RBFS Installation and Licensing

Version _24.9.1.2, 10 April 2025

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1. RBFS Installation Overview

RBFS software images are available in the RtBrick Image Store, allowing users to download and install the images for specific roles on supported hardware platforms. All the latest versions of RBFS software images are available in the RtBrick image store. For a complete list of the supported hardware platforms, see Supported Platforms section of the Platform Guide.

Access to Image Store and Debian package repositories on /https://releases.rtbrick.com/ is restricted through the use of TLS mutual authentication with TLS client certificates.

It is essential to familiarize with the components listed below before beginning the RBFS Image Download process.

- **RtBrick Image Store**: RBFS software images are stored in the RtBrick Image Store and can be downloaded after meeting licensing requirements.

  Image stores containing the RBFS ONL installer images are published on /https://releases.rtbrick.com/ and updated when new image versions are avaizlable.

  The rtb-image command (CLI tool) provided by the rtbrick-imgstore package is used to interact with "image stores".

- **RBFS ONL Image**: The RBFS software (NOS) available on the RtBrick Image Store is provided as the RBFS ONL installer image for installation on qualified OCP-compliant switches.

- **RtBrick Tools**: In addition to RBFS software, other RtBrick software tools are delivered in Debian package format compatible with Ubuntu. Currently, the only supported Ubuntu release is 22.04 LTS (Jammy). The software delivered as Debian packages includes a set of CLI tools and/or daemons designed to facilitate working with RBFS containers and the RBFS API. Debian package repositories containing these packages are available at /https://releases.rtbrick.com/ and are updated whenever a new version becomes available.

- **ONIE**: The Open Network Install Environment (ONIE) comes pre-installed on OCP-compliant switches. The ONIE environment is used for installing the RBFS ONL installer image. It provides an environment for installing the RBFS software to run on those switches. For more details about ONIE, please see

https://opencomputeproject.github.io/onie/.

1.1. Understanding RBFS Release Versioning

An RBFS release can be defined as a set of software packages (currently, in the Debian package format). However, it is delivered as an image, either a container (LXC/LXD) image or as a complete ONL installation image. The ONL installation image may or may not contain a container image pre-installed in it. An image can be defined as the archived root file system of a Linux OS installation with the needed software packages pre-installed and with a default configuration. In the current context, the terms 'RBFS release' and 'image' are used interchangeably.

RBFS uses the following versioning format:

<year>.<release>.<minor>[.<fix>][-<label>

Examples:

24.3.1
24.3.1.1
24.3.1-candidate.6

In the version example 24.3.1, the first number, "24," represents the year 2024. The second number, "3," indicates the release version, where "1" corresponds to the first release of the year, and this number will be incremented with each subsequent release. The third number, "1," denotes the minor release, which will also be incremented with each future minor release.

RtBrick also uses a four-number versioning format, represented as 24.3.1.1. In this format, the fourth number indicates the bug-fix release. Bug-fix releases are delivered only when necessary and are based on an existing RBFS release, such as 24.3.1. The bug-fix release numbers will also be incremented with each subsequent minor release.

Candidate releases will use a label such as "candidate.6", which will be incremented with each subsequent candidate release.

1.2. Understanding the RBFS Image Formats

RtBrick images delivered through the RtBrick Image Store and the rtb-image utility

have the following attributes:

- format: This is the file format in which the image is packaged and archived. The available format is onl-installer.
- role: The role inside a network of the device which will be running the image. For example, consolidated-bng signifies the full BNG functionality on a single image.
- platform: Identifies the hardware platform in which the image can run. For example, q2a signifies the switch ASIC Broadcom Qumran-2A.
- model: Identifies the hardware model. For example, s9510-28dc signifies the hardware model UfiSpace S9510-28DC.
- ver-range: Identifies the image version. For example, 24.8.1 signifies the RBFS release 24.8.1.

RtBrick images intended to be installed on supported hardware devices contain format, platform, and model set accordingly to the specific switching hardware.

You can see this using sudo rtb-image list command and look for the Format column.

1.3. Downloading the RBFS Image

Before you start the installation process, download the RBFS ONL image. For details on downloading the RBFS ONL image, see the RBFS Image Download section.

1.4. Installation Modes

After downloading the RBFS software image, you can install it in any of the following modes:

1. **RBFS Manual Installation**: In this mode, you install RBFS ONL installer on a new switch without manually using the ONIE install environment. For detailed step-by-step instructions on the manual installation process, see section RBFS Manual Installation.
2. **RBFS Automated Installation**: In this mode, you install RBFS on a new switch by using Zero Touch Provisioning (ZTP). For detailed step-by-step instructions on the automated installation process, see section RBFS Automated

Installation (Zero Touch Provisioning).

1.5. Self-Service Portal Sign-Up / Sign-In

RtBrick customers use the self-service portal to request access to the RBFS image download servers and request RBFS licenses. Every user of the Self-Service portal is associated with a specific organization, which is determined by the domain of their company email address. For example, all users with an email address under the domain @rtbrick.com are affiliated with RtBrick. If your email domain is not registered with RtBrick, please contact RtBrick Support for assistance.

The Self-Service portal uses OpenID/Connect to delegate user authentication to third-party authorization services. These authorization services ensure the secure storage of user credentials and provide additional security measures, including two-factor authentication and account recovery options for users who may have forgotten their passwords.

The portal suppors three authentication service providers:

- GitHub
- Google
- Microsoft

When a user logs into the portal for the first time, their membership is created. The member will be assigned to an organization based on the domain of their email address. This domain must be a trusted domain, meaning it should be listed in the trusted domains list of exactly one organization.

Attempts to sign up / sign in to the portal with an email address of an untrusted domain will be rejected.

GitHub

GitHub allows users to create new accounts for free. A user must declare their company email address as the public email in their GitHub profile to enable the portal to read the email address during the OpenID/Connect authentication process.

A user cannot sign up / sign in to the portal if the portal is not allowed to read the user's email address.

Google

The user must confirm that the portal has permission to access the email address from their user profile for the sign-up process. After the initial sign-up, subsequent logins will not require the user to grant access to their profile again.

Microsoft

Microsoft allows domain administrators to decide which sites can delegate authentication to the Microsoft's OpenID/Connect authorization services. This adds an additional level of security, because a user can not accidentally share profile data with an untrusted site.

A user will only be prompted for granting the portal access to its profile if the domain administrator has allowed the portal to delegate the login to Microsoft for its organization. In case the portal is not allowed to delegate authentication to Microsoft for the paritcular organization, the user attempting to sign-up to the portal will be prompted to request a domain administrator to grant the portal access to Microsoft authentication services.

In large enterprises with strict security processes granting the portal access to Microsoft authentication service might take a considerable amount of time. An alternative would be to create a GitHub account.

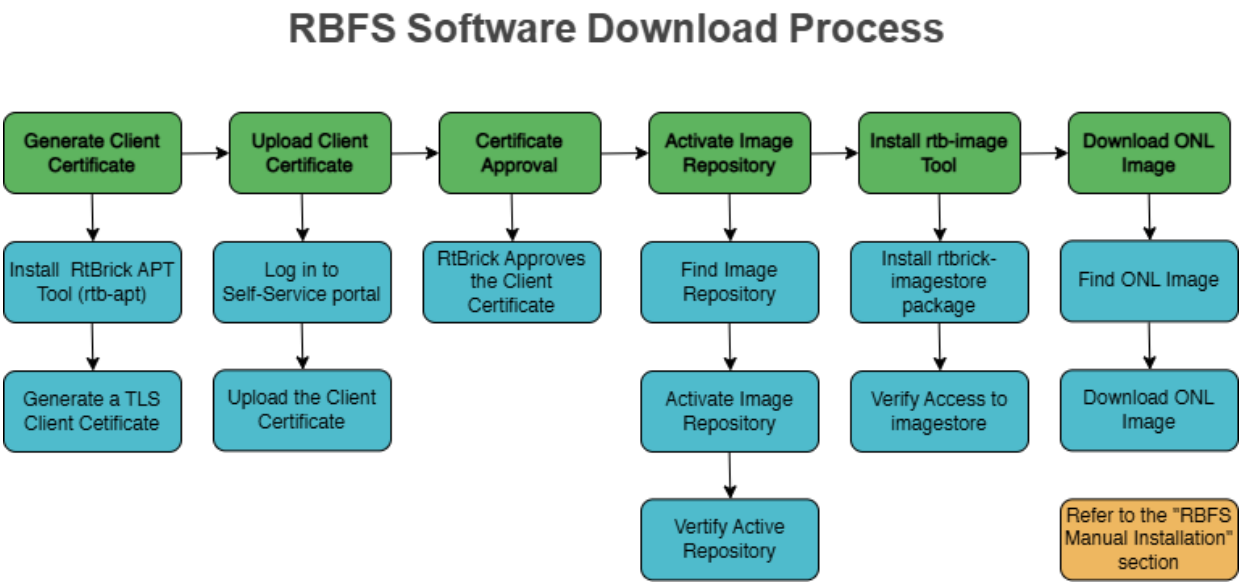
1.5.1. Using the Self-Service Portal

The Self-Service Portal can be used for generating and uploading client certificates. Also, it is required for obtaining new RBFS licenses or extend the existing licenses. For more information, see the Uploading the Certificate to the Self-Service Portal section of the RBFS Image Download Guide and Managing Licenses via Self-Service Portal section of the RBFS Licensing Guide.

2. RBFS Image Download

The RtBrick image download functionality enables authenticated users to download and install the RtBrick software (packages or images). Access to *image stores* and *Debian package repositories* on **/https://releases.rtbrick.com/** is **restricted** through the use of mutual TLS authentication with TLS client certificates (TLS client certificates can be self-signed).

The diagram below provides an overview of the RBFS software download process.



The process of downloading software involves the following tasks:

2.1. Generating a Client Certificate

RtBrick provides the rtb-apt tool to generate a client certificate. This section contains the following topics:

2.1.1. About the RtBrick APT Tool (rtb-apt)

The rtb-apt tool is an APT utility application that provides an easier way for managing the system configuration of RtBrick package repositories which can be used with the usual apt commands to install RtBrick software.

Some RtBrick package repositories require authentication via TLS client certificates and the rtb-apt tool provides commands for managing those repositories and the required apt authentication configuration.

The rtb-apt tool is a statically compiled Linux 64-bit executable file. Currently, it is verified to run on **Ubuntu 22.04**.

