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# White Paper: Cisco IOS Reference Guide

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Understanding the Cisco IOS® Software release model is essential for planning, designing, implementing, and managing network infrastructures. This document describes the release model—trains, releases, feature sets, and images. For information about how to install or configure Cisco IOS Software, see Cisco IOS Software Technical Documentation.

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- 1.2 Scope of this Document

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### Related Resources

- [Cisco IOS Roadmap](#)
- [The ABC's of Cisco IOS Software: Understanding the Essentials Series](#)
- [Cisco IOS Software Technical Documentation](#)

- **Software Center: Cisco IOS Software**
- **Cisco IOS Upgrade Planner**
- **Cisco Feature Navigator**
- **What's New for Cisco IOS Software**

## 1.0 Introduction

Cisco IOS Software is network system software that tightly integrates a broad range of Internet and enterprise network hardware. Cisco IOS Software is the unifying thread that connects otherwise disparate networks to build a scalable network infrastructure. It enables network services and Internet applications, serving as an end-to-end solution for global networking.

### 1.1 Growth of Cisco IOS

The Internet was a driving force in Cisco's growth. As the router market exploded, so did Cisco's growth. From the beginning, Cisco routers ran Cisco IOS Software.

Today, Cisco IOS Software supports new areas of networking technology, such as voice and video over IP networks, optical, wireless, storage networking, and network services to support e-commerce conducted over multi-service (Data/Voice/Video) applications.

Cisco IOS Software evolved over time and met the challenge of rapid changes in the business and network environment in the last decade. Cisco IOS Software supports an unparalleled array of features, applications, and an array of hardware that ensures its longevity. Customers can leverage their investment in Cisco hardware and software solutions for years, maximizing ROI, minimizing costs, and ensuring investment protection.

### 1.2 Scope of this Document

This document is intended for network administrators who upgrade and maintain a network. To perform these critical tasks, network administrators must understand the following topics:

- The evolution of Cisco trains and releases
- The names of trains and releases
- The types of trains and releases

To obtain new Cisco IOS images, network administrators must understand the following topics:

- Feature sets and images
- Cisco IOS tools, such as Feature Navigator and Upgrade Planner
- The Cisco IOS roadmap

## 2.0 Cisco IOS Trains

A Cisco IOS train is a vehicle for delivering releases that evolve from a common code base.

In recent years, with the addition of thousands of new features, hundreds of new applications, and a wide array of platforms, Cisco IOS Software diversified from one train of releases to multiple trains supporting different feature sets for different customer needs.

## 2.1 Types of Trains

Today, Cisco IOS releases are delivered on the following types of trains:

**Table 1: Types of Trains**

Train	Description	Examples
<b>mainline</b>	Consolidates releases and fixes defects. Inherits features from the parent T train, and does not add additional features.	12.2, 12.3
<b>T</b>	Introduces new features and fixes defects.	12.3T
<b>S</b>	Consolidates 12.1E, 12.2 mainline, and 12.0S, which supports high-end backbone routing, and fixes defects.	12.0S, 12.2S
<b>E</b>	Targets enterprise core and SP edge, supports advanced QoS, voice, security, and firewall, and fixes defects.	12.1E
<b>B</b>	Supports broadband features and fixes defects.	12.2B, 12.3B

## 2.2 Mainline and T Train Relationship

Early in Cisco's history, the need for at least two trains for releasing Cisco IOS Software emerged:

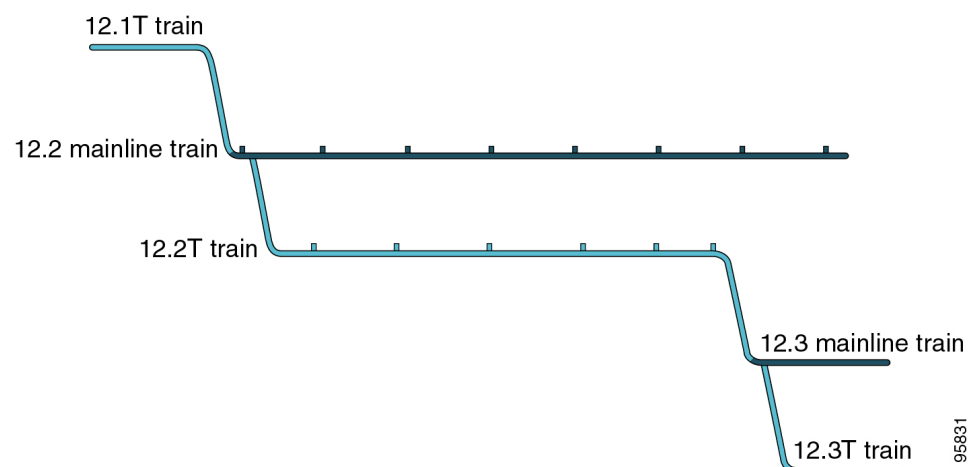
- A train for bug fixes mainline
- A train for bug fixes and new features T train

