



# **VistA Imaging DICOM Gateway**

## **Routing Setup and User Guide**

July 2010 – Revision 6  
MAG\*3.0\*53

Department of Veterans Affairs  
Office of Enterprise Development  
Health Provider Systems

**Routing Setup and User Guide  
VistA Imaging 3.0 Patch 53  
July 2010**

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# Introduction

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This manual explains how to configure and use the routing capability of the VistA DICOM Gateway. This manual also explains how to use the on-demand routing capability of the VistARad diagnostic workstation software.

This manual is intended for the following users:

- Imaging/radiology department staff who are responsible for setting up and maintaining a Routing Gateway.
- Clinical staffers who need to use VistARad for on-demand routing.

For technical staff, this manual assumes familiarity with the DICOM Gateways, the VistA system in general, and Windows networking. For clinical staff, this manual assumes familiarity with the Windows environment and the VistARad diagnostic workstation software.

## Terms of Use

In compliance with Food and Drug Administration (FDA) and VA policies, authorization to use the software described in this document is contingent on the execution of a Site Agreement between the VistA Imaging development group and the site where this software is installed.

Once a routing system is enabled at a site, an updated Site Agreement must be filed before the configuration of a routing system can be significantly altered. In addition to any restrictions noted in the Site Agreement, the following restrictions apply:

-  Caution: Federal law restricts this device to use by or on the order of either a licensed practitioner or persons lawfully engaged in the manufacture or distribution of the product.
-  No modifications may be made to this software without the express written consent of the VistA Imaging National Project Manager.
-  The Food and Drug Administration classifies this software as a medical device. Modifications to the computer where this software is installed, such as the installation of unapproved hardware or software, will adulterate the medical device. The use of an adulterated medical device violates US Federal Law (21CFR820).



US Federal regulations and VA internal policy prohibit unencrypted transmission of patient information outside the VA's intranet.

## About this Manual

### Using this Manual

This document contains material of interest to several different types of users, including the types described in the table below:

User	Please read...
All users	The <a href="#">Routing Overview</a> and the <a href="#">Glossary</a> . The <a href="#">Index</a> can also be used to find information about specific topics in this document.
Clinical users	The <a href="#">Using VistARad in a Routing System</a> chapter.
Users responsible for DICOM Gateway operation and maintenance	The <a href="#">Using Routing</a> chapter. You may also find useful information in the <a href="#">Troubleshooting Routing</a> and <a href="#">Defining Routing Rules</a> chapters.
Users responsible for installing or configuring a routing system	The <a href="#">Defining Routing Rules</a> and <a href="#">Configuring Routing</a> chapters. Installation worksheets are available in <a href="#">Appendix A</a> .

### Conventions

This manual uses the following conventions:

- Windows menu options, buttons, and other controls found in a graphical user interface are indicated by **bold**. Menu sequences are indicated by vertical bars (|).
- DICOM Gateway menu options are referred to by the menu sequence used to execute that option. For example, “Run option 4-2-2 (Update Gateway Configuration Parameters)” means:
  1. In the main DICOM Gateway menu, enter 4 (System Maintenance).
  2. In the System Maintenance menu, enter 2 (Gateway Configuration).
  3. In the Gateway Configuration menu, enter 2 (Update Gateway Configuration Parameters).
- Examples are shown in the `Courier` typeface.
- Useful or supplementary information is indicated by a **Note**, and critical information is indicated by

- Keyboard keys are shown in bold and in brackets.
- Cross-references are underlined. If this document is being used online, cross-references are shown in blue and are active links.

## Revision Table

Date	Rev.	Notes
15 Apr 2010	6	Minor updates for patch 53 in Other Properties section. P53 introduced the capability to use the value of 205,45 (Origin Index) in a routing rule. General corrections and clean-up. <b>REDACTED</b>
01 Oct 2009	5	Updates for patch 54 (“if” allowable in routing rules, change to study-based, rather than image-based evaluation logic). Expand conventions section. Expand and clarify content related to DICOM Storage SCPs. Rewrite “Routing Overview” chapter. Clarify instructions in Appendix B. General corrections and clean-up. <b>REDACTED</b>
03 Apr 2006	4	Minor updates for patch 18. Change bars in margins indicate updated content. <b>REDACTED</b> (formerly rev 1.3)
30 Jul 2005	3	Updates for patches 11 and 51. Change bars in margins indicate updated content. <b>REDACTED</b> I (formerly rev 1.2)
22 Sep 2003	2	Minor p22 updates in VistARad chapter. Added info about routing rules and priority that was not included in original rev. Minor clarifications and corrections throughout. <b>REDACTED</b> (formerly rev 1.1)
20 Mar 2003	1.0	Final version for p9 release. <b>REDACTED</b>
25 Jun 2002	.9	Draft. Based on 23 Sep 1999 “Autorouting Tutorial.” Updated for Patch 9, test 2 distribution.

## Related Documents

The following documents contain additional information about routing:

- Patch Descriptions for patches 9, 11, 51, and 54
- Routing Guidance Document

The following documents contain additional information about components in the routing system:

- DICOM Gateway User Guide
- DICOM Gateway Installation Guide

- VistARad User Guide

These documents are available at **REDACTED**

# Routing Overview

---

This chapter explains how routing functions within the VistA Imaging system. It covers the following topics:

- [Routing Explained](#)
- [Routing Prerequisites](#)
- [How Routing Works](#)

## Routing Explained

In VistA Imaging, routing is the combination of methods and software used to identify and transmit exams produced at one site to a storage location at another site. Scenarios where routing can be used include the following:

- Workload sharing between institutions or service providers
- Rapid access to exams at remote clinics or other facilities
- Remote specialist interpretation or consultation
- Off-hours, holiday, or emergency services
- Off-site contract radiology services for primary interpretation

Routing is a function of the DICOM Gateway software. When properly configured, any DICOM Gateway can function as a Routing Gateway. Typically, a Routing Gateway runs on a dedicated computer. However, at sites that produce only a small volume of images, a Routing Gateway can coexist on the same computer as an Image or Text Gateway.

Routing takes two forms: automatic and on-demand.

- In automatic routing, newly acquired exams are sent to one or more destinations based on a pre-defined set of routing rules.
- In on-demand routing, manually selected exams are transmitted to one or more destinations using VistARad or DICOM Gateway option 2-8-2 (Select DICOM Images for Transmission).

Images can be routed to two different types of destinations:

- Imaging destinations, which are typically used by VistARad users for remote reading.
- DICOM Storage SCP (Service Class Provider) destinations, which are typically non-VistA Imaging components, such as a film printer or an external PACS (Picture Archiving and Communication System).

## Routing Prerequisites

For a site to be authorized to use a routing system, the following conditions must be met:

- An executed Site Agreement must be filed with the VistA Imaging HSD&D group, and an updated site agreement must be filed if the routing system is altered (for example: if site information changes, if a new destination is added, or if routing volume increases by 50% or more).
- A contingency plan must be implemented at all sites in the routing system and filed with the VistA Imaging HSD&D group. The contingency plan must contain procedures to be followed should the routing system be unavailable.

General hardware and operational requirements for routing are summarized below. For detailed information, contact your VistA Imaging Implementation Manager.

## Infrastructure Requirements

Routing relies on the following infrastructure:

- If remote interpretation is being performed, you will need one or more VistARad diagnostic workstations and sufficient VistARad-accessible storage space for routed exams.
- If compression will be used for routed images, you will need to purchase Aware JPEG2000 toolkit licenses for each system that will be transmitting or receiving compressed images. For more information about compression, see Appendix B.
- An Image Gateway and a Routing Gateway must be configured as described in this document.
- Sufficient Wide Area Network (WAN) capacity must be available to handle the anticipated volume of routed exams.