2.1.2. Installing the rtb-apt Tool

This section contains the following topics:

Prerequisites to Install the rtb-apt Tool

Before you install rtb-apt, ensure that you have installed the following software:

- GNU Privacy Guard (GPG), which is used by apt to validate package repositories. To install GPG, enter the following command:

```
sudo apt install gnupg
```

- HTTPS support for apt is required to access the package repositories via HTTPS. To do this, enter the following command:

```
sudo apt install apt-transport-https ca-certificates
```

Downloading and Installing the rtb-apt Tool

The following example shows how to download and install the rtb-apt tool. It

shows the URL where the latest version of the rtb-apt tool is available for download:

```
¬ curl -o /tmp/rtb-apt https://releases.rtbrick.com/_/dl/sw/rtb-
apt/latest/linux_amd64/rtb-apt  \
    && sudo mv /tmp/rtb-apt /usr/local/bin/     \
    && sudo chown root:root /usr/local/bin/rtb-apt  \
    && sudo chmod 0755 /usr/local/bin/rtb-apt
```

Verifying the Version of the rtb-apt Tool

The following example shows the rtb-apt tool version. The rtb-apt version 2.1.2 or later is required.

```
¬ rtb-apt --version
2.1.2
```

2.1.3. Generating a TLS Client Certificate

The following example shows how to generate a TLS client certificate using the rtb-apt tool.

```
¬ sudo rtb-apt auth generate
A new self-signed TLS client certificate has been generated for this system:

Subject:     CN=bb59a25d-6b38-4f3c-81e0-065e525c8335,OU=rtb-apt
Valid until: 2024-09-06 10:30:26 +0000 UTC

The following additional auto-generated information is included in the certificate
and can be used to uniquely identify this system:

DNS names:       [hostname.example.net]
Email addresses: [root@hostname.example.net user@hostname.example.net]
< ..................................... >

If you already have a working account on https://portal.rtbrick.com then you can
use the Self-Service section to upload this certificate. If you DO NOT yet have an
account on https://portal.rtbrick.com, send the certificate to your RtBrick
support contact:


-----BEGIN CERTIFICATE-----
MIIHHzCCBYegAwIBAgIRAJcI5pqSK9O+g6yJGB15i7YwDQYJKoZIhvcNAQELBQAw
QTEQMA4GA1UECxMHcnRiLWFwdDEtMCsGA1UEAxMkYmI1OWEyNWQtNmIzOC00ZjNj
< ..................................... >
NuLIKfmwrcyXmzAOe1bRtlJrRw0zofxX4rFcMmJReNqOV0obP5r7TCtnWtAqkFx/
7JJa
-----END CERTIFICATE-----
```

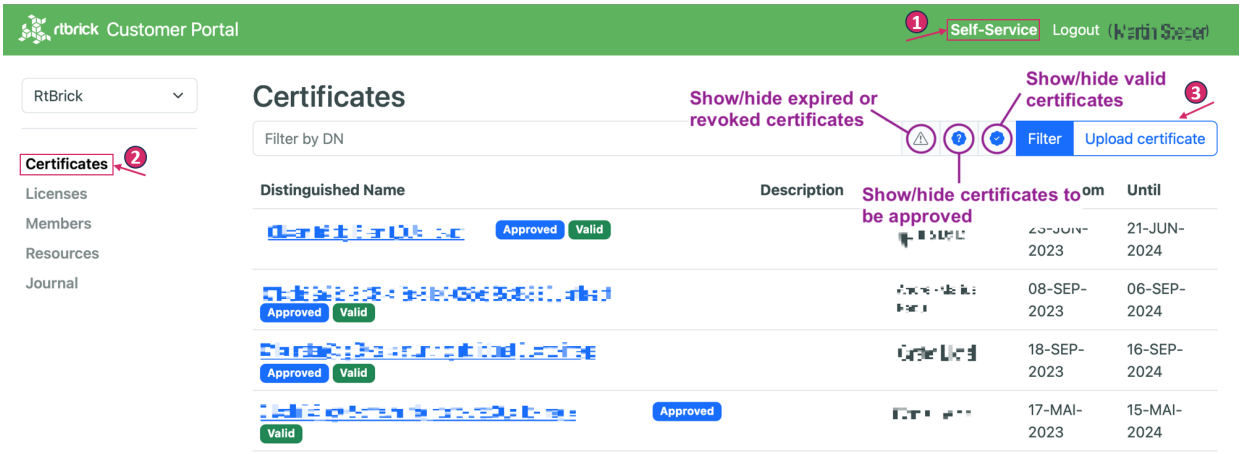
After generating the TLS Client Certificate, you need to upload it to the the **Certificates** section on https://portal.rtbrick.com. For details about uploading a certificate, see section Upload the Certificate to the Self-Service Portal below.

2.2. Uploading the Client Certificate to the Self-Service Portal

If your domain is registered with https://portal.rtbrick.com, you will be able to log into your account. If not, reach out to your sales/partner contact to initially have your domain registered with the portal.

To upload a new client certificate, perform the following steps:

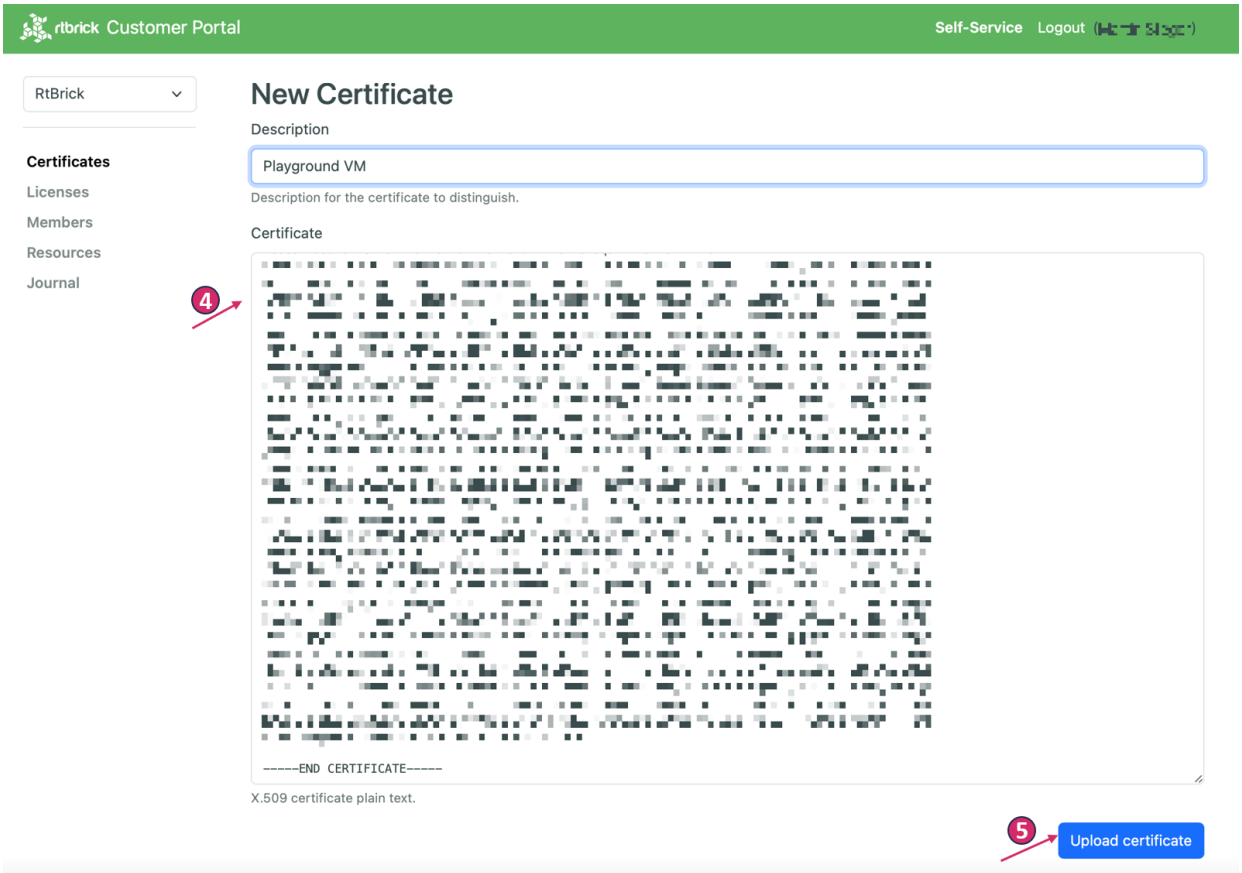
1. Log in to Self-Service Portal.



2. Click **Certificates** on the left navigation panel. The Certificates list page appears. The organization's certificate list shows all certificates of that particular organization.

The filter options allows filtering certificates by their distinguished name or lifecycle status.

3. Click the **Upload certificate** button in the organization's certificate list view to upload a new client certificate.



4. Copy the certificate content in PEM format into the text area. The description field is optional, but it can be used to provide additional information about the certificate.

5. Click the **Upload certificate** button to upload a new certificate.

2.3. Obtaining Approval and verification of the Client Certificate

1. RtBrick reviews and approves the client's certificate that is uploaded on the Self-Service portal.
2. After RtBrick approves the certificate, verify it by entering the command "sudo rtb-apt auth check".

```
¬ sudo rtb-apt auth check
Repository: releases/latest/rtbrick-tools ... restricted ... TLS client
certificate accepted
```

If the client certificate is not accepted by RtBrick, the following message will appear. Please contact the customer support team.

```
¬ sudo rtb-apt auth check
Repository: releases/latest/rtbrick-tools ... restricted ... TLS client
certificate NOT accepted
```

2.4. Identifying and Activating the Image Repository

You can install additional RtBrick Tools that help simplifying tasks related to debian package repositories. For details see Installing the rtb-image Tool and Verifying Access to Image Stores

This section contains the following topics:

2.4.1. Finding the Image Repositories

To find the available repositories, enter the "sudo rtb-apt repo list" command.

The following example shows how to find the available repositories:

```
¬ sudo rtb-apt repo list
Group               Repository      Distribution    Release Active  Restricted
releases/latest     rtbrick-tools   ubuntu          jammy   No      No
< ..................................... >
```

2.4.2. Activating an Image Repository

To activate an image repository, enter the "sudo rtb-apt repo activate" command.

The following example shows how to activate the "releases/latest/rtbrick-tools" repository.

```
¬ sudo rtb-apt repo activate releases/latest/rtbrick-tools
```

rtb-apt activated repository is added to /etc/apt/sources.list.d/rtbrick.list so that the repository can then be used with commands such as apt update and apt install to install the RtBrick Debian tool packages.

```
¬ cat /etc/apt/sources.list.d/rtbrick.list
deb [arch=amd64 signed-by=/etc/rtbrick/RtBrick-Support.pubkey.asc]
https://releases.rtbrick.com/_/latest/ubuntu/jammy/rtbrick-tools    jammy
rtbrick-tools
```

2.4.3. Verifying the Active Repositories

To verify the active repositories, use the "sudo rtb-apt repo list" command. For example in the below output releases/latest repository is active because its status is set to YES.

```
¬ sudo rtb-apt repo list
Group           Repository      Distribution    Release Active  Restricted
releases/latest rtbrick-tools   ubuntu          jammy   Yes     Yes
< ..................................... >
```

2.5. Installing the rtb-image Tool and Verifying Access to Image Stores

Once the TLS client certificate for the current system is trusted by RtBrick and once RtBrick package repositories have been activated with rtb-apt, the apt commands can be used to install the RtBrick software contained in those package repositories.

rtb-image version 3.11.0 or later is required to correctly work with managed downloads.

