk 2 to its associated folder or directory that you created for your upgraded appliances in "[Downloading and Preparing Software for the Upgrades](#)" on page 45.

NOTE: Default VMware disk names are constructed as follows:

- ◆ *vm_name.vmdk*
- ◆ *vm_name_1.vmdk* - This is Disk 2
- ◆ *vm_name_2.vmdk*

3. When the disk finishes copying, start up the appliance so that the TeamWorks service can continue.

4 - Editing the VM settings.

vSphere Client

1. In the vSphere Client, right-click the VM you just deployed and select **Edit Settings**.

The Virtual Machine Properties dialog displays.

Page, Dialog, or Option	Do This
Virtual Machine Properties	1. Set the Memory and CPU settings to match the appliance you are replacing, or increase them as planned.
5 - Configuring disk 2 (/vastorage)	
Virtual Machine Properties	1. Click Add .
Add Hardware	<ol style="list-style-type: none"> 1. Select Hard Disk, click Next and select Use an existing Virtual disk. 2. Click Next > Browse, then navigate to and select the copy of disk 2 that you made for this appliance. 3. Click Next > Next > Finish.
6 - Adding and Configuring disk 3 (/var)	
Virtual Machine Properties	1. Click Add .
Add Hardware	<ol style="list-style-type: none"> 1. Select Hard Disk. 2. Click Next > Next. 3. Adjust the Disk Size to the same size as disk 3 (/var) on the appliance you are replacing. 4. Under Disk Provisioning, select either: <ul style="list-style-type: none"> ◆ Thick Provision Eager Zeroed or ◆ Support clustering features such as Fault Tolerance Depending on the VMware version that you are running. 5. Under Location, select Specify a datastore or Datastore cluster 6. Click Browse. 7. Select the datastore and folder for this appliance. 8. Click OK. 9. Click Next. 10. Under the Virtual Device Node section, select SCSI (2:0). 11. Click Next. 12. Click Finish. 13. If you need to add network adapters, continue with 7 - (Optional) Adding a Network Adapter. Otherwise, click OK, return to “2 - Deploying the OVF Template and naming the VM.” on page 46, and deploy the next appliance that you have planned for When all of your planned appliances have been deployed, continue with “Deploying the Upgraded (Replacement) VMs” on page 49.

Page, Dialog, or Option	Do This
	<p>7 - (Optional) Adding a Network Adapter</p> <p>You can add a network adapter if your TeamWorks deployment accesses a separate network for one or more of the following reasons:</p> <ul style="list-style-type: none"> ◆ Appliance administration. ◆ NFS mount access to the /vashare mount point. ◆ Security of memcached. <p>IMPORTANT: Bonding or teaming NICs is not supported with TeamWorks.</p>
Virtual Machine Properties	1. Click Add .
Add Hardware	<ol style="list-style-type: none"> 1. Select Ethernet Adapter. 2. Click Next. 3. Under Network Connection, select the secondary network associated with the TeamWorks installation. 4. Click Next > Finish > OK.
vSphere Client	1. Repeat the steps in this table from 2 - Deploying OVF Template until all of your planned appliances have been deployed, then continue with "Deploying the Upgraded (Replacement) VMs" on page 49.

Shutting Down the Old Deployment

When your replacement appliances are ready for deployment, shut the old appliances in the following order:

1. TeamWorks
2. Search
3. PostgreSQL (if applicable)

Deploying the Upgraded (Replacement) VMs

IMPORTANT

- ◆ Make sure that you deploy (Start and configure) your appliances one at a time.

Attempting to start and configure multiple upgraded appliances at the same time causes timing, synchronization, and other problems.

- ◆ Also make sure that you deploy the appliances in the [deployment order](#) that you identified earlier:

1. PostgreSQL (if applicable)

If using an in-house database server, make sure it is online before continuing with the Search appliances.