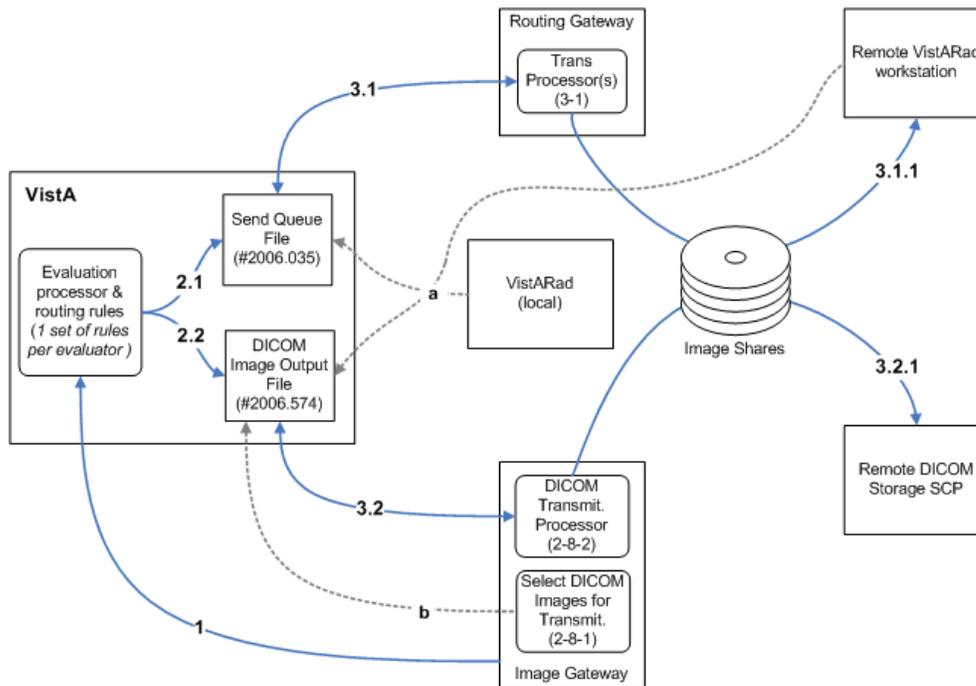
## Operational Requirements

The medical and IT management at a site implementing the routing system will need to develop policies establishing the following elements:

- Locations to which the exams may and may not be routed
- Reporting/transcription requirements for routed exams
- Bandwidth utilization guidelines and priorities
- Storage space and storage monitoring of routed exams at receiving sites
- Management of patient confidentiality and privacy issues related to routed exams
- Methods for addressing performance issues and/or misuse of the routing system

## How Routing Works

The following figure illustrates the processes used to route images both automatically and on-demand. Numbered items correspond to automatic routing steps described in the section below. Items marked with letters correspond to on-demand routing steps described on the next page.



### Automatic Routing

1. The evaluation queue is populated by one or more DICOM Image Gateways; for each new image processed by the gateway, a new entry is added to the evaluation queue.
2. The evaluation processor checks each entry in the evaluation queue against pre-defined routing rules. (The evaluation queue is part of the IMAGE BACKGROUND QUEUE File (#2006.03). Entries used by other processes are also stored in this file.)
  - 2.1. If an entry in the queue matches a routing rule for an Imaging destination (such as a remote VistARad workstation), a new entry identifying the image and the destination is added to SEND QUEUE File (#2006.035).
  - 2.2. If an entry in the queue matches a routing rule for a Storage SCP destination (such as a film printer), a new entry identifying the image and the destination is added to the DICOM IMAGE OUTPUT File (#2006.574).

3. Images are sent to their respective destinations.
  - 3.1. The transmission processor for Imaging destinations (3-1) reads the SENDQUEUE File (#2006.035).
    - 3.1.1. If an entry in the file matches one of the destinations serviced by this processor, the image is sent to the appropriate Imaging destination using information in the NETWORK LOCATION File (#2005.2).
  - 3.2. The transmission processor for DICOM Storage SCP destinations (2-8-2) reads the DICOM IMAGE OUTPUT File (#2006.574).
    - 3.2.1. If an entry in the file matches one of destinations serviced by this processor, the image is sent to the appropriate Storage SCP using information in the DICOM TRANSMIT DESTINATION File (#2006.587).

### **On-Demand Routing**

In on-demand routing, images to be routed are selected manually. Images can be selected using either of the following methods:

- a. Using the Route Request dialog in VistARad (security key required). Using this method, exams can be sent to both Imaging destinations and Storage SCP destinations. This method can also be used at a remote VistARad to “pull” images to itself.
- b. Using the Select DICOM Images for Transmission option (2-8-1) on the DICOM Image Gateway. Using this method, images can be sent only to Storage SCPs.

Once images are selected for routing, transmission is handled using the same process as automatic routing.

### **Automatic Routing of Prior Exams**

Automatic routing offers the option to include images from prior exams. When this option is used in a routing rule, the routing software will use the VistARad prefetch logic defined at the acquisition site to create a list of prior exams.

Images from the prior exams will be routed using the same priority as the newly acquired exam and, when appropriate, will be purged based on the same retention period as the newly acquired exam. For more details about automatically routing priors, see page [20](#).

## Priority and Routing

For automatically routed exams, the routing software uses the priority assigned in a routing rule and the clinical urgency of the exam to calculate a numeric value. Images with the highest priority value are transmitted first.

Factor	Values	Notes
Assigned priority	Low: +250	Priority is set in routing rules as described on page <a href="#">7</a> . If not explicitly set in a rule, the assigned priority is assumed to be Medium.
	Medium: +500	
	High: +750	
Clinical urgency	Routine: +0	Values are based on the clinical urgency assigned to the exam in the Radiology Package.
	Urgent: +10	
	STAT: +20	

When an exam is routed on-demand, VistARad's Route Request dialog can be used to assign a priority of Low, Medium or High. (The clinical urgency of the exam is not used.) If a user selects an exam to be routed on-demand that is already in the transmission queue, the higher priority of the two instances will be used.

Regardless of how an exam is routed, the following factors apply for determining relative priority:

- If two or more exams have the same priority, their images are processed on a First In, First Out (FIFO) basis.
- Because exams are routed on an image-by-image basis, it is possible for the images in a lower-priority exam to be interrupted mid-stream by the images in a higher-priority exam. If this happens, transmission of all lower-priority images will resume after transmission of all higher-priority images is complete.

## Remote Reading with VistARad

A properly configured VistARad workstation can be used to display and interpret exams routed from another site. Radiologists performing remote reading can use VistARad to log into the site that sent the routed exams, and then use VistARad's exam lists to locate exams that have been routed to them. For additional information about working with routed exams, refer to page [59](#).

## Image Handling for DICOM Storage SCPs

When an image is routed to a DICOM Storage SCP, the transmission processor (2-8-2) determines if a DICOM-format image is available to route. If there is no DICOM-format image available, a DICOM-format image is reconstructed using available Targa files,

associated text files, and the latest demographic data from VistA. The resulting image is then sent to the Storage SCP. The reconstructed image is retained for future use.

If a DICOM-format image is already available, the header data is checked to ensure that it includes the most recent demographic data from VistA. The image is then sent to the Storage SCP.

### **Management of Routed Images**

For Imaging destinations, the amount of time routed images are retained is based on the value of the `RETENTION PERIOD` field in the applicable entry in the `NETWORK LOCATION File (#2005.2)`. The first time the destination is connected to on a given day, the transmission processor (3-1) deletes any images that have been stored longer than the retention period. The age of an image is based on the transmission queue entry for that image, not on the date of the image itself.

In general terms, any DICOM Storage SCP can have exams routed to it either automatically or on-demand. Apart from transmission logs, images routed to a DICOM Storage SCP are not tracked by the Imaging system. Retention, management, and deletion of routed images is the responsibility of the Storage SCP.

# Defining Routing Rules

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This chapter covers the following topics:

- [Routing Rules Explained](#)
- [Destinations in Rules](#)
- [Conditions](#)
- [Routing Rule Priority](#)
- [Routing Rules and Compression](#)
- [Load Balancing](#)
- [Routing Rule Tips](#)

**Note** Routing rules can be defined before the configuration of the routing system is complete, but cannot be tested until the setup of the routing system is finished.