This section contains the following topics:

2.5.1. Installing the rtbrick-imgstore Package

If you have any existing RtBrick tools packages, it is essential to upgrade to the latest version because some of the RtBrick tools Debian packages have changed and have been upgraded several times. You can remove the exisiting RtBrick tools package using the below command:
apt list --installed | egrep -i rtbrick-imgstore | awk -F '/' '{print $1;}' | xargs sudo apt remove -y

The following shows the installation of the rtbrick-imgstore package which provides the rtb-image CLI tool.

```
¬ sudo apt update
Hit:1 https://releases.rtbrick.com/_/latest/ubuntu/jammy/rtbrick-tools jammy
InRelease
Hit:3 http://archive.ubuntu.com/ubuntu jammy InRelease
Get:4 http://archive.ubuntu.com/ubuntu jammy-updates InRelease [119 kB]
Get:7 http://archive.ubuntu.com/ubuntu jammy-backports InRelease [109 kB]
Get:8 http://archive.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Get:9 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [970 kB]
Get:10 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64 Packages [979
kB]
< ..................................... >
```

```
¬ sudo apt install rtbrick-imgstore
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  rtbrick-imgstore
0 upgraded, 1 newly installed, 0 to remove and 46 not upgraded.
Need to get 7,731 kB of archives.
After this operation, 26.3 MB of additional disk space will be used.
Get:1 https://releases.rtbrick.com/_/latest/ubuntu/jammy/rtbrick-tools
jammy/rtbrick-tools amd64 rtbrick-imgstore amd64 3.3.0 [7,731 kB]
Fetched 7,731 kB in 0s (41.4 MB/s)
Selecting previously unselected package rtbrick-imgstore.
< ..................................... >
```

2.5.2. Verifying Access (Authentication) to Image Stores

The rtb-image command (CLI tool) provided by the rtbrick-imgstore package is used to interact with "image stores". The "image stores" are used for delivery of RBFS container images and RtBrick ONL installer images.

Similarly to package repositories some of the image stores are *restricted* meaning that they require the client application (rtb-image in this case) to authenticate with a TLS client certificate. rtb-image re-uses the TLS client certificate already generated by rtb-apt for the current system.

This section contains the following topics:

Viewing Available Image Stores

The following example shows how to view the available image stores:

```
¬ sudo rtb-image stores list

Index   UUID                                    Name        RemoteURL
Active  Restricted
0       af73c0a6-40e7-4775-b74b-aadafeabe86d    latest
https://releases.rtbrick.com/_/images/latest    Yes     No
1       c4c896b0-52c5-4343-8a21-e2ca3ea440f1    resources
https://releases.rtbrick.com/_/resources        No      No
2                                               22.5.1
https://releases.rtbrick.com/_/images/22.5.1    No      No
3                                               22.6.1
https://releases.rtbrick.com/_/images/22.6.1    No      No
4                                               22.7.1
https://releases.rtbrick.com/_/images/22.7.1    No      No
< ..................................... >
```

Activating a Restricted Image Store

The following example shows how to activate a (possibly restricted) image store:

```
¬ sudo rtb-image stores activate 0
```

Verifying Access to Image Stores

If the TLS client certificate for the current system is already trusted by RtBrick, you can use rtb-image to download the images. Before downloading the image, you can verify the access to the image stores using the sudo rtb-image auth check command.

The following example shows how to verify the access to the image stores:

```
¬ sudo rtb-image auth check
Image store: latest (af73c0a6-40e7-4775-b74b-aadafeabe86d) ... restricted ... TLS
client certificate accepted
```

2.6. Downloading the ONL Image

Image stores contain the ONL installer images.

To download ONL installer images, perform the following steps:

2.6.1. Updating the Local Cached Copy of the Remote Image Store

Enter the following command to update the local cached copy of remote image store for RBFS container and ONL images.

```
¬ sudo rtb-image update
Local image store cached copy updated to: Store:
/var/cache/rtbrick/imagestores/847c6ecd-df58-462e-a447-38c620a12fe1 Version:
2.4.60878 ValidUntil: 2180-12-25 11:58:44
```

2.6.2. Finding the ONL Image

To find the ONL image, enter the "sudo rtb-image list" command with the following options.

```
-f, --format=FORMAT          Filter images with a specific format. This must be an
exact match of the image format attribute.
-r, --role=ROLE              Filter images with a specific role. This must be an
exact match of the image role attribute.
-p, --platform=PLATFORM      Filter images for a specific platform. This must be
an exact match of the image platform attribute.
-m, --model=MODEL            Filter images for a specific model. This must be an
exact match of the image model attribute.
-v, --ver-range=VER-RANGE    Filter images with versions that fall in the provided
version range. See the syntax for version ranges at
```

The following example shows how to find the ONL image details for UfiSpace S9510-28DC Consolidate-BNG image.

```
¬ sudo rtb-image list --format onl-installer --platform q2a --role consolidated-
bng --ver-range latest --model s9510-28dc
Store: /var/cache/rtbrick/imagestores/847c6ecd-df58-462e-a447-38c620a12fe1
Version: 2.4.60878 ValidUntil: 2180-12-25 11:58:44
UUID                                  Version              Role
Model          Platform  Format         Cached
db568345-a313-4abd-8c14-4970396d048f  24.8.1   consolidated-bng     s9510-28dc
q2a       onl-installer  false
```

2.6.3. Pulling the ONL Image

There are two options available for downloading the ONL image:

- Option 1: Downloading the image to the current working directory
- Option 2: Downloading the image to a specific directory

Option 1: Downloading the image to the current working directory

To download the ONL image, use the UUID (for example, 7f52060d-4af4-4ca7-8fe7-3619ee7f6bfb) of the ONL image in the "sudo rtb-image pull" command. Use the "--here" option to download the image to the current working directory.

```
$ sudo rtb-image pull --here 7f52060d-4af4-4ca7-8fe7-3619ee7f6bfb
rtbrick-onl-installer-accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d.sha512 233
B / 233 B
[=============================================================================]
100.00% 0s
rtbrick-onl-installer-accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d.asc 833 B /
833 B
[=============================================================================
] 100.00% 0s
rtbrick-onl-installer-accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d 1.17 GiB /
1.17 GiB
[=============================================================================]
100.00% 10s
rtbrick-onl-installer-accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d:
decompressing 100 B / 100 B
[=============================================================================] 100.00%
0s
7f52060d-4af4-4ca7-8fe7-3619ee7f6bfb downloaded as /home/rtbuser/playground
```

The Image will be downloaded to the current working directory under the rtbrick-onl-installer directory as shown below:

```
$ ls -al
total 36
drwxrwxr-x  6 rtbuser rtbuser 4096 Jan  9 05:18 .
drwxr-xr-x 16 rtbuser rtbuser 4096 Jan  9 05:17 ..
drwxr-xr-x  2 rtbuser rtbuser 4096 Jan  9 05:18 rtbrick-onl-installer

$ cd rtbrick-onl-installer/

$ ls -al
total 1227848
drwxr-xr-x 2 rtbuser rtbuser       4096 Jan  9 05:18 .
drwxrwxr-x 6 rtbuser rtbuser       4096 Jan  9 05:18 ..
-rw-r--r-- 1 rtbuser rtbuser 1257294496 Jan  9 05:18 rtbrick-onl-installer-
accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d
-rw-r--r-- 1 rtbuser rtbuser        833 Jan  9 05:18 rtbrick-onl-installer-
accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d.asc
```

```
-rw-r--r-- 1 rtbuser rtbuser        233 Jan  9 05:18 rtbrick-onl-installer-
accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d.sha512
```

Option 2: Downloading the image to a specific directory

Another method to save the image to a specific directory is shown below:

```
$ sudo rtb-image pull --dst=/home/supervisor 7f52060d-4af4-4ca7-8fe7-3619ee7f6bfb
rtbrick-onl-installer-accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d.sha512 233
B / 233 B
[==============================================================================]
100.00% 0s
rtbrick-onl-installer-accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d.asc 833 B /
833 B
[==============================================================================
] 100.00% 0s
rtbrick-onl-installer-accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d 1.17 GiB /
1.17 GiB
[==============================================================================]
100.00% 11s
rtbrick-onl-installer-accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d:
decompressing 100 B / 100 B
[==============================================================] 100.00%
0s
7f52060d-4af4-4ca7-8fe7-3619ee7f6bfb downloaded as /home/supervisor

$ cd home/supervisor

$ ls -al
total 36
drwxrwxr-x  6 rtbuser rtbuser 4096 Jan  9 05:18 .
drwxr-xr-x 16 rtbuser rtbuser 4096 Jan  9 05:17 ..
drwxr-xr-x  2 rtbuser rtbuser 4096 Jan  9 05:18 rtbrick-onl-installer

$ cd rtbrick-onl-installer/

$ ls -al
total 1227848
drwxr-xr-x 2 rtbuser rtbuser       4096 Jan  9 05:18 .
drwxrwxr-x 6 rtbuser rtbuser       4096 Jan  9 05:18 ..
-rw-r--r-- 1 rtbuser rtbuser 1257294496 Jan  9 05:18 rtbrick-onl-installer-
accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d
-rw-r--r-- 1 rtbuser rtbuser        833 Jan  9 05:18 rtbrick-onl-installer-
accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d.asc
-rw-r--r-- 1 rtbuser rtbuser        233 Jan  9 05:18 rtbrick-onl-installer-
accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d.sha512
```

2.6.4. Displaying the Location of the Downloaded Image

The details of the downloaded image can be viewed using the following command:

```
¬ sudo rtb-image show 7f52060d-4af4-4ca7-8fe7-3619ee7f6bfb
Store: /var/cache/rtbrick/imagestores/847c6ecd-df58-462e-a447-38c620a12fe1
Version: 2.4.60878 ValidUntil: 2180-12-25 11:58:44
```

```
UUID:         7f52060d-4af4-4ca7-8fe7-3619ee7f6bfb
Version:      24.9.1-candidate.12
Extra versions:
Tags:
Creation Date:  2024-11-27 12:58:40 +0530 IST (6 days ago)
Role:         consolidated-bng
Platform:     q2a
Model:        s9510-28dc
Format:       onl-installer
Architecture: amd64
Filename: rtbrick-onl-installer/rtbrick-onl-installer-consolidated-bng-q2a-s9510-
28dc-24.9.1-candidate.12.d
FullPath/URL: /var/cache/rtbrick/imagestores/847c6ecd-df58-462e-a447-
38c620a12fe1/rtbrick-onl-installer/rtbrick-onl-installer-consolidated-bng-q2a-
s9510-28dc-24.9.1-candidat…
SHA512:       1bf41a8f96933b73af2ce9c3484766db373ab87118b1aa9ef8
Base Image: 5117031a-53b9-4e49-9500-602f2757ebce
Embedded Packages: 16
Embedded Images: 1
IsLayered:    false
Cached:       false
ExtractedPath:
```

The sudo rtb-image show command displays only symlink information, so you need to copy the source file.

Once the image has been downloaded successfully, proceed to install it using ONIE. For details, see Installing ONL Manually.downloaded

3. RBFS Manual Installation

You can install open network Linux (ONL) manually on an OCP-compliant bare-metal switch. The Open Network Install Environment (ONIE) is an open-source utility that provides an installation environment for OCP-compliant bare-metal switches. ONIE is used to install different network operating systems (NOS) on a device.

ONIE provides several methods for locating a Network Operating System (NOS) installer image. Detailed information about these methods can be found in the ONIE User Guide. The RBFS ONL image can be installed using any of these methods.

- If you are upgrading your existing RBFS installation, please refer to the section Upgrading the RBFS Image.
- When installing ONL, any existing configurations on the switch will be deleted.
- The current RBFS configurations can be retrieved via a REST call from the RESTCONF endpoint. If you have saved the RBFS configuration using this method, you can load it onto the switch through a RESTCONF endpoint. For more information, refer to the following sections of the RtBrick documentation.