With two trains, Cisco could introduce new features in a Cisco IOS release from one train without affecting the code base of the other train.

### 2.2.1 T Train and Mainline Evolution

Mainline trains, such as 12.2, are built from previous generation T trains, such as 12.1T. Mainline trains, such as 12.2, are parents of other trains, such as 12.2T (see Figure 1).

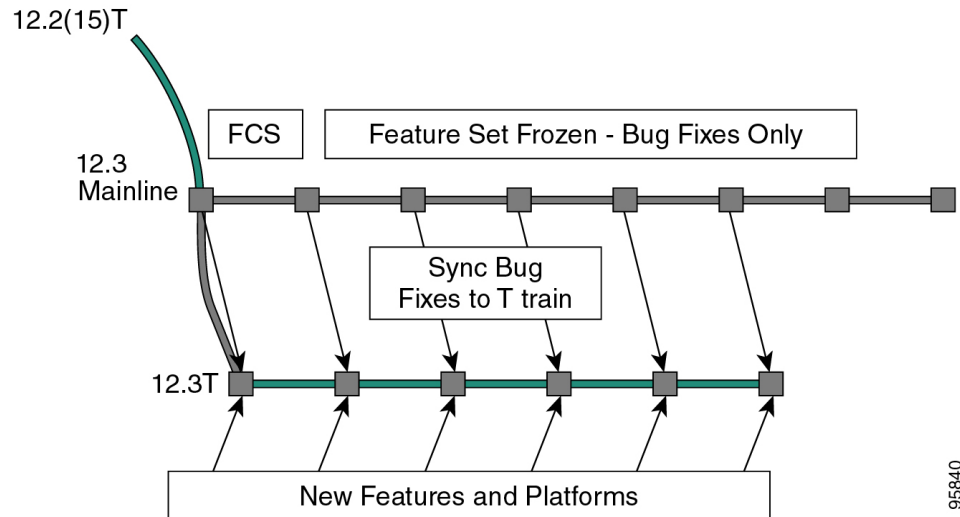
**Figure 1: Evolution of T and Mainline Trains**



## 2.2.2 Bug Synchronizing and Feature Integration

Bug fixes to maintenance releases on a mainline train are synchronized with subsequent maintenance releases on the child T train (see Figure 2). New features are integrated into the T train only the mainline train receives bug fixes only.

**Figure 2: Bug Synchronizing and Feature Integration**



## 2.3 Train Lifecycle Milestones

At some point in the life of a train, Cisco stops selling, maintaining, and supporting it. Cisco informs customers that a train has reached one of these milestones by issuing product bulletins and other communications. The following acronyms are associated with lifecycle milestones:

- FCS First Customer Shipment
- EoS End of Sale
- EoE End of Engineering
- EoL End of Life

The following table briefly describes the train lifecycle milestones.

**Table 2: Milestones in the Life of a Train**

<i>Milestone</i>	<i>Available through Sales Channels</i>	<i>Bug Fixes</i>	<i>TAC Support</i>	<i>Download from Cisco.com</i>
FCS	Yes	Yes*	Yes	Yes
EoS	No	Yes	Yes	Yes
EoE	No	No	Yes	Yes
EoL	No	No	No	No

\* FCS corresponds to the first maintenance release on the train. Each new release receives regular maintenance during the early part of the life cycle.

## 3.0 Cisco IOS Releases

A release is a snapshot in time of the code base of a train.