## Routing Rules Explained

The Routing Gateway uses routing rules to determine which images are to be automatically routed and where the images are to be sent. A rules definition worksheet is located in Appendix A.

The definition of routing rules involves:

1. Determining the needs of the staff at the sending and receiving sites.
2. Determining what resources will be used at the receiving site.
3. Translating the resulting information into a rule that can be executed by the routing software.
4. Implementing the rules by importing them to a Routing Gateway.

Once they are implemented, routing rules should be reviewed periodically and adjusted to accommodate changes in workload, staffing, and so on.

## How Routing Rules Work

A routing rule must contain at least one destination and one condition. A basic routing rule looks like:

```
send("destination")
  when [condition A
        condition B...]
```

When the evaluation processor is running, each potentially routable exam is checked against all available rules. If the first image in an exam matches all the conditions in a given rule, all images in that exam will be routed to the destination specified in the rule.

Note that in earlier versions of the software, each image was evaluated individually. This meant that for some exams, such as exams containing images from two modalities, multiple rules were needed.

### Typical Routing Rules

A common routing scenario is the need to send images to a different site for interpretation.

#### Send CR images to Kansas City

```
send("KANSASCITY")
  when MODALITY="CR"
```

**send** is the most frequently used command in the “destination line” of a rule, but other commands are available as well. For details, see page [10](#).

**when** or **if** indicates the presence of one or more conditions. If a rule contains more than one condition, all of the conditions must be met for an image to be routed. (In all examples provided in this section, **when** is used.)

#### Send CR images produced in Wichita to Kansas City

```
send("KANSASCITY")
  when MODALITY="CR"
        SOURCE="WICHITA"
```

Rule conditions are described in detail on page [11](#).

**Note** Do not use spaces immediately after the **send** command, or before or after operators (=, !=, etc.).

### Operators in Rules

The most frequently used operator in a rule is =, which indicates that a specific image property must match a supplied value in a condition for a rule to apply. In the following sample rule, all CR images are sent to Kansas City:

#### Send CR images to Kansas City

```
send("KANSASCITY")
  when MODALITY="CR"
```

Other operators can also be used. The following example uses !=, indicating that all images *except* CR images should be sent to Kansas City.

#### Send non-CR images to Kansas City

```
send("KANSASCITY")
  when MODALITY!="CR"
```

Operators are described in detail on page [17](#).

### Wildcards in a Rule

Use wildcards in a rule when you want a condition to be valid for more than one value. In the example below, all images, regardless of modality, will be routed.

#### Send all images to Kansas City

```
send("KANSASCITY")
  when MODALITY="*"
```

Wildcards are described in detail on page [18](#).

### Date/Time Conditions in Rules

A rule using date/time conditions can be used to route images based on date, time of day, or type of day (such as weekday, holiday, and so on). A rule to route all CR images on certain days would look like:

#### Send CR images to Kansas City Mon and Fri

```
send("KANSASCITY")
  when MODALITY="CR"
      NOW={MON 00:01AM to 11:59PM;
          FRI 00:01AM to 11:59PM}
```

Date/time conditions are described in detail on page [18](#).

## Destinations in Rules

### send, dicom, and balance Commands

The first parameter in a routing rule is one of the following commands: **send**, **dicom**, or **balance**.

**send** is used for Imaging destinations such as remote VistARad workstations.

```
send ("KANSASCITY")  
  when MODALITY="CR"
```

**dicom** is used for DICOM Storage SCP destinations such as film printers.

```
dicom ("LaserShare")  
  when MODALITY="CR"
```

Use the **balance** command when you want to divide a pool of exams among multiple destinations (Imaging destinations only). For detailed information about using the balance command, see page [21](#).

```
balance ("DEST1 "=25%, "DEST2 "=35%, "DEST3 "=40%)  
  when MODALITY="CR"
```

**Note** Do not use spaces between the **send**, **dicom**, or **balance** commands and the left parenthesis in the first line of a rule. If a space is present, the rule will not work.

### Specifying Destinations

In a rule, destinations are always indicated by parentheses. While quotation marks are required only if a destination name contains spaces or other special characters, it is recommended that quotation marks be used all the time for consistency.

```
send ("KANSASCITY")  
  when MODALITY="CR"
```

To automatically route similar exams to multiple destinations, multiple rules would be used, as shown below:

```
send ("KANSASCITY")
    when MODALITY="CR"

send ("LASERSHARE")
    when MODALITY="CR"
```

The destination specified in a rule must be a valid Imaging destination (such as a VistARad workstation) or a valid DICOM Storage SCP destination (such as an external PACS or film printer). Destinations are described in more detail on pages [25](#) and [35](#).

## Conditions in Rules

In routing rules, a condition is a comparison between a particular image property and a user-supplied value. The results of the comparison determine whether or not the rule will be applied to an image.

A single `when` statement precedes all conditions in a rule. (Optionally, `if` can be used instead of `when`.)

```
send ("KANSASCITY")
    when MODALITY="CR"
        SOURCE="WICHITA"
```

A routing rule can contain multiple conditions. (When defining multiple conditions for a rule, list the most restrictive condition first. This will minimize the amount of time needed to process the rule.)

After the `when` (or `if` statement), each condition must be rendered as:

`<property><operator><value>` where:

- `<property>` is one of the known attributes of an image. Properties that can be used in a condition are listed the following section.
- `<operator>` is a code for a type of comparison. Operators are described on page [17](#).
- `<value>` is supplied by the user, and specifies what is being tested in the condition. Values are described on page [18](#).

## Properties

The properties listed in this section can be used in routing rule conditions.

**Note** While property names are not case-sensitive, property names are typically rendered in upper case.

### Frequently Used Properties

#### MODALITY

Abbreviation for the type of modality. Possible values are listed below. Retired values are indicated by (ret).

AS Angioscopy (ret 2007)	FS Fundoscopy (ret 2007)	PT Positron emission tomography (PET)
AU Audio	GM General Microscopy	PX Panoramic X-Ray
BI Biomagnetic imaging	HC Hard Copy	REG Registration
BDUS Bone Densitometry (Ultrasound)	HD Hemodynamic Waveform	RF Radio Fluoroscopy
BMD Bone Densitometry (X-Ray)	IO Intra-oral Radiography	RG Radiographic imaging (conv. film/screen)
CD Color flow Doppler	IVUS Intravascular Ultrasound	RTDOSE Radiotherapy Dose
CF Cinefluorography (ret)	KO Key Object Selection	RTIMAGE Radiotherapy Image
CP Culpscopy (ret 2007)	LP Laparoscopy (ret 2007)	RTPLAN Radiotherapy Plan
CR Computed Radiography	LS Laser surface scan	RTRECORD RT Treatment Record
CS Cystoscopy (ret 2007)	MA Magnetic resonance angiography (ret 2007)	RTSTRUCT Radiotherapy Structure Set
CT Computed Tomography	MG Mammography	SC Secondary Capture (VA addition)
DD Duplex Doppler	MR Magnetic Resonance	SEG Segmentation
DF Digital fluoroscopy (ret)	MS Magnetic resonance spectroscopy (ret 2007)	SM Slide Microscopy
DG Diaphanography	NM Nuclear Medicine	SMR Stereometric Relationship
DM Digital microscopy (ret 2007)	OCT Optical Coherence Tomography	SR SR Document
DOC Document	OP Ophthalmic Photography	ST Single-photon emission computed tomography (SPECT)
DS Digital Subtraction Angiography (ret)	OPM Ophthalmic Mapping	TG Thermography
DX Digital Radiography	OPR Ophthalmic Refraction	US Ultrasound
EC Echocardiography (ret 2007)	OPT Ophthalmic Tomography	VF Videofluorography (ret)
ECG Electrocardiography	OPV Ophthalmic Visual Field	VL Visible Light (not an official code)
EPS Cardiac Electrophysiology	OT Other	XA X-Ray Angiography
ES Endoscopy	PR Presentation State	XC External-camera Photography
FA Fluorescein angiography (ret 2007)		

#### NOW

Date and time that the rule is being processed. For more information, see page [18](#).

