

# VMware AirWatch Content Rendering Engine Guide

For Linux

Workspace ONE UEM v9.4

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# Chapter 1:

## Overview

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## Overview for Content Management Enterprise Integration Solution

The Content Management solution provides a suite of enterprise integration components designed to address the unique challenge of securing the content on mobile devices. The available Content Management components include Content Gateway, Remote File Storage (RFS), and Content Rendering Engine (CRE).

### Content Gateway

The Content Gateway, together with VMware Content Locker, lets your end users securely access content from an internal repository. This means that your users can remotely access their documentation, financial documents, board books, and more directly from content repositories or internal file shares. As files are added or updated within your existing content repository, the changes will immediately be reflected in VMware Content Locker, and users will only be granted access to their approved files and folders based on the existing access control lists defined in your internal repository. Using the Content Gateway with VMware Content Locker allows you to provide unmatched levels of access to your corporate content without sacrificing security.

### Remote File Storage

Remote File Storage provides an on-premises storage alternative for Personal Content. Personal Content refers to a repository consisting of files uploaded and managed by end users. End users add files on their devices with VMware Content Locker, from any supported web browser with the Self-Service Portal, and from their personal computer with Content Locker Sync. By default, this content is stored in the Workspace ONE UEM database. For SaaS customers, that means Personal Content stores in the cloud by default. In some use cases, storing certain types of content in the cloud poses a security risk. Use Remote File Storage (RFS) to store Personal Content in a dedicated on-premises location.

### Content Rendering Engine

The Content Rendering Engine (CRE) integrates with Remote File Storage to secure shared Personal Content. When an end user shares Personal Content from the Self-Service Portal, CRE converts the shared content into a rendered image of the source file. These shared images eliminate the need to download shared content, and enforce read-only permissions.

CRE enforces read-only permissions for the file types listed below:

- Word (doc, docx)
- Excel (xls, xlsx)
- BMP
- PDF
- Power Point (ppt, pptx)
- JPEG, JPG
- PNG
- Text

## Available Content Management Enterprise Integration Solutions

Before console v8.3, the Mobile Access Gateway (MAG) for Windows or VMware Tunnel for Linux products bundled enterprise proxy, per-app tunnel, and content services together. In console v8.3 and above, administrators looking to leverage the latest updates to content integration must migrate to the standalone content service known as Content Gateway.

The table below overviews the different versions of Content Gateway and Remote File Storage (RFS) available for install, the corresponding UEM console version, and the availability of combined services.

Component	UEM Console Version					
	7.3	8.0	8.1	8.2	8.3	8.4+
<b>Content Gateway</b>						
VMware Tunnel	✓	✓	✓	✓		
Content Gateway					✓	✓
<b>Standalone RFS</b>						
v1.0*	✓					
v2.0		✓				
v2.1			✓			
v2.2				✓		
v2.3					✓	
v2.4+						✓
<b>RFS with CRE**</b>						
		✓	✓	✓	✓	✓
<b>RFS behind Content Gateway</b>						
						✓
<b>RFS with CRE behind Content Gateway**</b>						
						✓
*No fresh installations - continued support only						
**Linux only						

## Overview for Content Rendering Engine Procedural

Use the overview to gain insight about the overall structure of the Content Rendering Engine (CRE) installation procedure, and the purpose of the different pieces involved in the procedure.



### Install Remote File Storage (RFS)

Set up RFS storage so that CRE can render its files in the SSP. For instructions, see the **Remote File Storage Installation Guide** available in [Accessing Other Documents](#).



### Configure CRE

Configure CRE at a Customer level organization group in the Workspace ONE UEM console and download the installer.



### Upload SSL Certificate

Use the manual utility to upload the SSL certificate saved as a PEM file to the RFS-Tokens server selected during configuration.



### Install & Activate

Run the CRE installer on your server. Then, navigate to the UEM console and manually activate CRE.



## Verify

Perform API healthchecks and other basic procedures to verify that installation occurred successfully.