  Using the Proxy Endpoint

  RESTCONF API: Use Cases and Examples

3.1. Prerequisites for Manual Installation

- Ensure that you have downloaded the RBFS ONL image as described in the RBFS Image Download section.
- Provision the out-of-band management interface with an IP address either via DHCP or manual configuration (as described in Manual Configuration of the Management Interface IP).

3.2. Installing RBFS Using a USB Thumb Drive

This section describes how to install image using a USB thumb drive.

3.2.1. Prerequisites

- Format the USB drive with the FAT32 file system format because we need to place the RBFS image on the root directory of the USB drive.
- Ensure that you have downloaded the RBFS ONL image as described in the RBFS Image Download section.

3.2.2. Installation Procedure

You can also find instructions for installing via a USB thumb drive in the ONIE User Guide.

To install via USB, insert the USB drive to your computer and assume the USB drive appears as /dev/sda1 and is mounted at /media/rtbuser/4356-00B1 on Linux. This may vary depending on your system and operating system.

```
$ df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda1        29G   16K   29G   1% /media/rtbuser/4356-00B1
```

It is crucial to rename the RBFS ONL image to onie-installer, as ONIE only recognizes images with this name at the root of the USB drive.

To install via USB, simply copy the installer image (in this example, the image name is rtbrick-onl-installer-accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d) to the root directory of the USB thumb drive, as shown below:

```
$ cp rtbrick-onl-installer-accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d
/media/rtbuser/4356-00B1/onie-installer

$ ls -al /media/rtbuser/4356-00B1/
total 1256820
drwxr-xr-x  2 rtbuser rtbuser      16384 Jan  1  1970 .
drwxr-x---+ 3 root     root           4096 Jan  9 11:49 ..
-rw-r--r--  1 rtbuser rtbuser 1286955159 Jan  9 11:49 onie-installer
```

- Remove the USB drive from your computer and insert it into one of the USB ports on the front or rear panel of your ONIE-enabled device.
- Insert the cable into the console port and connect to the console port of the device.
- Power on the device and reboot it. ONIE will automatically detect the onie-

installer file located at the root of the USB drive and execute it.

```
root@bl1-pod1:~# reboot
```

- Wait for the device to show the "login:" prompt after installing the image. You can then log in and check the image version.

3.2.3. Manual Configuration of the Management Interface IP

If DHCP is not available, you need to manually configure the IP address, subnet mask, and default gateway for the device's management port while still logged in from its console port.

1. Identify the management port. Check the device documentation to determine which network interface is designated as the management interface (labeled "ma1").
2. Modify the ma1 interface network parameters by adding IP address, Netmask, and gateway using your preferred editor. The example below shows how to modify these parameters using the Vim editor.

```
supervisor@onl:/etc/network/interfaces.d $ vim ma1
auto ma1
iface ma1 inet static        <----- modify ma1 inet assignment as static
      address 192.0.2.187    <----- ma1 management interface ip address
      netmask 255.255.255.0  <----- subnet mask
      gateway 192.0.2.10     <----- configure gateway
```

3. Restart the networking service by disabling and enabling the ma1 interface, as shown in the example below. By default, the default route will point to the gateway IP address.

```
sudo ifdown ma1
sudo ifup ma1
```

3.3. Installing over the Network

For all network installation scenarios, ONIE expects the NOS installer image to be available on the network via HTTP.

3.3.1. Prerequisites

- Ensure that you have downloaded the RBFS ONL image as described in the RBFS Image Download section.
- Ensure that you have set up an HTTP server that will make available the downloaded images for ONIE to use.

3.3.2. Installation Procedure

You can also find instructions for installing the ONL image over the network in the ONIE User Guide.

To install the ONL image over the network, perform the following steps:

On a fresh box, **ONL prompt** is not available, so skip to **ONIE prompt** section.

ONL prompt section:

Option 1: Manually select ONIE boot mode

1. Connect to the console port
2. Reboot the device

```
root@bl1-pod1:~# reboot
```

3. Once the selection menu appears as shown in the selection menu below, select "**ONIE**" and press enter.

```
                    GNU GRUB  version 2.02

+----------------------------------------------------------------------------+
| Open Network Linux                                                         |
|*ONIE   <----- Select this one                                              |
+----------------------------------------------------------------------------+

      Use the ^ and v keys to select which entry is highlighted.
      Press enter to boot the selected OS, `e' to edit the commands
      before booting or `c' for a command-line.
```

4. Select "**ONIE: Install OS**" from the next selection menu displayed.

```
                    GNU GRUB  version 2.02
 +----------------------------------------------------------------------------+
 |*ONIE: Install OS   <----- Select this one                                  |
 | ONIE: Rescue                                                               |
 | ONIE: Uninstall OS                                                         |
 | ONIE: Update ONIE                                                          |
 | ONIE: Embed ONIE                                                           |
 +----------------------------------------------------------------------------+

      Use the ^ and v keys to select which entry is highlighted.
      Press enter to boot the selected OS, `e' to edit the commands
      before booting or `c' for a command-line.
```

5. Wait for the "**ONIE:/ #**" prompt.

```
NOTICE: ONIE started in NOS install mode.  Install mode persists
NOTICE: until a NOS installer runs successfully.

** Installer Mode Enabled **
ONIE:/ #
ONIE:/ #
ONIE:/ #
```

Provide the URL of the ONL installer image location.

```
ONIE:/ # onie-nos-install http://server.example.net/_/images/latest/rtbrick-onl-
ins
taller/rtbrick-onl-installer-spine-q2c-21.9.1.d
```

Wait until the device displays the "**login:**" prompt after the image upgrade completes. You can then log into the device and verify the image version.

Option 2: Preselect ONIE boot mode

1. Connect to the console port
2. Select ONIE boot mode

```
root@onl>bl1-pod1:~ # onl-onie-boot-mode --help
usage: onl-onie-boot-mode [-h] [--onie-only]
                          {install,rescue,uninstall,update,embed,diag,none}

positional arguments:
  {install,rescue,uninstall,update,embed,diag,none}

optional arguments:
  -h, --help            show this help message and exit
  --onie-only           Do not set ONIE boot menu option.
root@onl>bl1-pod1:~ #

root@onl>bl1-pod1:~ # onl-onie-boot-mode install
```

```
The system will boot into ONIE install mode at the next restart.
root@onl>bl1-pod1:~ #
```

To preselect ONIE boot mode, run the commands using sudo. For example, "sudo onl-onie-boot-mode install."

3. Reboot switch

```
root@onl>bl1-pod1:~ # reboot
```

ONIE prompt section:

You must update the URL of the ONL installer image location as per your specific HTTP server configuration.

```
ONIE:/ # onie-stop
discover: installer mode detected.
Stopping: discover... done.

ONIE:/ # onie-nos-install http://server.example.net/_/images/latest/rtbrick-onl-
ins
taller/rtbrick-onl-installer-spine-q2c-21.9.1.d

discover: installer mode detected.
Stopping: discover... done.

Info: Attempting http://server.example.net/_/images/latest/rtbrick-onl-
installer/rtbrick-onl-installer-spine-q2c-21.9.1.d ...

Connecting to server.example.net (198.51.100.125)
installer 100% |*****************************| 1176M 0:00:00 ETA

ONIE: Executing installer: http://server.example.net/_/images/latest/rtbrick-onl-
installer/rtbrick-onl-installer-spine-q2c-21.9.1.d
```

3.4. Upgrading RBFS

This section describes the process for upgrading your current version of RBFS.

If you are performing a fresh installation on an OCP-compliant bare-metal switch, refer to the section RBFS Manual Installation.

3.4.1. Guidelines

- When installing ONL, any existing configurations on the switch will be deleted.
- The current RBFS configurations can be retrieved via a REST call from the

RESTCONF endpoint. If you have saved the RBFS configuration using this method, you can load it onto the switch through a RESTCONF endpoint. For more information, refer to the following sections of the RtBrick documentation.

Using the Proxy Endpoint

RESTCONF API: Use Cases and Examples

3.4.2. Upgrading RBFS Using a Thumb Drive

Prerequisites

- Format the USB drive with the FAT32 file system format because we need to place the RBFS image on the root directory of the USB drive.
- Ensure you have downloaded the RBFS ONL image described in the RBFS Image Download section.

You can also find instructions for installing via a USB thumb drive in the ONIE User Guide.

To install via USB, perform the following steps:

- Insert the USB drive to your computer and assume the USB drive appears as /dev/sda1 and is mounted at /media/rtbuser/4356-00B1 on Linux. This may vary depending on your system and operating system.

```
$ df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda1        29G   16K   29G   1% /media/rtbuser/4356-00B1
```

Ensure that you rename the RBFS ONL image to onie-installer, as ONIE only recognizes images with this name at the root of the USB drive.

- Copy the RBFS image (in this example, the RBFS image name is rtbrick-onl-installer-accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d) to the root directory of the USB thumb drive, as shown below:

```
$ cp rtbrick-onl-installer-accessleaf-q2c-s9600-102xc-24.9.1-candidate.16.d
/media/rtbuser/4356-00B1/onie-installer
```

```
$ ls -al /media/rtbuser/4356-00B1/
total 1256820
drwxr-xr-x  2 rtbuser rtbuser      16384 Jan  1  1970 .
drwxr-x---+ 3 root     root           4096 Jan  9 11:49 ..
-rw-r--r--  1 rtbuser rtbuser 1286955159 Jan  9 11:49 onie-installer
```

- Remove the USB drive from your computer and insert it into one of the USB ports on the front or rear panel of your ONIE-enabled device.
- Connect to the console port.
- Reboot the device.

```
root@bl1-pod1:~# reboot
```

Once the selection menu appears as shown in the selection menu below, select "ONIE" and press enter.

```
                  GNU GRUB  version 2.02

+----------------------------------------------------------------------------+
| Open Network Linux                                                         |
|*ONIE   <----- Select this one                                              |
+----------------------------------------------------------------------------+

      Use the ^ and v keys to select which entry is highlighted.
      Press enter to boot the selected OS, `e' to edit the commands
      before booting or `c' for a command-line.
```

Select "ONIE: Install OS" from the next selection menu displayed.

```
                   GNU GRUB  version 2.02
 +----------------------------------------------------------------------------+
 |*ONIE: Install OS   <----- Select this one                                  |
 | ONIE: Rescue                                                               |
 | ONIE: Uninstall OS                                                         |
 | ONIE: Update ONIE                                                          |
 | ONIE: Embed ONIE                                                           |
 +----------------------------------------------------------------------------+

      Use the ^ and v keys to select which entry is highlighted.
      Press enter to boot the selected OS, `e' to edit the commands
      before booting or `c' for a command-line.
```

ONIE will automatically detect the onie-installer file located at the root of the USB drive and execute it.

- Wait until the device displays the "login:" prompt after the image upgrade

completes. You can then log into the device and verify the image version.

The default username is “supervisor”, and the password is “supervisor”.

3.4.3. Upgrading RBFS over the Network

For all network installation scenarios, ONIE expects the NOS installer image to be available on the network via HTTP.

Prerequisites

- Ensure that you have downloaded the RBFS ONL image as described in the RBFS Image Download section.
- Ensure that you have set up an HTTP server that will make available the downloaded images for ONIE to use.