#### SOURCE

Name of the site that originally acquired the image. The value for this field is determined as follows:

- If the ACQUISITION SITE field (#2005, .05) for an image entry contains a value, this value is considered the source. (For images acquired after Patch 11, ACQUISITION SITE is populated based on the value of Institution Name in

Instrument.dic. For images acquired before Patch 11, ACQUISITION SITE is not populated.)

- If there is no value for ACQUISITION SITE, the credentials of the user are checked. If a value is defined for the current division (i.e., the location code for the DICOM Gateway from which the evaluation processor was started), the number of this division will be used.
- If the division number cannot be derived from a user's credentials, the KERNEL SITE PARAMETER field for the number of the institution will be used.

#### **Other Properties**

##### **ABSTRACT\_REF**

The network storage location of the image abstract.

##### **ACQUISITION\_DEVICE**

The name of the device that generated the image as defined in the ACQUISITION DEVICE File (#2006.04), see **Note** below.

##### **BIG\_JUKEBOX\_PATH**

Full file path on jukebox for .BIG images.

##### **BIG\_MAGNETIC\_PATH**

Full file path for .BIG images. This field indicates on which magnetic server this file resides.

##### **CLASS**

The class of the image, as stored in the CLASS INDEX field (#2005, 41). Typical values are CLIN, ADMIN, CLIN/ADMIN, and ADMIN/CLIN, see **Note** below.

##### **CLINIC**

If an image is associated with a patient encounter (visit), the value of this parameter is the name of the clinic where the appointment occurred.

##### **DESCRIPTIVE\_CATEGORY**

This is mainly for Document Imaging; it further describes the type of document image.

##### **EXAM\_TIME**

Used to compare the date/time of the procedure to a user-supplied value. For more information about date/time-based comparisons, see page [18](#).

**Note** In older versions of the software, variations of this property (EXAM\_TIME\_FIRST, EXAM\_TIME\_LAST) could be used to base the comparison on the newest or oldest image in an exam. The current version of the software evaluates the first image encountered only, so all variations of this property are handled the same way.

**EXPORT\_REQUEST\_STATUS**

The value of this field, if defined, indicates if MailMan will send or has sent the image to another site. There are two possible values:

- 1 = EXPORT REQUESTED
- 0 = EXPORTED

**FILE\_REF**

The unique filename of the image, as stored on the magnetic server and/or jukebox.

**IMAGE\_SAVED**

Used to compare the date/time of the image capture to a user-supplied value. For more information about date/time-based comparisons, see page [18](#).

**Note** In older versions of the software, variations of this property (`IMAGE_SAVED_FIRST`, `IMAGE_SAVED_LAST`) could be used to base the comparison on the newest or oldest image in an exam. The current version of the software evaluates the first image encountered only, so all variations of this property are handled the same way.

**IQ**

Indicates if an image has questionable integrity, as specified in the IQ field (#2005, 13). This field is either empty or equal to YES. Note that images with questionable integrity may not be displayed by the software on the receiving system. (In VistARad, a warning is displayed if a user opens an image with questionable integrity.)

**LAST\_ACCESS**

Used to compare the date/time of an image's last access to a user-supplied value. For more information about date/time-based comparisons, see page [18](#).

**Note** In older versions of the software, variations of this property (`LAST_ACCESS_FIRST`, `LAST_ACCESS_LAST`) could be used to base the comparison on the newest or oldest image in an exam. The current version of the software evaluates the first image encountered only, so all variations of this property are handled the same way.

**MAGNETIC\_REF**

The path for the network location of the stored image.

**MICROSCOPIC\_OBJECTIVE**

Free text description of the Microscopic Objective selected by the pathologist.

**OBJECT\_NAME**

The natural language name for the image, usually consisting of the patient name, social security number, and image description.

**OBJECT\_TYPE**

The object type (such as still image, black and white image, or x-ray) as described in the OBJECT TYPE File (#2005.02).

**ORIGIN\_INDEX**

The field indicates the source of image. There are five possible values:

D = DoD

F = Fee-basis study ordered by VA to be performed at a contract facility

N = Other

V = VA

<null> = VA

**PACKAGE**

An abbreviation for the name of the package that the image is attached to, as defined in the PACKAGE INDEX field (#2005, 40). Possible values are: RAD, LAB, MED, NOTE, CP, SUR, PHOTOID, NONE, or CONS.

**PACS\_PROCEDURE**

The name that identifies the procedure in the radiology reports file.

**PACS\_UID**

The unique 26-character image identifier of the PACS image.

**PARENT\_DATA**

The name of the file that contains the "Parent Data." See also

PARENT\_DATA\_FILE\_IMAGE\_POINTER, PARENT\_GLOBAL\_ROOT\_D0 and  
PARENT\_GLOBAL\_ROOT\_D1.

**PARENT\_DATA\_FILE\_IMAGE\_POINTER**

In the file identified by "Parent Data," a multiple-valued field may exist that identifies groups of images. When there is such a "multiple," the value of this parameter is the entry number in this multiple that points back to the parent image of the current image.

**PARENT\_GLOBAL\_ROOT\_D0**

The internal entry number in the file identified by PARENT\_DATA.

**PARENT\_GLOBAL\_ROOT\_D1**

The value of this parameter is defined only for laboratory images to record the third subscript of ^LR(D0,"SP",D1) as a backward pointer for use in report display and image deletion.

**PATH\_ACCESSION\_NUMBER**

The Anatomic Pathology accession number — the identifying number for the slide.

**PATIENT**

The name of the patient.

**PROCEDURE**

An abbreviation for the procedure as stored in the PROCEDURE field (#2005, 6).

Typical values are COL for colonoscopy, SUR for surgery, SP for surgical pathology, or XRAY for radiology.

**PROCEDURE\_OR\_EVENT**

The name of the procedure or event for which the image was created, as stored in the PROC/EVENT INDEX field (#2005, 43), see **Note** below..

**PROCEDURE\_TIME**

This property works the same way as EXAM\_TIME, described earlier in this section.

**RADIOLOGY\_REPORT**

The name of the Radiology Report associated with the image.

**SAVED\_BY**

The name of the person who logged in to capture the image.

**SHORT\_DESCRIPTION**

A one-line description of the image or object record.

**SPECIALTY**

The specialty (or sub-specialty) for which the image was acquired, as stored in the SPEC/SUBSPEC INDEX field (#2005, 44), see **Note** below..

**SPECIMEN**

The specimen number of the slide given in the LAB DATA File (#63).

**SPECIMEN\_DESCRIPTION**

The description given to the specimen in the LAB DATA File (#63).

**STAIN**

Free text description of the Histological Stain.

**SUMMARY**

A flag that indicates whether or not the image functions as a summary for a group. The value of this property is either empty, or equal to 0 (NO) or 1 (YES).

**TRACKING\_ID**

The package that performed the Import (value looks like package name : ID-code).

**TYPE**

The type of image, as stored in the TYPE INDEX field (#2005, 42). Typical types are IMAGE, DIAGRAM, CONSENT, etc., see **Note** below.

**URGENCY**

A code indicating the clinical urgency of the exam. Possible values are ROUTINE, URGENT, and STAT.

**WORM\_REF**

The network location of the jukebox platter where the image is stored (provided there is a jukebox in the Imaging system).

**Note** There is a problem with the keywords ACQUISITION\_DEVICE, CLASS, PROCEDURE\_OR\_EVENT, SPECIALTY and TYPE. The documentation says that the name of the referenced entry should be used. The name matching for these keywords does not work and the pointer value in the IMAGING file (#2005) must be used for matching instead. This problem will be corrected in a later patch so that the name of the reference entry can be used for matching, instead of having to use the pointer value.

The following table shows the referenced file that is used to determine the value of the pointer that is needed for the match.