2. Search
3. TeamWorks

- 1 Power on the first (or next) appliance in your [deployment order](#) list.
- 2 Access the appliance's console.
- 3 When prompted, enter the root and vaadmin passwords for the appliance being replaced.
The upgrade process proceeds automatically.
- 4 When the appliance displays the final screen in the console window, open your management browser and log in to the appliance on port 9443 as the vaadmin user.
- 5 Depending on the appliance type you are upgrading, check the following:

PostgreSQL (optional)	TeamWorkssearch	TeamWorks
<ol style="list-style-type: none"> 1. Click the phpPgAdmin icon. 2. Verify that the database is populated as expected. 	<ol style="list-style-type: none"> 1. Click the TeamWorkssearch configuration icon. 2. Ensure that all of the settings are in place as expected. 3. If the configuration wizard displays, there was a problem with the configuration. Resolve the configuration issues, then click Finish to reconfigure the system. 	<ol style="list-style-type: none"> 1. Click the TeamWorks configuration icon. 2. Ensure that all of the settings are in place as expected. 3. If the configuration wizard displays, there was a problem with the configuration. Resolve the configuration issues, then click Finish to reconfigure the system. <p>Common configuration issues include:</p> <ul style="list-style-type: none"> ◆ If your system is not using DNS, the most likely problem is unresolvable DNS names and missing <code>etc/hosts</code> entries. ◆ If the appliance doesn't have access to the database, ensure that all of the settings are as expected.

- 6 When the appliance is running, deploy the next appliance.
- 7 When all of your appliances are running, continue with "[Performing Post-Upgrade Tasks](#)."

Performing Post-Upgrade Tasks

After upgrading to a new version of TeamWorks, you should perform the following tasks to ensure a fully functional TeamWorks system:

- ◆ ["Reindex Your Deployment After Migrating"](#) on page 51
- ◆ ["Re-Enabling SSH on the TeamWorks Search and Database Appliances"](#) on page 51
- ◆ ["Install Your New TeamWorks License"](#) on page 51

Reindex Your Deployment After Migrating

After the upgrade/migration is completed and before users can effectively begin using TeamWorks services, you must perform a full reindexing of the system.

See “[Perform Full Reindex Now](#)” in the *TeamWorks 18.1: Administrative UI Reference*.

We recommend using the Offline option because reindexing is performed much more quickly and requires substantially fewer system resources.

Re-Enabling SSH on the TeamWorks Search and Database Appliances

If you enabled SSH on the search or database appliances before upgrading your TeamWorks system, it is disabled after upgrading, and you need to re-enable it. For more information about how to enable SSH, see “[Managing System Services](#)” in the *TeamWorks 18.1: Administrative UI Reference*.

Install Your New TeamWorks License

Upgraded TeamWorks appliances have a 60-day evaluation license installed.

To prevent a service interruption, you must install your new license by following the instructions in “[Installing/Updating the TeamWorks License](#)” in the *TeamWorks 18.1: Administrative UI Reference*.

12 Updating/Patching TeamWorks

- [“Minimizing Service Disruption” on page 53](#)
- [“Registering for Updates” on page 53](#)
- [“Updating the Appliances” on page 54](#)

Minimizing Service Disruption

To avoid needing to perform a full reindexing of TeamWorks, you must shut down the GroupWise TeamWorks system service prior to beginning the update.

Therefore, as a best practice, we recommend updating during a time when service interruption will be least disruptive, such as at night or on a weekend.

Registering for Updates

Only registered appliances can have updates applied. If you need to register an appliance, do the following:

- 1 On an appliance, log into the [Port 9443 console](#) as the vaadmin user.
- 2 Click the **Online Update** icon.
- 3 Use the Register Online Update Service dialog to register the appliance. For help, see [“Register Online Update Service”](#) in the *TeamWorks 18.1: Administrative UI Reference*.

When Updates Become Available

After you register the appliances to receive online updates, update availability is registered in the [Port 9443 console](#) of each appliance.