### 3.1. Types of Releases

- Maintenance releases
- Rebuild releases
- General Deployment (GD) releases
- Special releases

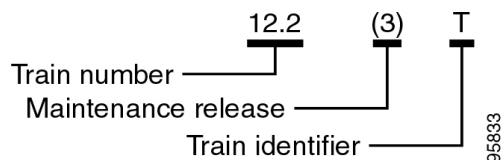
### 3.2 Maintenance Releases

A maintenance release is a scheduled revision of Cisco IOS Software that introduces new features or bug fixes, or both. Maintenance releases typically occur every eight to thirteen weeks, depending on the train.

#### 3.2.1 Maintenance Release Naming

A maintenance release name, such as 12.2(3)T, has a number enclosed in parentheses (see Figure 3).

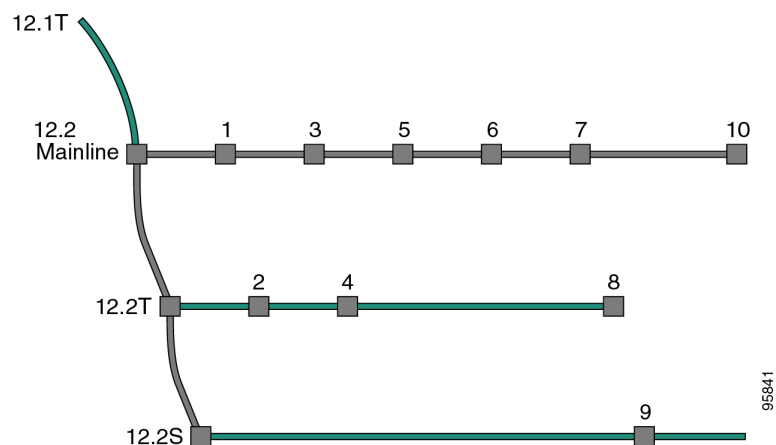
**Figure 3: Example of Maintenance Release Name**



#### 3.2.2 Cisco IOS Maintenance Release Revision Number Sharing

Bug fixes are synchronized from the mainline to the T train (see Figure 2). With the release of the 12.2 mainline train, Cisco started sharing a sequence of numbers among maintenance releases on the mainline, T, and S trains (see Figure 4), so customers can determine which T and S train release gets bug fixes from a particular mainline release.

**Figure 4: Maintenance Release Number Sharing Between Mainline, T, and S Trains**



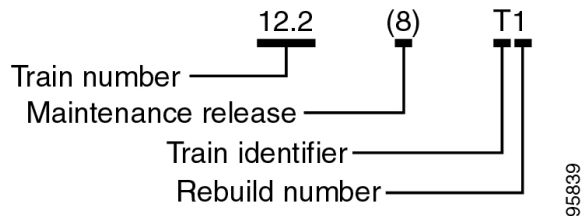
## 3.3 Rebuild Releases

Circumstances and business demands may require that a number of images from a Cisco IOS train be rebuilt and posted prior to the next planned maintenance release. Rebuilds are a Cisco IOS vehicle that delivers fixes on an accelerated schedule.

### 3.3.1 Rebuild Release Naming

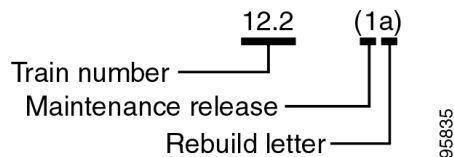
A numeric suffix in a release name, such as 12.2(8)T1, indicates a rebuild of a maintenance release on a B, S, T, or E train (see Figure 5).

**Figure 5: Example of a Rebuild Release Name—T Train**



A lowercase alphabetic suffix in a release name, such as 12.2(1a), indicates a rebuild of a maintenance release on a mainline train (see Figure 6).

**Figure 6: Example of a Rebuild Release Name—Mainline Train**



## 3.4 General Deployment (GD) Releases

A Cisco IOS Software release reaches GD certification when its quality has been demonstrated by extensive deployment in diverse networks over extended periods of time.

Cisco IOS releases achieve GD status after meeting strict standards.