Property Name	Field #	Referenced File
ACQUISITION_DEVICE	107	2006.04
CLASS	41	2005.82
PROCEDURE_OR_EVENT	6	2005.85
SPECIALTY	44	2005.84
TYPE	42	2005.83

You must use FileMan to determine the number that must be used for the match. This example shows how to do this for CLASS.

```
DVA>D P^DI
```

```
VA FileMan 22.0
```

```
Select OPTION: PRINT FILE ENTRIES
```

```
OUTPUT FROM WHAT FILE: IMAGE// 2005.82  IMAGE INDEX FOR CLASS
(4 entries)
```

```
SORT BY: NAME//
```

```
START WITH NAME: FIRST//
```

```
FIRST PRINT FIELD: NAME
```

```
THEN PRINT FIELD: NUMBER
```

```
THEN PRINT FIELD:
```

```
Heading (S/C): IMAGE INDEX FOR CLASS LIST  Replace
```

```
DEVICE:  HERE
```

```
IMAGE INDEX FOR CLASS LIST
```

```
FEB 26, 2010
```

```
07:46  PAGE 1
```

```
NAME  NUMBER
```

```
-----
```

```
ADMIN 8
```

```
ADMIN/CLIN 9
```

```
CLIN 1
```

```
CLIN/ADMIN 7
```

```
Select OPTION:
```

If you wanted to match on “CLIN”, you would have to match on the number 1, that is CLASS=1.

(In a later patch, once the problem has been corrected, the match will use the name instead of the number, like CLASS="CLIN".)

## Operators

The following operators can be used in routing rule conditions:

Operator	Image property must...
=	Match value in rule.
!=	Not match value in rule.
<	Be less than a numeric value in rule. For date/time values, this operator can be used for "earlier than."
>	Be greater than a numeric value in rule. For date/time values, this operator can be used for "later than."
<=	Be less than or equal to a numeric or date/time value in rule.
>=	Be greater than or equal to a numeric or date/time value in rule.

**Note** When operators are used, spaces between the operator and the operand are not allowed.

## Values

Values are the user-supplied part of a routing rule condition. Most values are text strings.

Values are typically enclosed in quotation marks ("). If a value contains both upper and lowercase characters, or if it contains punctuation marks or spaces, quotation marks are required.

Two types of wildcard characters can be used in routing rules: the asterisk (\*) and the question mark (?). The question mark allows one single character in a value to be "any character." The asterisk allows one or more characters to be "any character."

## Values for Date/Time Properties

When a condition based on date and time is used, the supplied value must adhere to FileMan conventions. Values for date/time conditions are presented as a range enclosed in braces { }.

The most frequently used date/time property is `NOW`. `NOW` can be used to select the times that a staff member will be present by specifying certain days and times of day.<sup>1</sup> Note that all day abbreviations use the first three letters of the day name (Thursday = Thu).

**Send CR images to Kansas Mon/Wed/Fri**

```
send ("KANSAS")
  when MODALITY="CR"
    NOW={MON 08:00AM to 17:00PM;
        WED 08:00AM to 15:30PM;
        FRI 08:00AM to 17:00PM}
```

Date/time properties can also be used to specify holidays. In this context, holidays are those days that are marked as such in the sending site's HOLIDAY File (#40.5). A rule to send images on holidays would be specified as:

**Send CR images to Kansas on Holidays**

```
send ("KANSAS")
  when MODALITY="CR"
    NOW={ HOLIDAY }
```

Date/time ranges use a 24-hour clock. While use of AM or PM indicators is not required they can be useful when the hours specified are 0:00 AM (midnight) and 12:00 PM (noon).

When the routing software compares a date/time property in an image entry to a specified value, the date/time value is broken into components:

Day of week	Hour
Day of month	Minute
Month	Second
Year	

The use of each component in an actual comparison depends on the specified value.

<sup>1</sup> The actual value of `NOW` is the moment when the rule is evaluated.

## Routing Rule Priority

Automatically routed exams are assigned a default priority of Medium. This priority can be changed by adding a **priority** statement after the conditions for the rule.

### — Prioritize images based on destination

```
send ("KANSAS")
  when MODALITY="CT"
  priority HIGH

send ("BACKUP")
  when MODALITY="CT"
  priority LOW
```

In addition to the priority that is derived from routing rules, the clinical urgency of an exam is taken into account for automatic routing. For more information, see [page 5](#).

## Routing Images from Prior Exams

Images from prior exams can be automatically routed by adding a **priorstudy** statement after the conditions for the rule.

### — Include prior studies

```
send ("KANSAS")
  when MODALITY="CT"
  priorstudy YES
```

When **priorstudy** is set to YES, images from prior exams will be included based on routing-specific settings in the MAG RAD PRIOR EXAMS LOGIC File (#2006.65). Settings in this file are described in detail on [page 37](#).

**Note** Only priors acquired at the same site as the current exam can be automatically routed.

When **priorstudy** is set to NO, or if the **priorstudy** statement is absent, images from prior exams will not be included.



Using **priorstudy** in a routing rule can significantly increase network traffic. If a rule of this sort is implemented, be sure to monitor the network to ensure no problems arise.

## Routing Rules and Compression

Images routed to Imaging destinations (such as a VistARad workstation) can be compressed if the destination is set up as described in Appendix B. Images routed to DICOM Storage SCP destinations cannot be compressed.

While the use of compression is dictated by a destination's definition, rather than by routing rules, you will need to set up two rules if you want to route both compressed and uncompressed images. You will also need to set up two destinations in the NETWORK LOCATION File (#2005.2).

The definitions of the two destinations in the NETWORK LOCATION File will be the same, except for the destination name and the setting for compression.

The rules would also be the same, except for the destination name.

```
send("Sample")
    when MODALITY="MR"

send("Sample_Compressed")
    when MODALITY="MR"
```

This will allow both compressed and uncompressed images to be sent to the same destination.

## Load Balancing

The **balance** command can be used when you want to divide a pool of exams across multiple destinations. All destinations must be Imaging destinations (not DICOM Storage SCP destinations), and the total value of the percentages specified in the command must equal 100 percent.

```
balance("DEST1"=25%, "DEST2"=35%, "DEST3"=40%)
    when MODALITY="CR"
```

The balance command can also be used to route some exams and not others. In the sample rule below, 75% of the exams are not routed, while the remaining 25% are sent to KANSASCITY.

```
balance(<local>=75%, "KANSASCITY"=25%)
    when MODALITY="CR"
```

When the **balance** command is used, two things determine which destination receives a given exam: the percentages specified in the rule and internal counters set by the routing software.

The first time a load balancing rule is applied, the routing software begins distributing exams the same way a deck of cards is dealt: the first destination receives one exam, the second destination receives the next exam, and so on. Exams are evenly distributed until the destination with the lowest value specified in the **balance** command has received its allotted percentage of exams. Then that destination is skipped until the counter resets. Since load balancing is based on percentages, the counter is reset each time 100 exams have been sent.

For example, if a rule specifies...

```
balance ("DEST1"=10% , "DEST2"=40% , "DEST3"=50%)  
  when MODALITY="CR"
```

- The first 30 exams will be distributed evenly, with each destination receiving 10 exams. After `DEST1` has received 10 exams, `DEST1` is skipped until the counter resets.
- The next 60 exams are split evenly between `DEST2` and `DEST3` until `DEST2` and `DEST3` each have 40 exams. `DEST2` now has its allotment of 40 exams, and will be skipped until the counter resets.
- The remaining 10 exams are sent to `DEST3`, giving that destination a total of 50 exams.
- Once 100 exams have been sent, the routing software resets its counters to zero, and starts distributing exams to all three destinations again.

### Resetting the Load Balancing Counter

When routing rules are imported, the counters used for load balancing are all reset to zero. You can take advantage of this trait if you need to fine-tune or troubleshoot situations where load balancing is used. Note that it is not necessary to change routing rules to achieve this; you only need to re-import them.

## Routing Rule Tips

The following tips may be useful while creating or editing routing rules:

- When defining multiple conditions for a rule, list the most restrictive condition first. This will reduce the amount of time needed to process the rule.