Procedure to Upgrade RBFS over the Network

You can also find instructions for installing the ONL image over the network in the ONIE User Guide.

- Connect to the console port.
- Select ONIE boot mode.

```
root@onl>bl1-pod1:~ # onl-onie-boot-mode --help
usage: onl-onie-boot-mode [-h] [--onie-only]
                          {install,rescue,uninstall,update,embed,diag,none}

positional arguments:
  {install,rescue,uninstall,update,embed,diag,none}

optional arguments:
  -h, --help            show this help message and exit
  --onie-only           Do not set ONIE boot menu option.
root@onl>bl1-pod1:~ #

root@onl>bl1-pod1:~ # onl-onie-boot-mode install
The system will boot into ONIE install mode at the next restart.
root@onl>bl1-pod1:~ #
```

To preselect ONIE boot mode, run the commands using sudo. For example, "sudo onl-onie-boot-mode install".

- Reboot switch

```
root@onl>bl1-pod1:~ # reboot
```

ONIE prompt section:

You must update the URL of the ONL installer image location as per your specific HTTP server configuration.

```
ONIE:/ # onie-stop
discover: installer mode detected.
Stopping: discover... done.

ONIE:/ # onie-nos-install http://server.example.net/_/images/latest/rtbrick-onl-
ins
taller/rtbrick-onl-installer-spine-q2c-21.9.1.d

discover: installer mode detected.
Stopping: discover... done.

Info: Attempting http://server.example.net/_/images/latest/rtbrick-onl-
installer/rtbrick-onl-installer-spine-q2c-21.9.1.d ...

Connecting to server.example.net (198.51.100.125)
installer 100% |*******************************| 1176M 0:00:00 ETA

ONIE: Executing installer: http://server.example.net/_/images/latest/rtbrick-onl-
installer/rtbrick-onl-installer-spine-q2c-21.9.1.d
```

4. RBFS Automated Installation (ZTP)

4.1. Overview

Zero Touch Provisioning (ZTP) automates the tasks of installing software images. It is a method for setting up and configuring devices automatically. ZTP installs or upgrades the RBFS software image on your hardware platforms without any manual intervention.

ZTP automatically provisions routers newly installed in the network and it is very useful in deploying routers in a large-scale environment as it eliminates much of the manual intervention. ZTP is also used to automate the software upgrade process and help with a high level of network automation.

4.2. ZTP Workflow

A new hardware platform comes pre-installed with the ONIE (Open Network Installation Environment). ONIE is an open-source installation environment that acts as an enhanced boot loader utilizing capabilities in a Linux or BusyBox environment. ONIE allows users and channel partners to install the Network Operating System as part of provisioning.

ONIE requires a management LAN to obtain the configuration and software image information through the management interface. ONIE can access only the management interface. It starts a Dynamic Host Configuration Protocol (DHCP) based discovery process to obtain basic configuration information, such as the management IP address and the URL of the image to install on the bare-metal switch.

Then ONIE pulls the image and boots it.

Even after ONIE boots the image, the switch is not configured. This leads to questions about how to configure the switch.

The RtBrick images come with some pre-installed daemons. The pre-installed Control Daemon (CtrlD) is responsible for the management of the switch, and takes over after the image is activated.

The Control Daemon is responsible for configuring the switch. To do this, the hardware platform must be connected to the DHCP server and the management server through a management LAN.

The management server is responsible for providing the image binaries and the configuration of each device.

In the ZTP, ONIE performs the role of discovering, downloading and activating the image from the image registry.

In essence, the following is the high-level workflow of ZTP process:

ONIE performs the following tasks:

- DHCP discovery
- Image download
- Image activation

Control Daemon performs the following tasks:

- DHCP discovery
- Switch configuration

ONIE allows to automate the firmware update. The image request to the management server is slightly different, and the management server needs to provide the firmware update image that the device vendor provides.

This section provides information about the NOS installation and firmware (FW) update.

4.2.1. ZTP Process

This section provides information about ZTP process. Figure. 1 illustrates the ZTP process at a high level.

The ZTP process is divided into two main parts:

Software Image Discovery and Installation

The ONIE in the device uses information that you have defined on the Dynamic Host Configuration Protocol (DHCP) server to locate the IP address and image

download URL.

- ONIE uses different ways to pull the image from the repository for downloading. In the ZTP process, HTTP is used to pull the image because ONIE conveys the serial number as the HTTP header. This serial number allows the image registry to identify the switch and select the appropriate image.

Along with the serial number, ONIE also sends the onie-operation that allows to distinguish between an os-install and onie-update, and select the correct image for either NOS install or firmware upgrade.

- See the ONIE image discovery for further information (/ONIE/)
- CtrlD configuration discovery and application.
- CtrlD sends DHCPINFORM to request all options required for configuration discovery.
- The configurations are downloaded from the management server (httpd) and applied.

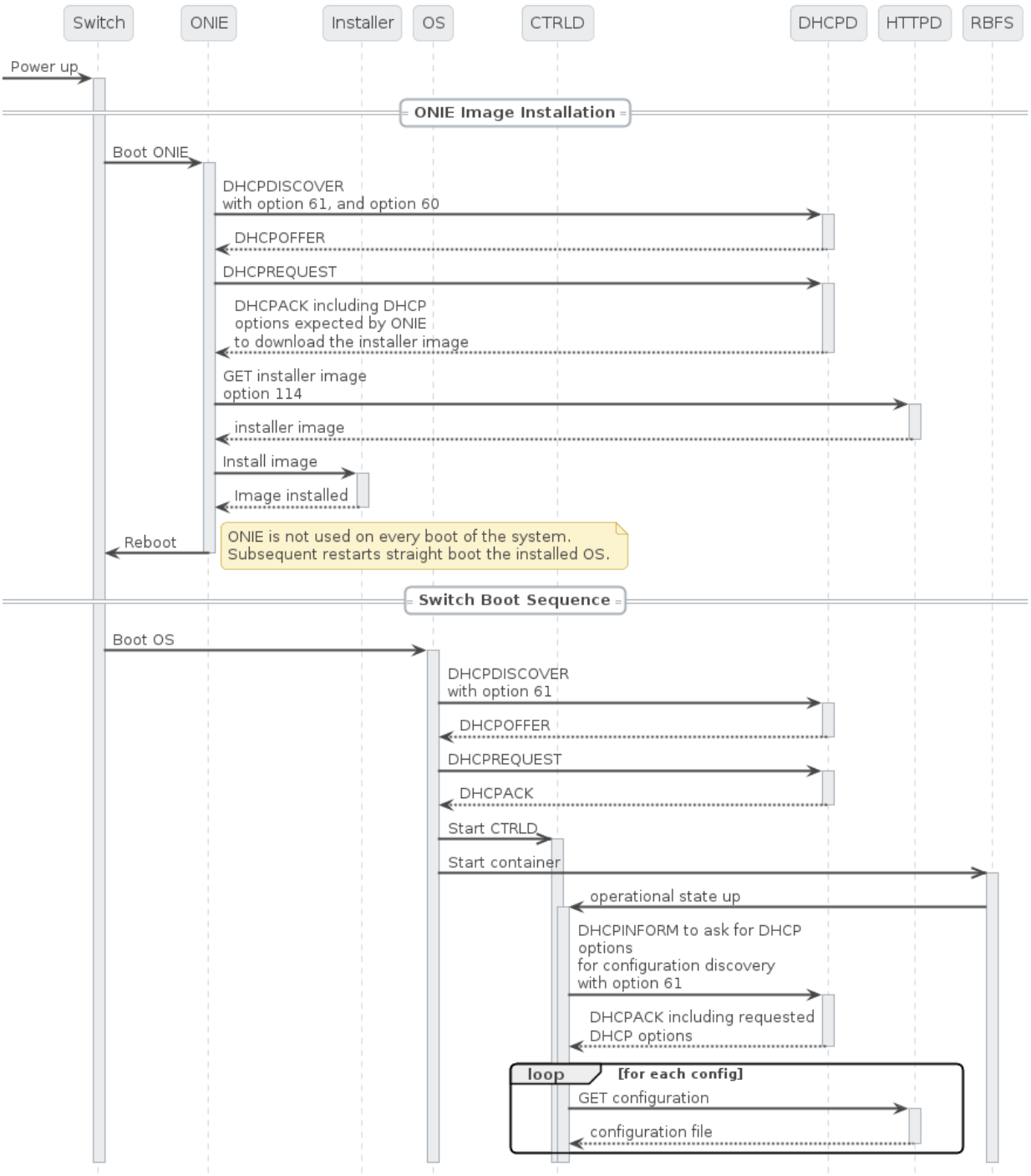


Figure 1. The ZTP Process

Figure 2. depicts the relationship between the fabric, the DHCP server, and the management server.

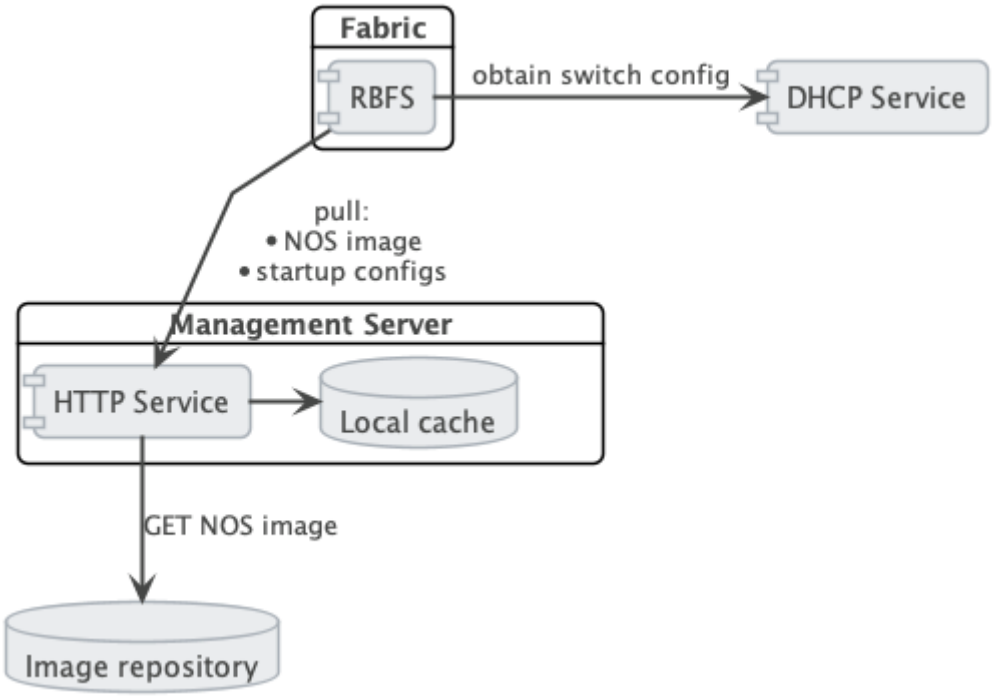


Figure 2. The Management Server Architecture

4.3. DHCP Service

Because of its low set of requirements, the default DHCP server shipped with ubuntu, isc-dhcp, is used to run the DHCP service.