# Chapter 2:

## CRE Architecture and Security

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## Overview of Architecture and Security

The Content Rendering Engine (CRE) is a product you can install on physical or virtual servers that reside in either the DMZ or a secured internal network zone. The Content Rendering Engine requires integration with the Remote File Storage solution.

Content Rendering Engine offers two architecture models for deployment: stand alone deployment with Remote File Storage or behind a VMware AirWatch Content Gateway deployment for additional security. Both configurations support load-balancing for high availability and SSL offloading.

Configure your Content Rendering Engine deployment in a way that best addresses your security needs and existing setup. The variety of available options provides administrative flexibility when deciding on solution architecture.

Consider using a load balancer in the DMZ to forward traffic on the configured ports to a Workspace ONE UEM component. Also consider using dedicated servers to eliminate the risk of other web apps or services causing performance issues.



# Chapter 3:

## CRE Installation Preparation

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## Requirements for Content Rendering Engine

Meet the minimum requirements to ensure a successful installation of Content Rendering Engine (CRE).

Requirement	Notes			
<b>VM or Physical Server (64-bit)</b>	Co-locate CRE on a separate server in the same data-center or network as Remote File Storage (RFS) for maximum performance.			
<b>Sizing Recommendations</b>	Sizing estimates for devices may vary based on concurrent usage. If CPU, RAM, or I/O utilization approaches 70-80%, consider adding more resources or servers.			
	<b># of Devices</b>	<b>CPU Cores</b>	<b>RAM (GB)</b>	<b>Disk Space (GB)</b>
	1-1000	4+	4-8	20+
	1,000-5,000	8-16 CPU cores OR 4 CPU cores w/4 load-balanced servers	8-16	
	5,000-25,000	16 CPU cores w/4 load-balanced servers OR 8 CPU cores w/8 load-balanced servers	16-32	
	25,000+	8-16 CPU cores w/8-16+ load-balanced servers	32+	

### General Requirements

Requirements	Notes
<b>Internally registered DNS record</b>	Register the Endpoint server.
<b>Externally registered DNS record</b>	Register the Endpoint server.
<b>SSL Certificate from trusted third party with subject name of server hostname</b>	Requires a PKCS12 (.pfx) format and the trust of all device types in use. Keep in mind: <ul style="list-style-type: none"> <li>Android does not natively trust all Comodo certificates.</li> <li>PKCS12 (.pfx) format includes the server certificate, private key, root chain, and password protection.</li> </ul>
<b>Remote File Storage set up and configured</b>	Because CRE integrates with RFS for Linux, you must install RFS for Linux before proceeding with CRE installation.  For more information, see the <b>VMware AirWatch Remote File Server Guide for Linux</b> .

### Software Requirements

Requirement	Notes
<b>SSH access to Linux Servers and an admin account with full write permissions.</b>	Root permissions, or sudo access with the same privileges as root required. Once installation completes, you can put restrictions into place for these account types.

Requirement	Notes
<b>yum Enabled</b>	Enable to allow the installer to request and install any missing prerequisites.
<b>CentOS 7.x</b> <b>SUSE 12.x</b> <b>RHEL 7.x</b>	UI-less recommended. Basic infrastructure type recommended.

## Network Requirements

Source Component	Destination Component	Protocol	Port	Configurable	Notes
<b>UEM Console</b>	VMware AirWatch CRE	HTTPS	443	Yes	Post-installation, activate CRE in the UEM console to verify success.
<b>DS Server</b>	VMware AirWatch CRE	HTTPS	443	Yes	Post-installation, activate CRE in the UEM console to verify success.
<b>Devices (from Internet and Wi-Fi)</b>	VMware AirWatch CRE	HTTPS	443	Yes	Post-installation, use a diagnostic endpoint to verify availability.
<b>CRE Server</b>	RFS Load Balancer or HA Proxy	HTTPS	443	Yes	
<b>CRE Server</b>	Other CRE Servers in cluster	TCP	5701	Yes	Hazelcast opens the port 5701 by default, and follows this +1 naming convention for all subsequent ports. Post-installation, use diagnostic endpoints to verify availability.