### 3.4.1 General Deployment (GD) Release Criteria

A GD release must meet the following criteria:

- Improving Trend in Defect Backlog
  - ◆ Customer Advocacy (CA) evaluation of known defects
  - ◆ No new features or platforms, defect resolution commits only
  - ◆ No open Critical Account Program (CAP) issues
  - ◆ Defect density measurements
  - ◆ Software Reliability Engineering (SRE) projected defects
  - ◆ Minimal code changes No serious defects in previous maintenance releases
- Customer Success
  - ◆ Extensive customer exposure
  - ◆ High level of customer satisfaction

- Cisco Deployment
  - ◆ Comprehensive system test and deployment in Cisco's internal network
- Documentation
  - ◆ Release Notes Enclosures (RNEs) complete

### 3.4.2 General Deployment (GD) Lifecycle

After a release attains GD status, every subsequent revision of the release is also GD. Consequently, when a release is declared GD, it enters a restricted maintenance phase. While in this phase, modification of the code, including bug fixes, is strictly limited and controlled by a program manager to prevent bugs from being introduced into the release.

## 3.5 Special Releases

A special release is a branch from a train code base that is introduced to quickly meet market demands for new features or additional platform support. The early field adoption of new features and platforms that Cisco introduces in special releases benefits customers who need to run new network equipment or services. The following table lists technology identifiers used in the names of special releases.

**Table 3: Special Release Technology Identifiers**

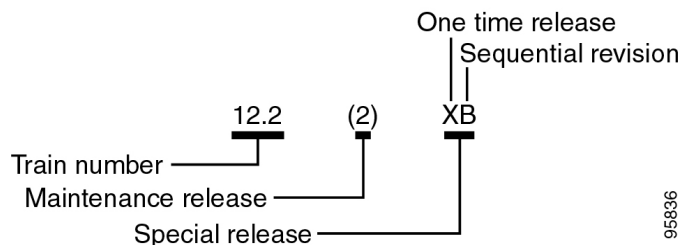
<i>Identifier</i>	<i>Target Technology or Platform</i>
X	Varies, one time release
Y	
Z	
A	Aggregation/Access Server/Dial
D	xDSL
H	SDH/SONET
J	Aironet Wireless Networking
M	Mobile Wireless
W	ATM/LAN Switching/Layer 3 Switching

### 3.5.1 Naming of Special Releases

The names of special releases have double letter identifiers after the train and maintenance release numbers. Special release names do not conform to a strict naming convention.

Figure 7 shows an example of a special release name, 12.2(2)XB. When this type of naming is used, the first letter of the double letter identifier can represent the one-time release X, Y, or Z. The second letter can be a sequential revision identifier, A–Z.

**Figure 7: Release Name Example 1**



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Figure 8 shows an example of another type of special release name, 12.2(2)EX. When this type of naming is used, the first letter of the double letter identifier designates the parent of the special release. The second letter represents the one-time release X, Y, or Z.

**Figure 8: Release Name Example 2**

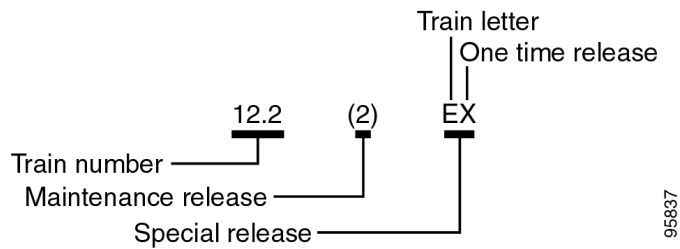
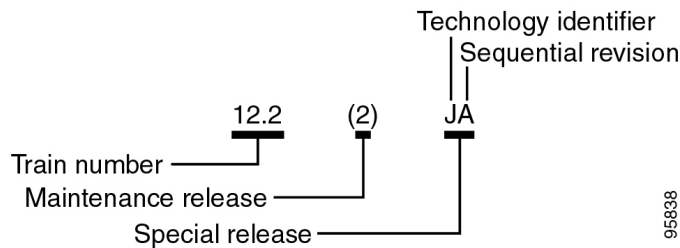


Figure 9 shows an example of another type of special release name, 12.2(2)JA. The first letter of the double letter identifier indicates the technology the release delivers (see Table 3). The second letter is a sequential revision identifier A–Z.