The following code shows an example configuration of a DHCP server and hardware box (**dhcp.conf**).

dhcp.conf

```
authoritative;
default-lease-time 600;
max-lease-time 72----

# This is only needed if the version is lower than 4.4
option loader-pathprefix code 210 = text;


subnet 10.0.0.0 netmask 255.255.255.0 {
  range 10.0.0.200 10.0.0.250;
  option routers 10.0.0.138;
  option domain-name-servers 10.0.0.210;
  option domain-name "local";
  host LEAF01 {
    # Identify client by MAC address.
    hardware ethernet 48:65:ee:11:da:85;
    # Identify client by serial number
    option dhcp-client-identifier "\000WLC1C27L00003P2";
    fixed-address 10.0.0.250;
    option host-name LEAF01;
```

```
    # Set DHCP option 114 (default-url) to set the installer image URL.
    # ONIE loads the installer image from the specified URL.
    option default-url "http://managementserver/ztp/image";
    # Set DHCP option 210 (path prefix) to set the configuration base URL.
    # CTRLD loads all configuration files from this base URL.
    option loader-pathprefix "http://managementserver";
  }
}
```

Most of the used options are already predefined in the ISC-DHCP server. You can see the reference under /ISCKB/, the loader-pathprefix is defined since DHCP 4.4, so if you use an older one, define it as described above.

4.4. HTTP Service (Management Server)

The HTTP daemon (httpd) is responsible for providing the NOS installer and the configuration files.

Therefore, a self-implemented Golang HTTP server is used, which reads the ONIE_SERIAL_NUMBER and ONIE-OPERATION HTTP header and maps them to the NOS/FW installer image download path, and maps the serial number to the ZTP configuration files. For more details about the configuration files, see the following section.

The ONIE-OPERATION header can have the following values:

- install nos: os-install
- update firmware: onie-update

The following sections provide information about the installation and configuration of the server.

4.4.1. ZTP installation

For the installation, you can choose any one of the following two options:

ZTP Installation with the Debian Package

You must perform the following steps for ZTP installation using the Debian package.

- Ensure that you have added the rtrbick repository to your apt.sources list and updated the cache.

- Ensure that the port 80 is available and not in use on your device.
- Install the package rtbrick-fabric-ztp.
- The package installs a systemd service named rtbrick-fabric-ztp.
- Ensure that the service is running with sudo systemctl status rtbrick-fabric-ztp.
- The default location for the ZTP configuration files is /var/rtbrick/ztp/configs/ where you need to copy your configuration files.

If you want to override server settings, perform the following:

- Edit the service configuration file /etc/systemd/system/rtbrick-fabric-ztp.service and add parameters to the ExecStart command.
- Parameter --addr: the listen address of the server, default is 0.0.0.0:80.
- Parameter --requestTimeout: the request timeout server in seconds, default is 600, must possibly be increased depending on the connection speed and image file sizes.
- Parameter --filePath: the location for the ZTP configuration files, the default location is /var/rtbrick/ztp/configs/.

ZTP Installation as Docker Container

You must perform the following steps for ZTP installation as a docker container.

- Ensure that you have access to the rtbrick docker registry.
- Ensure that the port 80 is available and not in use on your device.
- Create a compose file docker-compose.yml. The following is a sample compose file.

```
version: '3.3'
services:
  ztp:
    image: 'docker.rtbrick.com/rbms-fabric-ztp:latest'
    container_name: rbms-fabric-ztp
    restart: unless-stopped
    ports:
      - '80:80'
    volumes:
      - './configs:/var/rtbrick/ztp/configs'
```

- The compose setup uses a 'bind mound' method for the ZTP configuration

folder. Therefore, the docker-compose.yml must be placed in the same location together with the ./configs folder for the ZTP configurations. To know the details of the configuration files, see the following sections.

- If required, adapt the compose file for a different image version, port binding or different configuration folder location.
- Start the container using the docker-compose up -d command.

4.4.2. ZTP configuration

The HTTP service matches the ONIE-SERIAL-NUMBER header to the configuration files. Therefore, the configuration folder should contain a JSON file for the serial number (<serial_number>.json) for each supported serial number.

This file contains settings for locations of all additional configuration files that have to be delivered for the specific device and settings for the NOS installer image and the firmware update image.

Example sample.json file for a serial number 'sample':

/var/rtbrick/ztp/configs/sample.json

```
{
  "description": "192.168.202.116",
  "ctrld": "ctrld.json",
  "ctrldrbac": "ctrldrbac.json",
  "startup": "sample_startup.json",
  "accessjwks": "sample_accessjwks.json",
  "apigwd": "sample_apigwd.json",
  "tls": "sample_tls.pem",
  "image": "http://pkg.rtbrick.net/_/images/latest/rtbrick-onl-installer/rtbrick-
onl-installer-accessleaf-qmx-20.4.0-g8daily.20200415051734+Bmaster.C059a09ea",
  "update_image": "http://pgk.rtbrick.net/firmwares/onie-firmware-x86_64-
ufispace_s9600_32x_ufispace_s9600_64x-r0_v0.3.0.updater"
}
```

Image Location Configuration

For the configuration entries "image" and "update_image" you have three possibilities:

- Redirect URL: Configuration value must start with http, the server redirects the request to download the image from the URL. For example, "http://pkg.rtbrick.net/_/images/latest/rtbrick-onl-installer/rtbrick-onl-installer-accessleaf-qmx-20.4.0-g8daily.20200415051734+Bmaster.C059a09ea"

- Absolute File Location: config value must start with /, can point to any file on the local disk, example /usr/share/images/rtbrick-onl-installer.img.
- Relative File Location: config value must be a filename and not start with /, points to any file in the <ztppath>/configs/images/ folder, example "rtbrick-onl-installer.img"

4.4.3. ZTP APIs

For information about ZTP REST APIs, refer to the /resources/techdocs/current/api/rbms-apis.html[ZTP Management Server API].

4.5. Control Daemon

Once the RBFS image is activated by ONIE, Control Daemon (CtrlD) is responsible for executing the remaining tasks and configuring the switch. CtrlD acts as a post-ZTP daemon, it runs after the image is activated.

There are various configuration files that CtrlD can load from a management server and apply to the system.

- **CtrlD config**: This is the base configuration for CtrlD. There the RBMS and Graylog can be specified, but also the authentication and authorization mechanism can be controlled.
- **CtrlD rbac policy**: The Role Based Access Control (RBAC) policy of CtrlD is defined in this configuration file.
- **Startup Config**: This is the file for RBFS switch configuration.
- **TLS pem file**: This file is intended for the API Gateway (ApiGwD). The file is an X509 public/private key file in PEM format defined in the RFC7468.
- **Access JWKS file**: This file is intended for the ApiGwD. The JSON Web Key Set (JWKS) is described in the RFC 7517.

4.5.1. Trigger the ZTP process

The ZTP process in CtrlD is triggered for a specific container (LXC) on the switch. This can be triggered in the following ways.

- By the switch (RBFS Linux container) itself by sending the *operational state up* to CtrlD.

- By sending a REST request to trigger the ZTP process to CtrlD (/api/v1/ctrld/ztp/_run).

If 'load-last-config' option is set to true, ZTP is in the disabled state. ZTP is enabled if load-last-config is false.

By default, 'load-last-config' is false and ZTP is enabled. You must set to 'load-last-config' true to disable ZTP.

4.5.2. Trigger the reinstall

The reinstall of a switch can be triggered by sending a POST request to CtrlD (/api/v1/ctrld/system/_reinstall)

4.5.3. Trigger Firmware Update

The firmware update of a switch can be triggered by sending a POST request to CtrlD (/api/v1/ctrld/system/_update)

4.5.4. Management Server URL Discovery

CtrlD has to discover the management server URL to download the configuration files from the management server. Therefore, a management interface, that allows sending an DHCPINFORM request to the DHCP server, is defined.

The request contains **DHCP option 60**, that conveys the vendor class identifier "rtbrick", which informs the DHCP server about the vendor information.

The request contains the **DHCP option 61** that conveys the client identifier. The client identifier is either omitted or contains the serial number. The serial number is gathered from the ONIE file system information file /lib/platform-config/current/onl/onie-info.json. If that does not result in a valuable result the following command is executed dmidecode -s system-serial-number (see /RFC2131/ and /RFC2132/ for further information).

There are at least two DHCP options requested, **DHCP option 54** that conveys the IP address of the DHCP server (see /RFC2132/ for further information), and **DHCP option 210** that conveys the path prefix for all configuration files (see /RFC5071/ for further information).

If the DHCP option 210 is not returned, CtrlD attempts to read the configurations

from the IP address of the ZTP server. Otherwise, CtrlD attempts to read the configurations from the base URL specified in DHCP option 210.

4.5.5. Request configurations

The request to the Management server contains the following HTTP headers:

- ONIE-SERIAL-NUMBER: This serial number is either the onie serial number or empty string.
- CONTAINER-NAME: Container that triggered the ZTP process.
- ELEMENT-NAME: Element name that triggered the ZTP process.
- HOST-NAME: Host name of the device that triggered the ZTP process.

All this information can be used to select the right configurations for the container. This also allows the use of ZTP Configuration Process for virtual environments.

The requested URL:

- CtrlD Config: <management server url>/ztp/config/ctrld
- CtrlD rbac policy: <management server url>/ztp/config/ctrldrbac
- Startup Config: <management server url>/ztp/config/startup
- TLS pem file: <management server url>/ztp/config/tls
- Access JWKS file: <management server url>/ztp/config/accessjwks

If any of the file is not found, the process still goes forward.

4.5.6. Business Events

During the ZTP Process log messages are sent to the configured ztp graylog endpoint.

For more information, see the switch API documentation.

4.5.7. Overall Process Flow

The following two figures show the CtrlD ZTP process flow.