# Chapter 4:

## CRE Configuration


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## Configure the Content Rendering Engine

Configure Content Rendering Engine (RFS) settings in the UEM console to establish a connection from CRE to Remote File Storage (RFS) and pre-configure the settings files that get bundled into the installer, eliminating the need to manually configure them post-installation on the server.

1. Navigate to **Content > Settings > Content Viewer**, at a Customer level Organization Group.
2. Select **Configure** if configuring the first CRE instance. After the first instance, the option switches to **Add**.
3. On the **Assignment** screen, select an **RFS Node** from the same data-center or network as CRE to have content rendered in the SSP. Limit one CRE instance per RFS node. Select **Next**.
4. Configure the fields on the **Details** screen. Select **Next**.

Setting	Description
<b>Name</b>	Provide a name for the content viewer. This name displays in the UEM Console.
<b>CRE URL</b>	Provide the externally accessible URL for the CRE you set up on your server.

5. Assign a **Public SSL Certificate** on the **Authentication** screen to establish trust between RFS and the Content Viewer. Select **Next**.
6. Select the **Edit** icon  from the actions menu for the CRE node.
7. Select the **Advanced** tab.
  - Copy and record the **Client ID**.
  - Select **Generate PEM**. Copy and paste the text into a text editor, saving it as a .pem file.  
**Example:** Save the text as **CreClientCertificate.pem**.
8. Review the **Summary** screen. Select **Save** after reviewing the newly configured settings.
9. Select **Download** under the **Installer** column and follow the prompts.
10. Use the manual utility to upload the SSL certificate to the RFS Tokens server selected during configuration.

## Remote File Storage Manual Utility

Use the Remote File Storage (RFS) manual utility, pre-packaged within the RFS-Web module, for manually uploading certificates. Client and regenerated certificates for Content Rendering Engine (CRE) and regenerated RFS certificates require the use of the manual utility.

Review the commands and the explanation of the command's components to gain insight about the information needed for manually adding an RFS or CRE certificate to the RFS-Web server.

Command Line and Components		
OS	Command	
Linux	<pre>sh /opt/airwatch/rfs/rfs-web/etc/unix/rfs-cert-util.sh -cn ALIAS_NAME -cp CLIENT_CERTIFICATE_FILE -fp TRUSTSTORE_PATH -t yes</pre>	
Component	Description	Notes
ALIAS_NAME	The <b>Client ID</b> for the certificate.	Do not use spaces.
CLIENT_CERTIFICATE_FILE	The uploaded .pem file's location.	
TRUSTSTORE_PATH	The path to the directory that contains the truststore folder, located by default under the RFS file storage path at subdirectory: <b>/truststore/</b> .	Verify the file storage or truststore path by reviewing the <b>aw.filesystem.root</b> and <b>aw.truststore.path</b> values found at <b>/opt/airwatch/rfs/rfs-web/config/rfs.properties</b> on Linux .

## Upload a Content Rendering Engine Certificate

Use the Remote File Storage (RFS) manual utility, pre-packaged within the RFS-Web module, to manually upload certificates to a shared truststore instance. The manual utility handles client certificates for Content Rendering Engine (CRE) as well as regenerated RFS and CRE certificate uploads.

### Process Overview

1. Transfer the .pem file to the truststore path on the appropriate RFS-Web server.
2. Run the appropriate command from a server with the RFS-Web component installed.
3. If the notification **Certificate was added to keystore** appears, restart all services to complete the process.  
If the notification **<name> truststore ... does not exist. Creating <name> truststore path** appears, delete the newly created truststore folder, adjust the **-fp** path, and rerun the command.

### CRE Components

Use the specified component values and associated instructions to gain insight into how the manual certificate upload process works. Do not view the provided values as recommendations. The example defines the components as absolute paths for the sake of clarity.