IMPORTANT: Depending on the nature and scope of a given update, it might apply to only one appliance type.

Regardless of which appliance types have updates available, the update process outlined in [“Updating the Appliances” on page 54](#) must be followed in each case. In other words, access to TeamWorks must be disabled during the update process, appliances types must be updated in order, and so on.

For example, if updates are available for only the Search and PostgreSQL appliances, you must still disable TeamWorks access, then update the PostgreSQL appliance, and finally update the Search appliances before restoring TeamWorks access.

Updating an All-in-One Appliance

To update an all-in-one TeamWorks appliance, complete the instructions in only the following sections:

- ♦ [“Disabling User Access to TeamWorks” on page 54](#)
- ♦ [“Updating the TeamWorks Appliances” on page 55](#)
- ♦ [“Resolving Web Client Connection Issues” on page 55](#)

Updating the Appliances

IMPORTANT: Make sure that you update only one appliance at a time. Do not begin with the next update until the previous update process is completed.

Complete the following sections in the order presented:

- ♦ [“Disabling User Access to TeamWorks” on page 54](#)
- ♦ [“Updating the PostgreSQL Appliance” on page 54](#)
- ♦ [“Updating the Search Appliances” on page 55](#)
- ♦ [“Updating the TeamWorks Appliances” on page 55](#)
- ♦ [“Resolving Web Client Connection Issues” on page 55](#)

Disabling User Access to TeamWorks

Before beginning the update process, you must disable user access to each TeamWorks appliance.

If you use a forward proxy or other load-balancing solution to provide TeamWorks access, you should be able to accomplish this by taking the service offline.

If your users access TeamWorks appliances directly, you must disable the TeamWorks service on each TeamWorks appliance by doing the following:

- 1 On a TeamWorks appliance, log in to the [Port 9443 console](#).
- 2 Click the **System Services** icon.
- 3 Click **GroupWise TeamWorks > Action > Stop**.
- 4 Repeat this on each TeamWorks appliance in your deployment.
- 5 (Conditional) If you are updating an all-in-one appliance, skip to [“Updating the TeamWorks Appliances” on page 55](#).

Updating the PostgreSQL Appliance

If you use the PostgreSQL appliance for TeamWorks database services, and if updates are available for the PostgreSQL appliance, do the following. Otherwise, skip to [“Updating the Search Appliances” on page 55](#).

- 1 On the PostgreSQL appliance, log in to the [Port 9443 console](#).
- 2 Click the **Online Update** icon.
- 3 In the drop-down options list, make sure that **Needed Patches** is selected.

- 4 Above the drop-down options list, click **Update Now**.
- 5 When the update completes, click **Home** (upper-right corner).
- 6 Click the **Reboot Needed** button, click **OK**, and then wait for the appliance to reboot before continuing.
- 7 Continue with [“Updating the Search Appliances” on page 55](#).

Updating the Search Appliances

If updates are available for the Search appliances, do the following. Otherwise, skip to [“Updating the TeamWorks Appliances” on page 55](#).

- 1 On a Search appliance, log in to the [Port 9443 console](#).
- 2 Click the **Online Update** icon.
- 3 In the drop-down options list, make sure that **Needed Patches** is selected.
- 4 Above the drop-down options list, click **Update Now**.
- 5 When the update completes, click **Home** (upper-right corner).
- 6 Click the **Reboot Needed** button, click **OK**, and then wait for the appliance to reboot before continuing.
- 7 Repeat the update process on each Search appliance before continuing with the TeamWorks appliances.
- 8 When all of the Search appliances are updated and running, continue with [“Updating the TeamWorks Appliances” on page 55](#).