- The number symbol (#) can be used for comments, or to disable a rule. When disabling a rule, precede each line in the rule with #.
- For rules that serve DICOM Storage SCP destinations, use **dicom** instead of **send**.
- Either **when** or **if** can be used to set up comparisons in a routing rule.
- Make sure that there are no spaces between operators (described on page [17](#)) and other parameters in a rule.

When rules are imported as described on page [41](#), the routing software will check the syntax used and will report on any problems detected.

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# Configuring Routing

---

**This chapter assumes that routing software has been installed, and that an initial set of routing rules has been defined.**

This chapter explains how to configure a routing system. The following table lists the configuration tasks described in this chapter.

Configuration Task	Performed By	See Page...
Set up Imaging destinations	All sites involved	<a href="#">24</a>
Set up DICOM Storage SCP destinations	All sites involved	<a href="#">35</a>
Review/edit route priors logic	Sending site	<a href="#">37</a>
Image Gateway configuration	Sending site	<a href="#">40</a>
Routing Gateway configuration	Sending site	<a href="#">41</a>
Import routing rules	Sending site	<a href="#">41</a>
VistARad site parameter setup	Sending site	<a href="#">44</a>
VistARad workstation setup	Receiving site	<a href="#">45</a>
Alter configuration in response to changes in routing system	All sites involved	<a href="#">46</a>

A configuration checklist is also available in [Appendix A](#).

## Defining Imaging Destinations

An Imaging destination (such as a remote VistARad workstation) is defined by creating an entry in the NETWORK LOCATION File (#2005.2), and implemented by creating a target folder and share where the routed images will be stored.

Before you begin, you should establish naming conventions that are agreed upon by the sending and receiving sites.

A destination definition worksheet is located on page [69](#).

## Naming Conventions for Imaging Destinations

The values that identify an Imaging destination are stored in the NETWORK LOCATION File (#2005.2) at the site where the Routing Gateway is installed.

Before an Imaging destination is established, the sending and receiving sites need to decide how to identify themselves.

Description	Notes	Field
The "official" destination name	Used to identify the destination in routing rules. Also specified at VistARad workstations that will be accessing routed images.  Cannot match any other name in the NETWORK LOCATION File or in the DICOM TRANSMIT DESTINATION File (#2006.587).  Up to 30 characters, no spaces or punctuation.	Network Location (#2005.2,.01)
The computer and share name at the receiving site	The name used should be meaningful to both the sending and receiving sites.  Up to 63 characters, may contain any valid machine/share syntax.	Physical Reference (#2005.2,1)
Destination as reported to VistARad users	Used in the RC column of VistARad's exam lists.	Site (#2005.2,25)

The example on the next page illustrates how the key values in the NETWORK LOCATION File would be used in a sample routing system.

## A Sample Routing System for Imaging Destinations

Images are routed from the main hospital (VAMC1) to two different destinations. One of the destinations is an affiliated university that provides after-hours radiology coverage. The other destination is the office of a radiologist who provides consultations for ultrasound exams.

### NETWORK LOCATION File entries at VAMC1 (partial entries; other fields excluded)

```
Name (#2005.2,.01): UNI TELERAD
Phys. Ref. (2005.2.1): \\10.132.xxx.001\ROUTING$\
Site (#2005.2,25): UNI TELE
```

```
Name (#2005.2,.01): CONSULT US
Phys. Ref. (2005.2.1): \\10.132.xxx.002\ROUTING$\
Site (#2005.2,25): CON US
```

### Routing rules at VAMC1

```
send("UNI TELERAD")
  when MODALITY="*"
    URGENCT=STAT
    NOW={MON 08:00PM to 11:59PM; TUE 12:00AM to 03:59PM;
        TUE 08:00PM to 11:59PM; WED 12:00AM to 03:59PM;
        WED 08:00PM to 11:59PM; THU 12:00AM to 03:59PM;
        THU 08:00PM to 11:59PM; FRI 12:00AM to 03:59PM;
        FRI 08:00PM to 11:59PM; SAT 12:00AM to 03:59PM;
        SAT 08:00PM to 11:59PM; SUN 12:00AM to 03:59PM;
        SUN 08:00PM to 11:59PM; MON 12:00AM to 03:59PM;

send("CONSULT US")
  when MODALITY="US"
```

### Setup at affiliated university

```
Storage folder share name: \\10.132.xxx.001\ROUTING$\
VistARad CacheLocationID: UNI TELERAD
Exam source in VistARad RC column: UNI TELE
```

### Setup at offsite ultrasound specialist's office

```
Storage folder share name: \\10.132.xxx.002\ROUTING$\
VistARad CacheLocationID: CONSULT US
Exam source in VistARad RC column: CON US
```

## Storage Folders for Imaging Destinations

This section explains how to create and verify a folder for an Imaging destination on a Windows-based server. The folder will be used as the storage location for routed images at a receiving site, and will be referenced in the NETWORK LOCATION File (#2005.2) entry that defines the destination.

### Folder Prerequisites

- Determine which credentials (user name and password) will be used by the routing software to access the storage folder. The routing software must have full access to the folder.
  -  Receiving sites need to establish a procedure by which user name/ password changes can be implemented without affecting routing. Unannounced password changes are a major cause of routing problems.
- The sending site should work with the receiving site to estimate the amount of storage space needed based on the anticipated volume of transmitted images and the planned retention period.

### Folder Creation

When the folder to be used as an Imaging destination is established, the receiving site will need to choose a logical folder name and share name. The share name will ultimately be referenced in the *sending* site's NETWORK LOCATION File.

### Creating and sharing a folder to be used as an Imaging destination

1. Log in as an Administrator to the computer where you will be creating the folder, and start Windows Explorer.
2. Select the drive (or folder) in which you want to create the new folder.
3. Click **File | New | Folder**. After the new folder appears in the right side of the Explorer window, type the name of the new folder and press **<Enter>**.
4. Right click the new folder, then click **Sharing**.
5. On the **Sharing** tab, click the **Sharing and Security** option, then enter the share name you want used for the folder.
  - To minimize DNS issues, use the IP address instead of the computer name.
  - The combined string identifying the computer and the shared folder cannot be more than 63 characters long.

- It is recommended that you make the folder a hidden share by adding a dollar sign (\$) to the end of the share name. A hidden share will be accessible by the routing software, but will not be visible to users browsing your network.
6. After typing the share name, click **Permissions**.
  7. In the Permissions dialog, click **Add**, then select the user group/user name that the routing software will use to access this folder.
    - Include the user name and password for the user you choose in the NETWORK LOCATION File entry that references this folder.
    - Use the domain name as well as the user name. Example: `VHAIS\VHAKANIU` (note the absence of leading backslashes).
  8. After adding the “routing user,” set the access type for the routing user to **Full**.
  9. In the list of users allowed to access the folder, click the **Everyone** user group, then click **Remove**.
  10. When you have finished, click **OK** to apply your changes and to close the Properties dialog.
  11. Notify the sending site that the folder is available, and provide the site with the share name, user name and password.

#### **Folder Verification**

The sending site will need to verify that the folder can be remotely accessed and that files can be copied to and deleted from the folder.

#### **Verifying a folder using Windows Explorer**

1. On the computer you will be using to test the folder, log in as an Administrator and then start Windows Explorer.
2. In Windows Explorer, click **Tools | Map Network Drive Hash Subdirectory:** <set as appropriate for your site> (value is Yes).
3. In the Map Network Drive dialog, enter the drive letter, path, and user name (including domain name) that the routing software will be using. Then click **OK**.
4. When prompted, enter the password that will be used by the routing software, then click **OK**.

5. Select the folder to which you just mapped, copy a test file into the folder, and delete the file. If the file is successfully copied and deleted, the routing software should be able to use the folder.
6. Disconnect the mapped drive.

**Note** If you cannot map the folder, use the next set of steps below to provide more detailed information about the problem you are encountering.