Component	CRE
Manual Certificate Utility Name	rfs-cert-util.sh
Manual Certificate Utility File Location	/opt/airwatch/rfs/rfs-web/etc/unix/
ALIAS_NAME	Acme_Production_Cre_Cert
CLIENT_CERTIFICATE_FILE	/mnt/RFS_Storage/CreClientCertificate.pem

Component	CRE
TRUSTSTORE_PATH	/mnt/RFS_Storage/
.pem File Name	CreClientCertificate.pem

## Upload Process

Review how to upload a CRE certificate on a Linux RFS-Web server.

1. Transfer the **RfsClientCertificate.pem** file to the **/mnt/RFS\_Storage/truststore/** on the RFS-Web servers.
2. Run the command from a Linux server with the RFS-Web component installed.

```
sh /opt/airwatch/rfs/rfs-web/etc/unix/rfs-cert-util.sh -cn 98cfa7ef-4e2f-14d2-8134-efa03e34748c -cp /mnt/RFS_Storage/truststore/CreClientCert.pem -fp /mnt/RFS_Storage/
```

3. Review the **Certificate was added to keystore** notification that appears, indicating the certificate uploaded successfully. Restart the RFS Service to complete the process.

## View Successfully Uploaded Certificates

Generate a TXT file to review certificates successfully uploaded to the keystore.

1. Change your command line working directory to the truststore directory and run the following command:

```
keytool -list -v -keystore rfs.jks > keystoreContents.txt
```

2. When prompted to enter a password, press **Enter**.
3. Open and review the resulting .txt file.

# Chapter 5 :

## CRE Installation

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## Install Content Rendering Engine on Linux

Install Content Rendering Engine (CRE) so that end users can securely share the content as an image from the Self-Service Portal. After configuring CRE in the UEM console, download the installer and proceed with the installation. To install CRE on the Linux Server, complete the following steps. Workspace ONE UEM requires installing Redis and CRE on separate servers using the GUI-less method outlined in these instructions.

1. Copy the file you downloaded from the UEM console into a folder in the Linux server.
2. Navigate to the folder you copied the file to in the Linux box. Un-archive the .tar file using the following command:

```
unzip CREInstaller.zip
```

3. Open the un-zipped installation folders:

- config.xml
- ContentRenderingEngine.bin
- rest-ssl-cert.pfx
- rfs-plugin-cert.pfx

4. Make the **ContentRenderingEngine.bin** an executable file using the following command:

```
sudo chmod +x ContentRenderingEngine.bin
```

```
sudo ./ContentRenderingEngine.bin
```

5. Review the Introduction that appears during an initial installation.
6. Press **Enter** until you receive a prompt to accept the licensing agreement. Press **Y** to accept.
7. Enter and confirm the **Certificate Password** you entered when downloading the installer in the console.

```
=====
CRE Certificate Password
-----

Please provide your CRE Certificate Password:
Please confirm your CRE Certificate password:
```

8. To confirm that the server is **Secure Socket Layer (SSL) Offloaded**, enter **Y**. Enter **N** if your server is not behind an SSL offloaded load balancer.

```
=====
Secure Socket Layer (SSL) Offloaded
-----

Is this server behind a load balancer (f5/HAProxy) that is SSL Offloaded?

(Y/N): _
```

9. Review the **Summary** information for accuracy. Press **Enter** to continue.

```
Install Folder:
  /opt/airwatch/cre

Product Features:
  Content Rendering Engine

Disk Space Information (for Installation Target):
  Required:  193,267,433 Bytes
  Available: 23,983,607,808 Bytes

PRESS <ENTER> TO CONTINUE:

=====
Ready To Install
-----

InstallAnywhere is now ready to install ContentRenderingEngine onto your system
at the following location:

  /opt/airwatch/cre

PRESS <ENTER> TO INSTALL: _
```

10. Press **Enter** to begin installation. Any install errors display in an error message, and in the installation log which saves in the same directory as CRE. Press **Enter** to exit the installer.

```
=====
Installing...
-----

[=====|=====|=====|=====]
[-----|-----|-----|-----]
```

11. After the installation is finished, you can check if the CRE service is running by using the following command:

```
$ sudo service cre status
```

12. In the UEM console, navigate to **Content > Settings > Content Viewer**. Select **Activate**. If successful, the icon turns green. Otherwise, the install failed and you must troubleshoot before proceeding.