**Figure 9: Release Name Example 3**

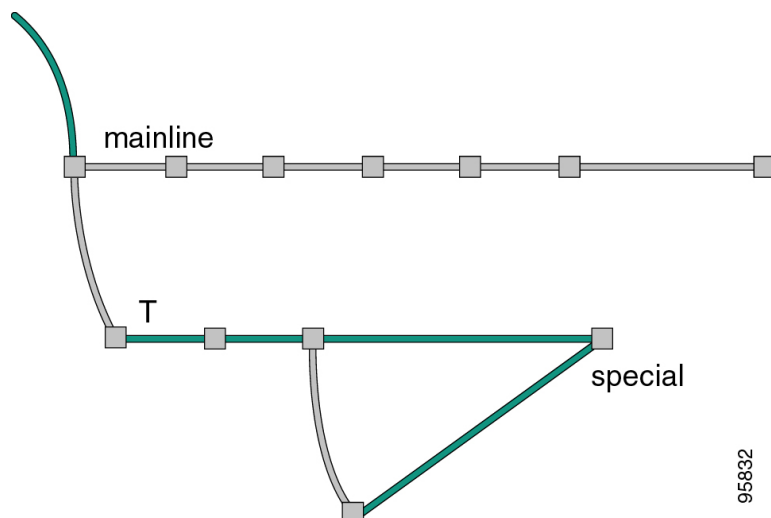


Maintenance or rebuild identifiers (not shown in Figures 7–9) follow the double letter special release designator.

### 3.5.2 Feature Migration of Special Releases

At some point in its lifecycle, a special release is integrated back into the parent train (see Figure 10).

**Figure 10: Integration of Special Release Features into Parent**



### 3.5.3 Lifecycle of Special Releases

Cisco's end of life (EoL) policy is not applicable to special releases.

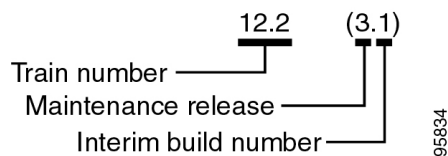
## 3.6 Interim Builds

An interim build is software from an internal Cisco engineering build process that the Cisco Technical Assistance Center (TAC) gives customers to use on a temporary basis to address a specific issue. Customers who have an interim build installed on their network should contact TAC for assistance in replacing the interim build.

### 3.6.1 Interim Build Naming

An interim build name, such as 12.2(3.1) has a train number plus a maintenance release number and decimal number in parentheses (see Figure 11).

**Figure 11: Example of an Interim Build Name**



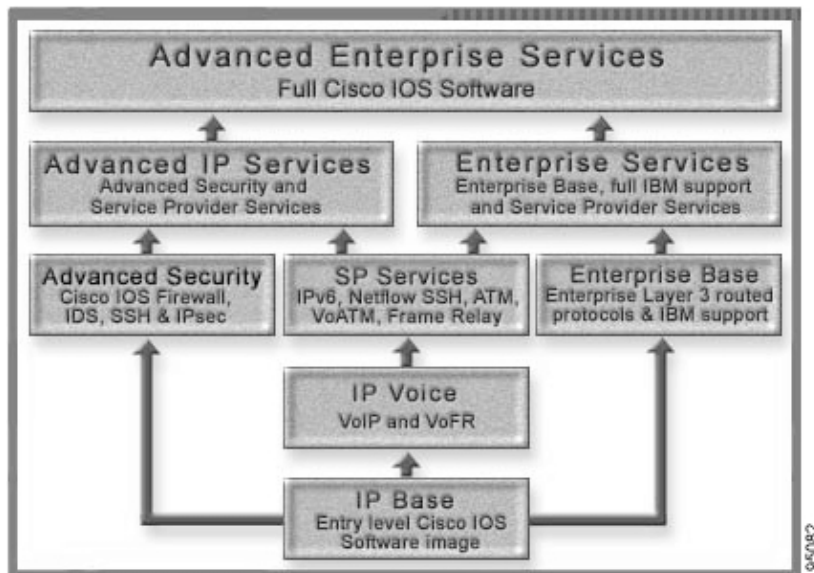
## 4.0 Cisco IOS Feature Sets

A feature set is a bundle of the features available for a release. Customers can use multiple feature sets of a release.