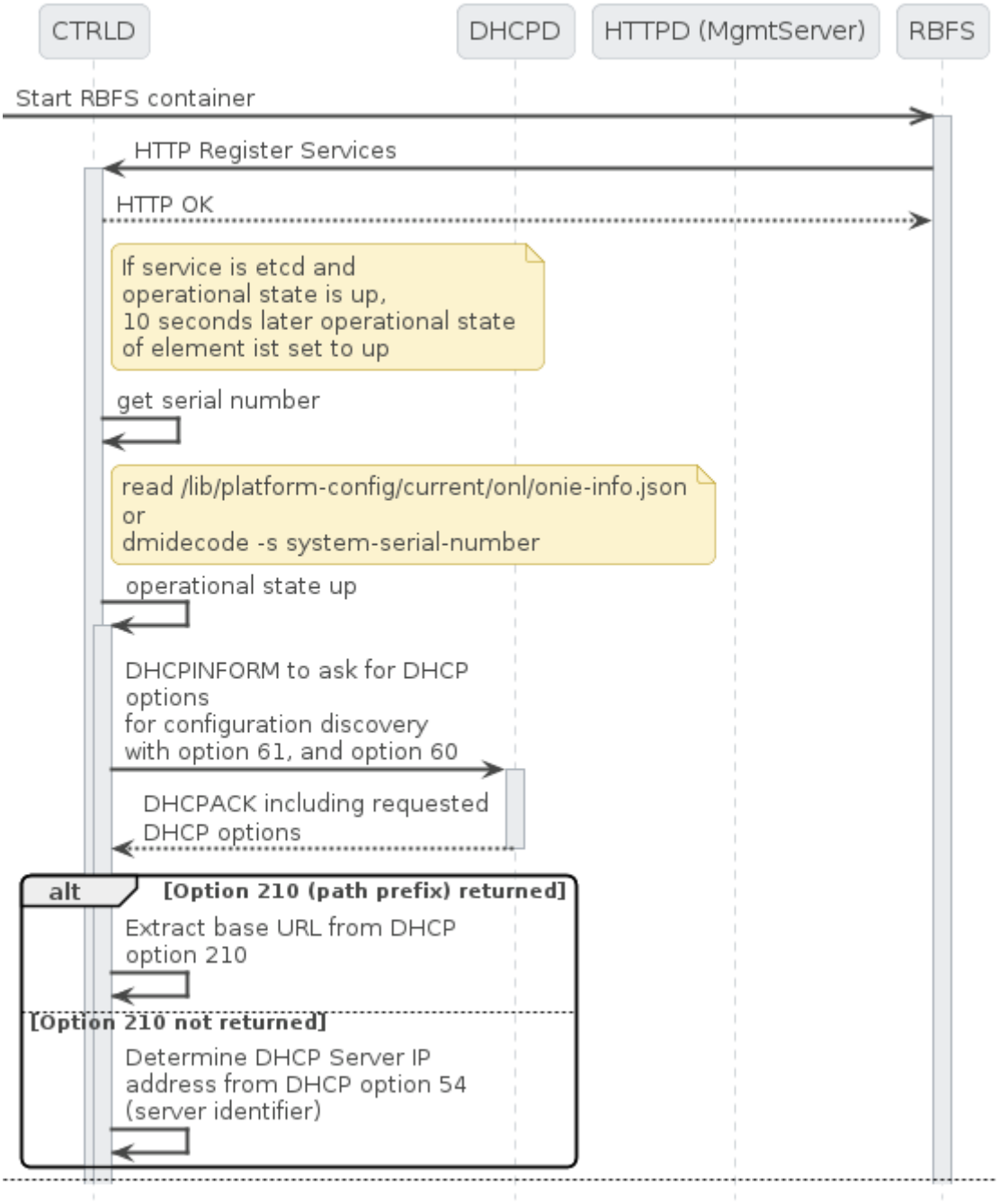


Figure 3. CTRLD ZTP process flow (Part 1/2)

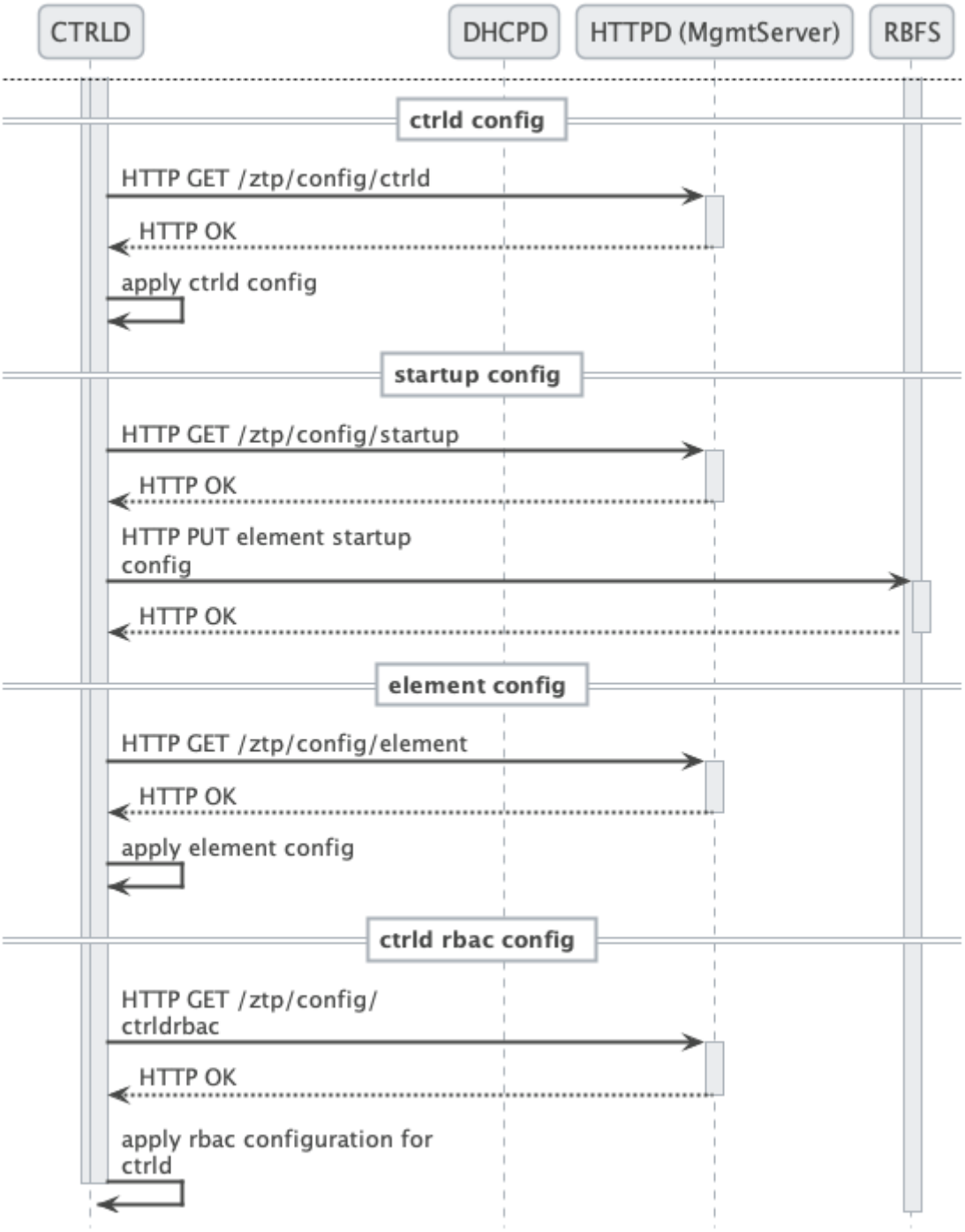


Figure 4. CTRLD ZTP process flow (Part 2/2)

4.6. References

References

/ONIE/	Open Network Installation Environment Image Discovery
/RFC2131/	RFC2131 - Dynamic Host Configuration Protocol
/RFC2132/	RFC2132 - DHCP Options and BOOTP Vendor Extensions https://tools.ietf.org/html/rfc2132

/RFC5071/	RFC5071 - Dynamic Host Configuration Protocol Options Used by PXELINUX
/ISCKB/	ISC Default DHCP Options

5. RBFS Licensing

5.1. Overview

RBFS Licensing allows you to access the full functionality of your RtBrick FullStack (RBFS) installation. Rtbrick provides a 28-day evaluation license on request. It is not allowed to be used in production. Use a permanent or subscription license that has been purchased through RtBrick Sales. If you want to extend the evaluation period and get additional licenses, contact RtBrick Support.

Without any license installed on your system, you can evaluate RBFS for 7 days. You need to get an evaluation license or purchase an actual license within 7 days to use the full functionality of RBFS.

5.2. Obtaining or Extending Licenses

To obtain new RBFS licenses or extend the existing licenses, go to https://portal.rtbrick.com/, click **Licenses** in the left-side menu, and then select the **Request license** link. For details, see the Managing Licenses via Self-Service Portal section below.

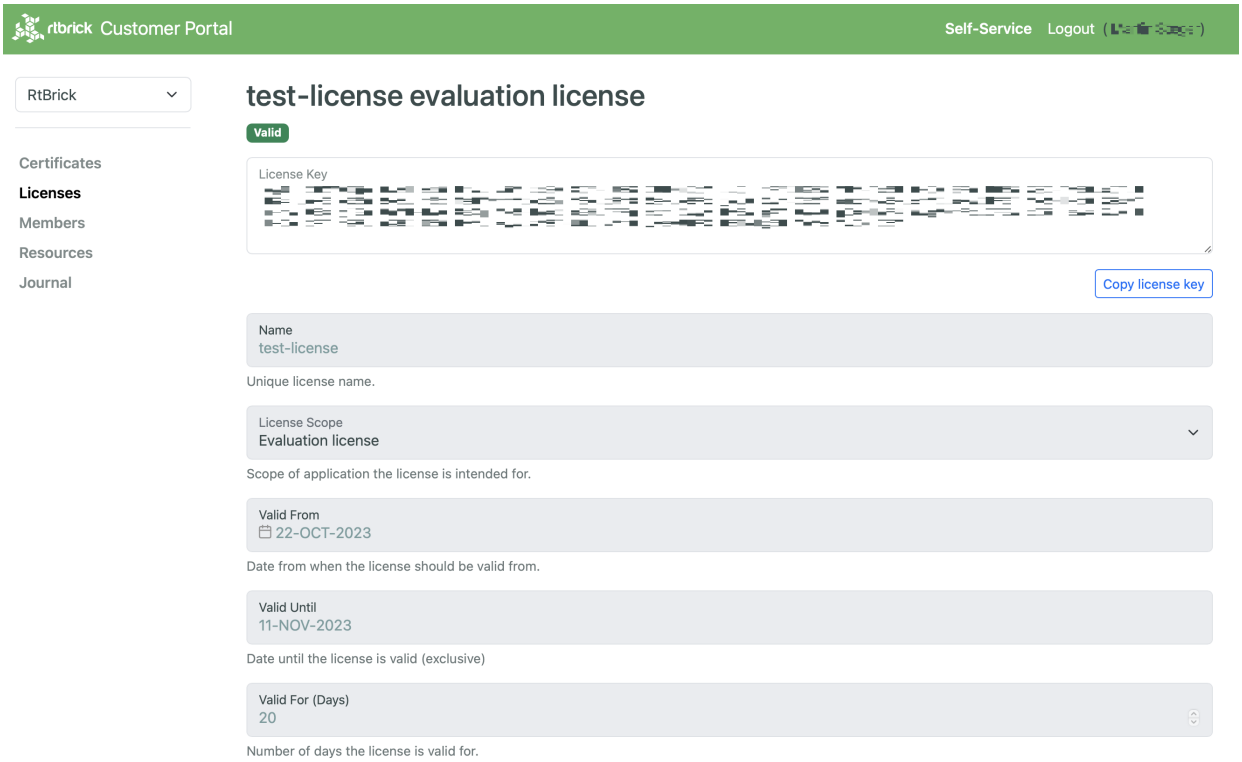
5.3. Managing Licenses via Self-Service Portal

The RtBrick Self-Service portal enables users to view existing license keys, request new licenses, and renew licenses that are about to expire.

5.3.1. Accessing the license key

To access the license key, click on **Licenses** in the left-side menu. This page lists your available licenses. Select the license you want to view.

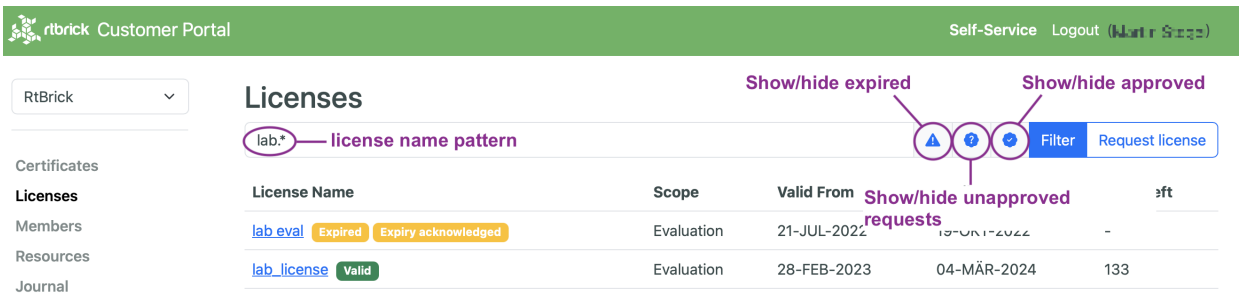
The detail view shows the license details including the license key.