Updating the TeamWorks Appliances

For each TeamWorks appliance, do the following:

- 1 On a TeamWorks appliance, log in to the [Port 9443 console](#).
- 2 Click the **Online Update** icon.
- 3 In the drop-down options list, make sure that **Needed Patches** is selected.
- 4 Above the drop-down options list, click **Update Now**.
- 5 When the update completes, click **Home** (upper-right corner).
- 6 Click the **Reboot Needed** button, click **OK**, and then wait for the appliance to reboot before continuing.
- 7 Repeat the update process on each TeamWorks appliance.
- 8 When all of the TeamWorks appliances are updated and running, the update is complete.
Continue with [“Resolving Web Client Connection Issues” on page 55](#).

Resolving Web Client Connection Issues

Depending on the web browser and version, web client users that were connected to TeamWorks when the update process began, might have issues connecting after the update completes.

Connection issues can be resolved by doing one of the following:

- ♦ Refreshing the browser.

- ◆ Closing and restarting the browser.
- ◆ Clearing browser cache by typing Ctrl+F5.

Appendixes

- ◆ [Appendix A, “Creating an All-in-One Deployment,” on page 59](#)
- ◆ [Appendix B, “Configuring the PostgreSQL Appliance to Provide the SQL Database \(Alternate Practice\),” on page 61](#)
- ◆ [Appendix C, “VMware—Changing the SCSI Controller Type,” on page 63](#)
- ◆ [Appendix D, “Troubleshooting the TeamWorks Installation,” on page 65](#)
- ◆ [Appendix E, “Third-Party Materials,” on page 67](#)

A

Creating an All-in-One Deployment

To create an all-in-one deployment, you install one TeamWorks appliance. By default TeamWorks also includes the PostgreSQL database and Search functions.

Ensuring All-in-One Suitability

With few exceptions, small deployments are only suitable for proof-of-concept deployments, which, by definition, do not require extensive planning. There is, however, a planning worksheet for all-in-one deployments. See Worksheet 10-1 - All-in-One Appliance.

For a production deployment, you should use the [TeamWorks 18.1 Planning Your TeamWorks Deployment—Best Practices](#) guide and associated planning worksheets to gauge whether a small deployment could meet your organization’s production needs.

All-in-One System Requirements

Most of the requirements in [Chapter 3, “System Requirements,”](#) on page 11 apply to small deployments.

However, minimum RAM and CPU recommendations are increased to handle the database and search functions running in addition to TeamWorks.

- ♦ 16 GB of RAM is the minimum
- ♦ 4 CPUs - minimum

80% of the RAM should be dedicated to the Java heap.

For information about adjusting the Java heap settings, see [“Changing the Memory Configuration Settings”](#) in the [TeamWorks 18.1: Administrative UI Reference](#).

All-in-One Deployment

To deploy an all-in-one TeamWorks appliance, complete the instructions in the following sections:

Table A-1

Section	Additional Information
Chapter 5, “Downloading and Preparing the TeamWorks Software,” on page 19	You only need to download the TeamWorks software for your virtualization platform.
Chapter 6, “Creating the TeamWorks Virtual Machines,” on page 21	Follow the instructions in the section for your virtualization platform.
Chapter 7, “Starting and Configuring the Appliances,” on page 23	Follow the instructions in the referenced section, then continue with “Setting Up an All-in-One (small) TeamWorks Appliance” on page 60