### Verifying a folder using the command line

1. Log in as an Administrator to the computer you will be using to test the folder.
2. Open a command prompt window (choose **Start | Run**, then enter **cmd**).
3. Enter the following command to map the folder to a local drive. Parameters shown in bold will need to be replaced with valid values established by the receiving site.

```
> net use x: \\VHAxxxxxx\sharename\ password /u:username
```

4. After mapping the drive, copy a test file to the folder, and then delete the file. If the file is successfully copied and deleted, the routing software should be able to use the folder.

```
> copy any.file x:\<path>
> delete x:\<path>\any.file
```

5. When you are satisfied that the above parameters can be used to successfully access the folder, delete the test file, then terminate the test connection.

```
> net use x: /delete
```



Be sure to terminate the test connection. Letting a connection linger may prevent the routing software from establishing its own connection to the folder.

## Imaging Destination Definition

### Imaging Destination Definition using FileMan

The following steps explain how to create an Imaging destination using FileMan. For information about values for specific fields, refer to page [31](#). A destination definition worksheet is also located on page [69](#).

### Editing the NETWORK LOCATION File at the sending site

1. Log into the VistA Hospital Information System.
2. Use FileMan to select the NETWORK LOCATION File (#2005.2) for editing.

```
Select OPTION: E ENTER OR EDIT FILE ENTRIES

INPUT TO WHAT FILE: 2005.2 NETWORK LOCATION (7 entries)
EDIT WHICH FIELD: ALL// <Enter>
```

3. When you are prompted to select a network location, enter the name that you want used for the destination.

```
Select NETWORK LOCATION: TESTDEST
Are you adding 'TESTDEST' as a new NETWORK LOCATION (the 11TH)?
No// YES
```

**Note** The name must be entered in uppercase, cannot contain punctuation or spaces, and must be unique.

4. Skip the prompt for PLACE. This field is not used for routing purposes.
5. At the next prompt, enter the computer name and share name specified for the destination.

```
PHYSICAL REFERENCE: \\VHAxxxxxx\images$\
```

6. At each new prompt, enter the desired values for each field. Be sure to enter Y at the ROUTER prompt.

**Note** Typical values for a routing destination are shown below. For more detailed information about a particular field, enter "?" at the prompt, or refer to the next section.

```
...
STORAGE TYPE: MAG MAGNETIC
TOTAL SPACE: <blank>
SPACE USED: <blank>
FREE SPACE: <blank>
OPERATIONAL STATUS: 1 On-Line
HASH SUBDIRECTORY: <set as appropriate for your site>
ABSTRACT: N No
FULL: Y Yes
BIG: Y Yes
TEXT: Y Yes
DICOM: N No
```

```

COMPRESSION: <blank or J2K>
USER NAME: <Use the "routing user name" here>
PASSWORD: <Use the "routing password" here>
MAINTAINCONNECTION: <blank>
MAX # RETRY ON CONNECT: 3
MAX # RETRY ON TRANSMIT: 5
SYNTAX: U UNC
SUBDIRECTORY: <blank>
Select USER <blank>
RETENTION PERIOD: 5
LAST PURGE DATE: <set by routing software>
SITE: <set as appropriate for your site>
ROUTER: Y YES
TIME OFFLINE: <blank>
MUSE SITE #: <blank>
MUSE VERSION #: <blank>

```

### Imaging Destination Definition using the Background Processor

The Background Processor software can also be used to define an Imaging destination in the NETWORK LOCATION File (#2005.2). (In the Background Processor, choose **Edit | Network Location Manager**). A destination definition worksheet is also located on page [69](#).

### Imaging Destination Values

Fields in the NETWORK LOCATION File are described below. These fields are listed in the order that they are defined in the file, and their descriptions assume that a routing destination is being defined.

#### NETWORK LOCATION

This field serves as the destination name for the location where image files will be sent, and is used in routing rules. The routing software will accept uppercase alphanumeric characters, but will not accept values that use lowercase characters or other punctuation marks.

#### PLACE

Not used for routing.

#### PHYSICAL REFERENCE

This field identifies the physical network location where routed images will be stored. This value must contain the computer name and the share name of the directory where routed images will be stored.

```

\\ISWIMG01\IMAGE1$\
\\TeleRad\Wichita$\

```

This value must be entered using UNC (Universal Naming Convention) standards. This field is limited to 63 characters in length, and must end in a backslash (\).

**TOTAL SPACE, SPACE USED, FREE SPACE**

These fields are not used for routing.

**OPERATIONAL STATUS**

The value for this field can be 0 (off-line) or 1 (on-line). The routing software will set this value appropriately as it is operating. When no connection can be established, the routing software will set this field to 0 (off-line). Once this field is set to 0, the routing software will not attempt to reach the storage location referenced in this entry for 15 minutes. After 15 minutes have passed, the routing software will reset this field to 1 and then try to connect again.

**STORAGE TYPE**

The value of this field describes the media type for the storage location identified above. For routing destinations, the value will be `MAGNETIC`.

**HASH SUBDIRECTORY**

The value of this field determines if routed image files are stored in one single directory (value is `Yes`), or in a hierarchy of directories (value is `Yes`). This value should be set based on the needs of your site.

**ABSTRACT**

The value of this field indicates whether or not “abstract” files should be transmitted to this destination. Abstract files (also known as thumbnail or icon files) are used by Clinical Display workstations.

**FULL**

Set to `Yes` for routing. The value of this field indicates whether or not “full” files should be transmitted to this destination. Full files contain the complete image, potentially at a reduced resolution. (If an image is stored in DICOM format, the “full” file is a DICOM file, not a Targa file.)

**BIG**

Set to `Yes` for routing. The value of this field indicates whether or not “big” files should be transmitted to this destination. Big files contain the complete image, always at the original resolution.

**TEXT**

Set to `Yes` for routing. The value of this field indicates whether or not text files should be transmitted to this destination. Text files contain the header information from the original DICOM file.

**DICOM**

Do not use.

**COMPRESSION**

A code that indicates which type of compression will be used for routed images. When the value of this field is equal to “J2K”, JPEG 2000 compression will be

applied before the file is transmitted. When the value of this field is None, or if the field is empty, no compression will take place. All images that are sent to the destination will be treated in the same fashion, that is: either compressed or uncompressed.

**Note** If compressed images are to be sent to a VistARad workstation, the MAG\_Decompressor software will need to be installed on the workstation. See Appendix B for more information.

**Note** You will need to purchase an Aware JPEG2000 Toolkit **client** license for each system that is receiving routed images. (Even if that system serves as a centralized temporary storage for multiple workstations, only a single client license is needed). For each system (DICOM Gateway) that is transmitting compressed routed images, you will need to purchase an Aware JPEG2000 **server** license. For more information, contact Clinical Project Support.

**USER\_NAME**

The user name of the account that the routing software will use to log into the shared folder defined in the PHYSICAL\_REFERENCE field.

**PASSWORD**

The password of the account that is used by the routing software to log into the destination. The password is case-sensitive and is stored in an encrypted format.

**MAINTAINCONNECTION**

This field is not used for routing, and should be left blank.

**MAX # RETRY ON CONNECT**

Indicates the maximum number of successive attempts that will be made by the routing software to connect to a destination. A typical value is three attempts. If a successful connection cannot be made, the destination will be marked "off-line." After 15 minutes, the destination will be marked "on-line," and the routing software will begin trying to connect to this destination again.

**MAX # RETRY ON TRANSMIT**

Indicates the maximum number of successive attempts the routing software will make to transmit a file to this destination. A typical value is five attempts. If the transmission fails after the defined number of attempts, the entry for the image in the transmission queue will be marked as failed. (There is a Routing Gateway menu option to re-transmit failed queue entries.)

**SYNTAX**

Indicates the format for the name of the physical location. Currently, only UNC (Universal Naming Convention) is accepted.

**SUBDIRECTORY**

Typically, this field is left blank. The value of this field determines if a subdirectory (under the directory specified in `PHYSICAL REFERENCE`) should be used to store files for this destination. If hashing is turned off, all transmitted files will be stored in the subdirectory specified in this field; if hashing is turned on, all transmitted files will be stored in subdirectories of this subdirectory.