Click **Copy license key** to add the license key to the clipboard.

5.3.2. Working with the license list view

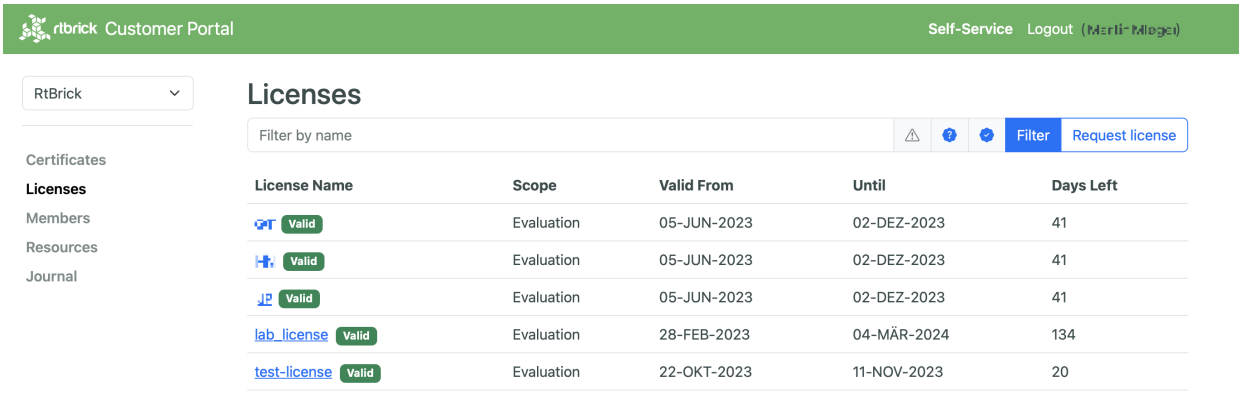
The license list view allows filtering licenses by their names and lifecycle status.



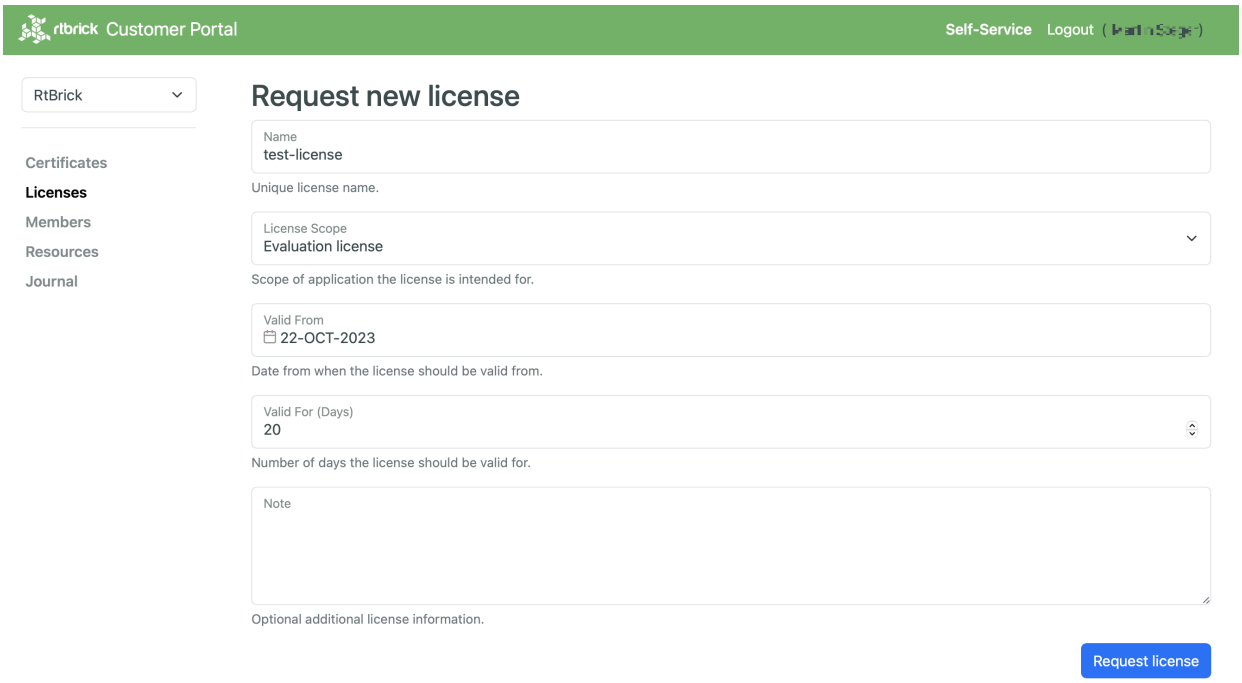
The name filter is a regular expression. The icons next to the filter allow including or excluding expired licenses, unapproved license requests and approved licenses from the license list.

5.3.3. Requesting a new license

To request a new license, proceed to licenses on the left-side menu and click the **Request license** button to request a new license.



Fill the license request form with all relevant data.



Click the **Request license** button to submit the license request.

5.3.4. Renewing an existing license

The portal reports when a license is about to expire. Click the **Renew** button to create a license request from the current license and copy all relevant data from the license to the license request. Once the license request has been approved, the new license and the license about to expire are both valid to give some time for deploying the new license key to the RBFS instances.

Click the **No renew** button if a license is supposed to expire and shall not be included in the expiry notifications anymore.

5.4. Installing a License

You can install a license by using the RBFS CLI or via the RESTCONF API. You should get a license encrypted string from Rtbrick and configure the same via CLI.

When you upgrade your RBFS installation, the existing license should either get restored via saved configuration or it needs to be installed again.

To install a license, enter the following command:

Syntax

set system license <license_key>

Example

```
supervisor@rtbrick: cfg> set system license
“eyJzdGFydF9kYXRlIjogMTYxNTg3MTE3MCwgImVuZF9kYXRlIjogMTYxNTk1NzU3MH0=.Yx/XiFDFRzAt
XPUOaIoh5GqiXa+kOJBWp3LgDeJooVrl88mpPs2ZRMPC+k5HvoZDXvsreqRrqoFR3vk7S2PlqmLxYf0bNB
ly4d1hrloBwwFkFuJaiU/M+ZGPExgILdVyXumI88VYx8m/Z5SxEj0bFQGUy8UHRUYW/Ay8fhPfYejWuSgp
v3OrIThH9CVjlDmrp/k4yOuHyTz5gLgq4A0h33vB5O99aOIJW5UX4XDKvQqmqX5kytRlR1SseWuAbWKjUd
VOkf2Mk36IbF9/xAKier++LzXESpLMI+MT63AybSDHOBZydoMjLH9C6cPEfGHzWTIBNtT3679Tokf25EK1
Jw==”
```

The following example shows the running configuration.

```
supervisor@rtbrick: cfg> show config system
{
    "rtbrick-config:system": {
        "license": [
```

```
            {
                "license-key":
"eyJzdGFydF9kYXRlIjogMTYxNTg3MTE3MCwgImVuZF9kYXRlIjogMTYxNTk1NzU3MH0=.Yx/XiFDFRzAt
XPUOaIoh5GqiXa+kOJBWp3LgDeJooVrl88mpPs2ZRMPC+k5HvoZDXvsreqRrqoFR3vk7S2PlqmLxYf0bNB
ly4d1hrloBwwFkFuJaiU/M+ZGPExgILdVyXumI88VYx8m/Z5SxEj0bFQGUy8UHRUYW/Ay8fhPfYejWuSgp
v3OrIThH9CVjlDmrp/k4yOuHyTz5gLgq4A0h33vB5O99aOIJW5UX4XDKvQqmqX5kytRlR1SseWuAbWKjUd
VOkf2Mk36IbF9/xAKier++LzXESpLMI+MT63AybSDHOBZydoMjLH9C6cPEfGHzWTIBNtT3679Tokf25EK1
Jw=="
            }
        ]
    }
}
```

5.5. Installing Multiple Licenses

You can install multiple licenses. Additional licenses can be installed even when you have existing license(s). The license with the maximum evaluation period will be prioritised over others. When you have multiple evaluation licenses installed, the one that expires later takes higher priority compared to the other licenses.

5.6. Viewing the installed license

Syntax

show system license

Example

```
root@rtbrick: cfg> show system license
License Validity:
  License 1:
    Start date : Tue Mar 16 05:06:10 GMT +0000 2021
    End date   : Wed Mar 17 05:06:10 GMT +0000 2021
root@rtbrick: cfg>
```

After verifying the validity of the license, the license file will be installed at the following location:

```
/etc/rtbrick/license/rtbrick-license
```

5.7. Deleting a License

To delete a license, enter the following command:

Syntax

delete system license <license_key>

Example

```
supervisor@rtbrick: cfg> delete system license
“eyJzdGFydF9kYXRlIjogMTYxNTg3MTE3MCwgImVuZF9kYXRlIjogMTYxNTk1NzU3MH0=.Yx/XiFDFRzAt
XPUOaIoh5GqiXa+kOJBWp3LgDeJooVrl88mpPs2ZRMPC+k5HvoZDXvsreqRrqoFR3vk7S2PlqmLxYf0bNB
ly4d1hrloBwwFkFuJaiU/M+ZGPExgILdVyXumI88VYx8m/Z5SxEj0bFQGUy8UHRUYW/Ay8fhPfYejWuSgp
v3OrIThH9CVjlDmrp/k4yOuHyTz5gLgq4A0h33vB5O99aOIJW5UX4XDKvQqmqX5kytRlR1SseWuAbWKjUd
VOkf2Mk36IbF9/xAKier++LzXESpLMI+MT63AybSDHOBZydoMjLH9C6cPEfGHzWTIBNtT3679Tokf25EK1
Jw==”
```

5.8. License Expiry

When a license expires, you will not be able see the operational state of the system via CLI or BDS API.

5.8.1. License Validation

The process of verifying the validity of the software license is known as license validation. If no license is installed, a 7-day evaluation period will be provided. During this time, there will be no license validation. After the evaluation period ends, the system will check perform license validation every 12 hours. If a valid license is not found, access to the operational state of the system via CLI or BDS API will not be available.

Once a license is installed on the device, it will be validated every 12 hours. If a license is installed within 7 days of evaluation, it is considered the end of the evaluation period, and the license validation will start from that point onward.

Relevant warning or error messages will be generated based on the license validation:

- A warning is generated if the license validity is less than seven days.

- An error message is generated if the license validity is less than one day.
- A critical message is generated if the license has already expired.

Both BDS and file logs are generated for license expiry, and if the Graylog plugin is configured, they are sent to the Graylog. For a list the logs related to license expiry, refer to the section License Log Messages.

To find out the details about the license installed on your system, run the “show system license” command as explained in the section Viewing the installed license.

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