## Verify Content Rendering Engine Connectivity

Post-installation, perform checks to verify the installation completed successfully.

1. Verify CRE connectivity to RFS by entering the following command:

```
curl -I <rfsURL>/awhealth
```

2. Use a browser on a different machine within the same network to check the health API endpoint availability.

	HTTP GET request to	Return HTTP status	Service Status
<b>CRE</b>	< CRE_URL > :< PORT > /awhealth	200 status with the CRE version	UP

## Upgrade Content Rendering Engine

Follow the upgrade procedure to access the most current version of the Content Rendering Engine (CRE).

1. Log in to the UEM console and navigate to **Content > Settings > Content Viewer**.
2. Find the CRE node you want to upgrade and then select the **Download** hyperlink under the Installer heading.
3. Enter and confirm a **certificate password** and then click **Download**.
4. Perform the for the CRE server component.

# Chapter 6 :

## CRE Management

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## Add Content Rendering Engine Nodes


The procedure for adding additional Content Rendering Engine (CRE) servers mimics the initial configuration process, but includes two additional requirements.

Add an additional server by completing the following steps:

1. Navigate to **Content > Settings > Content Viewer** in a *Customer Level* Organization Group.
2. Select **Add**.
3. Follow the steps for .
  - Limit one CRE configuration per Remote File Storage (RFS) configuration
  - Co-locate CRE and RFS in the same data-center or network

## Regenerate Content Rendering Engine Certificates

Regenerate certificates in the UEM console. Save the certificate as a .pem file to convert it into the format required when uploading to the RFS-Web server.

1. Select the **Edit** icon  from the actions menu for the CRE node.
2. Select the **Advanced** tab.
3. Under the AirWatch Client Certificate section, select the **Regenerate** button.
4. Copy and record the **Client ID**.
5. Select **Generate PEM**. Copy and paste the text into a text editor, saving it as a .pem file.

**Example:** Save the text as **CreClientCertificate.pem**.

## Uninstall Content Rendering Engine on Linux

To uninstall a previously installed CRE server, run the following commands:

1. Navigate to the **/opt/airwatch/cre/\_ContentRenderingEngine\_installation/** directory.

```
cd /opt/airwatch/cre/_ContentRenderingEngine_installation
```

2. Run the uninstall script.

```
sudo ./UninstallContentRenderingEngine
```

## Troubleshooting Resources for Content Rendering Engine

Use the available installation logs, server logs and configuration files to troubleshoot Content Rendering Engine (CRE). Access these resources from their directory location or by entering server commands on the vi editor.

Name	Location
<b>Directories</b>	
<b>Post-Installation Log</b>	/opt/airwatch/cre/_ContentRenderingEngine/Logs/
<b>Server Logs</b>	/var/log/airwatch/cre
<b>Configuration Files</b>	/opt/airwatch/cre/conf
<b>Default Directory</b>	
<b>CRE Properties File</b>	/opt/airwatch/cre/conf/cre.properties
<b>CRE logback.xml File</b>	/opt/airwatch/cre/conf/logback.xml
<b>Commands</b>	
<b>Read a Log File</b>	<pre>\$ cd /var/log/airwatch/cre \$ tail -f cre.log</pre>
<b>Read a Log File</b>	<pre>\$ cd /var/log/airwatch/cre \$ tail -f cre.log</pre>

## Set Logging Levels

To change the logging levels, follow the steps:

1. Access the **logback.xml** file contained in the [RFS Configuration Folder](#).
2. Edit the file on using the Linux vi editor or on WinSCP:
3. Write the text in the logback.xml file:
  - Enter **i** to begin writing text.
  - Change the **logging level** XML attribute value in both logger and root XML elements.
  - Press **Esc** to exit edit.
  - Press **:wq !** to write and quit.
4. **Restart** each service after saving changes.