### 4.1. Cisco IOS Packaging

Cisco IOS 12.3 Packaging simplifies the feature set selection process by consolidating the number of packages and using consistent package names across all platforms. Cisco IOS 12.3 Packaging is initially available for Release 12.3 for the Cisco 1700, 2600, and 3700 series routers. Other hardware platforms will be introduced with Release 12.3T. Along with Cisco IOS legacy images, Cisco IOS 12.3 Packaging introduces eight new feature sets (see Figure 12).

**Figure 12: Cisco IOS 12.3 Packaging Feature Sets**



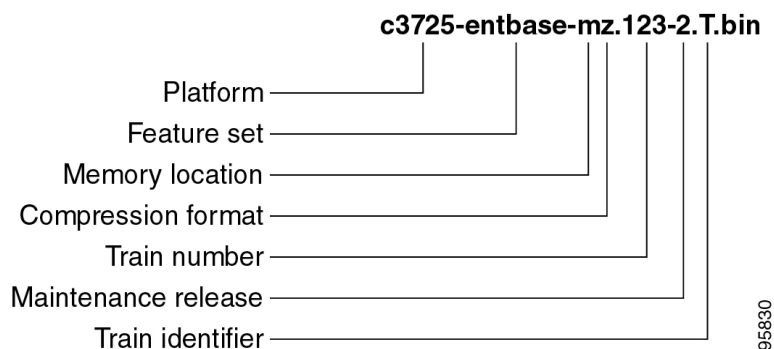
## 5.0 Cisco IOS Images

A Cisco IOS image is a binary executable file of a feature set for a specific platform. Multiple images exist for a release, representing supported platform and feature set combinations.

### 5.1 Image Naming

The software image name represents the platform, feature set, format, and other information about the image file. The following example shows the image name of a 12.3(2)T release with the Enterprise Base feature set for the Cisco 3725 platform.

**Figure 13: Example of an Image Name**



Refer to the **Cisco IOS Software Image Naming Convention** for information about identifying the platform or board for which the binary software is built, the package feature content of the image, and the area of memory used by the image at run time.

### 5.2 Images Running on a Router

The show version command displays the name of the Cisco IOS image that is running on a device.

## 6.0 Tools and Resources

The [Cisco IOS toolbox](#) is a table that briefly describes and lists links to important Cisco IOS tools and documentation. Customers can use the tools to get information about releases, feature sets, platforms, and images.

### 6.1 Tools

The following table briefly describes some of the most useful tools in the Cisco IOS toolbox.

**Table 4: Key Cisco IOS Tools**

<i>Tool</i>	<i>Description</i>
<a href="#">Software Selector</a>	Finds required features for a given technology.
<a href="#">Feature Navigator</a>	Finds releases that support a set of software features and platforms, and compares releases.
<a href="#">Software Advisor</a>	Compares IOS releases, matches IOS and CatOS features to releases, and finds out which software release supports a given hardware device.
<a href="#">Cisco IOS Upgrade Planner</a>	Finds releases by platform, release, and feature set, and downloads images of Cisco IOS Software.
<a href="#">Bug Toolkit</a>	Searches for known bugs based on software version, feature set, and keywords.

### 6.2 Cisco IOS Roadmap

The [Cisco IOS roadmap](#) consists of graphical links to detailed information about specific Cisco IOS releases and trains. The roadmap shows the lineage of releases.

## 7.0 Important Communications about Releases

Cisco issues many software advisories to customers for informational purposes only. Often, software advisories describe problems with Cisco IOS Software that are platform specific or occur under unusual circumstances, and therefore, do not affect most customers. Often, no action is required by the customer.

Critical communications about releases from Cisco that do require action include:

- Security Advisory Product Security Incident Response Team (PSIRT) issues a security advisory to alert customers to security issues that directly impact Cisco products and to help customers repair the Cisco product.
- Security Notices Cisco issues Security Notices about issues that require a response to information posted to a public forum, or to make recommendations to mitigate general problems affecting network stability.
- Deferral Advisory Cisco issues a deferral advisory to announce the removal of a Cisco IOS image from Cisco's offerings and to introduce a replacement image. A deferral advisory is most often issued to correct a defect. At the time that the deferral of a Cisco IOS image is advised, customers are strongly urged to migrate from the affected image to the replacement image.