Setting Up an All-in-One (small) TeamWorks Appliance

Table A-2 Logging in and Setting Up a Small TeamWorks Appliance

Page, Dialog, or Option	Do This
	<ol style="list-style-type: none">1. Open a management browser on your administrative workstation and access the Port 9443 Appliance Console on the TeamWorks appliance using the following URL: <code>https://TeamWorks_IP_Address:9443</code> Where <i>IP_Address</i> is the IP address of the TeamWorks appliance.
TeamWorks Appliance Sign In	<ol style="list-style-type: none">1. Log in as the <code>vaadmin</code> user with the password that you set for the appliance in "Vaadmin password and confirmation:" on page 24.
TeamWorks Appliance Tools	<ol style="list-style-type: none">1. Click the Configuration icon  to launch the TeamWorks Configuration Wizard.
TeamWorks Configuration Wizard	<ol style="list-style-type: none">1. Click Next.
Database, Search, and Messaging services Passwords	<ol style="list-style-type: none">1. Type and confirm a password for each of the following system users:<ul style="list-style-type: none">◆ <code>db-user</code>◆ <code>postgres</code>◆ <code>svcs-user</code>◆ <code>svcs-admin</code>2. Make a record of the passwords in case Micro Focus Support needs them to resolve a support incident in the future. (No administrative tasks require these passwords.)
Default Locale	<ol style="list-style-type: none">1. Select your Locale from the dropdown list.2. Click Finish.3. Do not close or exit the browser page until the warning message disappears.
Set Up TeamWorks Services	<ol style="list-style-type: none">1. Use the information in Chapter 9, "Setting Up TeamWorks Services," on page 33 as a guide for setting up your all-in-one appliance.

B Configuring the PostgreSQL Appliance to Provide the SQL Database (Alternate Practice)

Table B-1 Configuring a PostgreSQL Appliance

Page or Dialog	Do This
	<p>IMPORTANT: The following steps assume that you installed and prepared a PostgreSQL appliance in addition to your TeamWorks and Search appliances, as documented in Chapter 6, “Creating the TeamWorks Virtual Machines,” on page 21.</p> <ol style="list-style-type: none"> Using a browser on your management workstation, access the Port 9443 Appliance Console on the PostgreSQL appliance by entering the following URL: <pre>https://PostgreSQL_IP_Address:9443</pre> <p>Where <i>IP_Address</i> is the IP address of the PostgreSQL appliance.</p>
PostgreSQL Appliance Sign In	<ol style="list-style-type: none"> Log in as the <code>vaadmin</code> user with the password that you set for the appliance in “Vaadmin password and confirmation:” on page 24.
PostgreSQL Appliance Tools	<ol style="list-style-type: none"> Click the phpPgAdmin icon  to launch the phpPgAdmin utility. In the left panel, click PostgreSQL, then log in as <code>postgres</code> with password <code>postgres</code>.
phpPgAdmin	<ol style="list-style-type: none"> Click the Roles icon . On the <code>postgres</code> role row, click Alter. Type and confirm a new password for the <code>postgres</code> role/user, then click Alter. Click Create role.
Create Role	<ol style="list-style-type: none"> Type a name in the Name field, such as <code>db-user</code>, for the role that will create the database and provide TeamWorks services with database access. Type and confirm a password for the role you are creating. Select the Create DB? and Can login? options. Click the Create button. The role you created is added to the Roles list. Close the browser and return to “Setting Up Three Search Appliances” on page 29.

C VMware—Changing the SCSI Controller Type

To change the SCSI controller type on a VMware-based appliance to **VMware Paravirtual**:

1. Finish the installation and power on the TeamWorks system.
2. Ensure that the TeamWorks system is running. (Log in as the TeamWorks administrator, create a user, and log in as that user.)
3. Shut down each appliance in the TeamWorks system. (For information about how to safely shut down an appliance, see [“Shutting Down and Restarting the Micro Focus Appliance”](#) in the *TeamWorks 18.1: Administrative UI Reference*.)
4. In VMware, change the controller to **VMware Paravirtual**.
5. Power on each appliance in the TeamWorks system.

D Troubleshooting the TeamWorks Installation

Unable to Access a Newly Installed Appliance

If you are unable to access a newly installed appliance and you need to change appliance settings, such as the IP address, use the VACONFIG utility from the TeamWorks command prompt.

For more information, see “[Using VACONFIG to Modify Network Information](#)” in the *TeamWorks 18.1: Maintenance Best Practices Guide*.

E Third-Party Materials

- ◆ “Growl License” on page 67
- ◆ “Oracle Outside In Technology” on page 68
- ◆ “ANTLR 3 License” on page 68
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Firebug Lite

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