**Select USER**

Do not use.

**RETENTION PERIOD**

The value of this field determines the number of days routed image files are stored at this destination. A typical value is five days, the maximum value that may be set is 365 days.

Whenever a transmission processor (3-1) connects to a destination, it checks whether or not it has executed a purge for that destination on that day. If the connection in question is the first of the day and no purge has been executed yet, a purge will be initiated. During a purge, any image files older than the number of days specified by `RETENTION PERIOD` are deleted (note that files are always retained at the sending site).

**LAST PURGE DATE**

Do not change. This field is set by the transmission processor (3-1) when it executes a purge.

**SITE**

The value of this field is a code used by VistARad to identify the source of routed exams. The value of this field can be any text string. In the VistARad software, the value for this field will be shown in the RC (Remote Cache) exam list column.

**ROUTER**

The value of this field indicates whether or not the shared folder defined in the `PHYSICAL REFERENCE` field is being used as a routing destination. For routing, the value of this field must be `Yes`. Refer to the *Background Processor User Manual* for other uses of this field.

**TIME OFFLINE**

The value of this field will be filled in by the transmission processor (3-1) if it marks a destination as off-line. For more information, see `MAX # RETRY ON CONNECT`.

**MUSE SITE #, MUSE VERSION #**

These fields are not used for routing.

## Defining DICOM Storage SCP Destinations

To define a DICOM Storage SCP destination (such as a film printer or external PACS), you will need to:

- Determine the names that will be used to identify the destination and gather information about the receiving application.
- Edit the `SCU_List.dic` file, a dictionary file used by the DICOM Gateway(s).
- Use the DICOM Gateway to load the contents of `SCU_List.dic` into the local DICOM Gateway database and into the DICOM TRANSMIT DESTINATION File (#2006.587) on VistA.

A destination definition worksheet is located on page [71](#).

## Naming Conventions for DICOM Storage SCP Destinations

The first step in defining a DICOM Storage SCP destination is determining what to name the destination and how to identify the sender of DICOM images.

- The destination name can be up to 31 characters long (case-insensitive, punctuation is allowed), and must be unique. The name will ultimately be entered as the value for Application in `SCU_List.dic`.
- A title for the transmission processor (2-8-2) must be established. This value will ultimately be entered as the Calling AE in `SCU_List.dic`.

The remaining information needed to define a DICOM Storage SCP destination is determined by the system that will be receiving the routed images. This information is described in detail on page [36](#).

## Adding Storage SCP Destinations for Routing to SCU\_List.dic

This section explains how to update `SCU_List.dic` for routing, and how to load the contents of `SCU_List.dic` into the DICOM Gateway and VistA system databases. The steps below assume that a single instance of `SCU_List.dic` is used by all DICOM Gateways at a site.

1. Stop all active DICOM processes by waiting until they reach an idle state, and then terminate them.
2. On the DICOM Gateway, use a text editor to open `x:\DICOM\Dict\SCU_List.dic`, where `x` is the name of the drive used by the DICOM Gateway to store dictionary files.

3. Add the information for each Storage SCP destination as shown below (comment lines are preceded by #). Specific fields are defined in the next section.

```
# User Application List
# Format:
# line 1:App Name|Called AE|Calling AE|Destination IP Address|Socket
# line 2:|Presentation Context Name|Transfer Syntax Name
# line 3:||Transfer Syntax Name (if there are more than one)
#
MERGE EFILM|VistA_Storage|VistA_Send_Image|111.222.33.44|4006
|Modality Worklist Information Model - FIND|Implicit VR Little Endian
|Verification SOP Class|Implicit VR Little Endian
```

4. Save the file.
5. Open a terminal window and log into the DICOM Gateway software.
6. In the first menu, enter 4 (System Maintenance).
7. In the second menu, enter 2 (Gateway Configuration and DICOM Master Files).
8. In the third menu, enter 5 (Update SCU\_List.dic).
9. When you are prompted to update the file, enter Y.

```
Ready to read dictionary file "<x>:\DICOM\Dict\SCU_List.dic"? y// Y
<Enter>
```

10. The file will be updated.

## Field Definitions

Fields defined in SCU\_List.dic are described below. These fields are listed in the order that they appear in SCU\_List.dic.

### App(lication) Name

The name that will be used to identify the receiving application, and to identify the destination in a routing rule. The value for this field may be up to 31 characters long, is case-insensitive, and allows the use of punctuation.

### Called AE

The Application Entity Title of the application that is being called. The value of this field is dictated by the system that will be receiving the DICOM transmission.

### Calling AE

The Application Entity Title of the application that initiates the call (i.e., the Transmit DICOM Images to a DICOM SCP function of the DICOM Gateway). The value for

this field may be up to 16 characters in length, is case-insensitive, and allows the use of punctuation.

**Destination IP**

The TCP/IP address of the machine that will be receiving the DICOM transmission. The IP address can be numeric (123.46.57.89), symbolic (xxx.yyy.med.va.gov), or a name stored in the local “hosts” file.

**Socket**

The TCP/IP port number of the system that will be receiving the DICOM transmission.

**Presentation Context**

The name of a presentation context supported by the system that will be receiving the DICOM transmission. Refer to the current DICOM standard for a complete list of possible values.

**Transfer Syntax**

The transfer syntax supported by the system that will be receiving the DICOM transmission. There are four possible transfer syntaxes:

- Implicit VR Little Endian
- Implicit VR Big Endian
- Explicit VR Little Endian
- Explicit VR Big Endian

## Defining “Route Priors” Logic

### Verifying that Prefetch is Enabled

For priors to be included with automatically routed exams, prefetch must be enabled on VistA. Prefetch is generally enabled at sites using Vistarad.

You can verify that prefetch is enabled by checking the following settings.

- In the PROTOCOL File (#101), use FileMan to verify that MAGJ PREFETCH/SEND ORM is defined as a Subscriber to the RA REG protocol.
- In the APPLICATION PARAMETER File (#771), verify that MAGJ CLIENT is set to “Active.”

**Note** The PREFETCH ACTIVE? setting in the VISTARAD SITE PARAMETERS FILE (#2006.69) does not affect the automatic routing of priors.

For more information, refer to chapter 3 in the *Imaging System Installation Guide*.

## How Prior Exam Routing Works

The logic for automatically routing prior exams is triggered when a `prior study` statement is used in a routing rule. The baseline logic for routing priors is:

For each exam being automatically routed, also route up to one matching prior exam up to 1800 days (about five years) old.

**Note** Only priors from the same site as the current exam are considered. Priors from sites other than the current exam cannot be routed automatically (they can, however, be routed on-demand).

This logic is stored in the MAG RAD PRIOR EXAMS LOGIC File (#2006.65). This file:

- Identifies, based on procedure name/CPT (Current Procedural Terminology) code, what qualifies as a prior exam.
- Determines the maximum number and age of exams to automatically route as priors.
- Determines the maximum number and age of exams to retrieve from the jukebox for VistARad prefetch.

## Changing “Route Priors” Logic

To change the logic used for automatic routing of prior exams, you will first need to identify the procedure name/CPT code of the current exams in question. Then you will need to edit the MAG RAD PRIOR EXAMS LOGIC File (#2006.65) as described below.

**Note** Altering the settings used to identify a prior will affect VistARad’s prefetch function, as well as the auto-route priors capability. However, the settings that determine the number and age of priors to be automatically routed can be set independently from the similar settings used for prefetch.

### To change “route priors” logic

1. Log into the VistA Hospital Information System.
2. Use FileMan to select the MAG RAD PRIOR EXAMS LOGIC File (#2006.65) for editing.

```
Select OPTION: E ENTER OR EDIT FILE ENTRIES
INPUT TO WHAT FILE: 2006.65 MAG RAD PRIOR EXAMS LOGIC (288 entries)
```

3. Select fields .01, 1, 2, and 3 for editing.

```

EDIT WHICH FIELD: ALL// .01 <Enter> CURRENT CASE CPT GROUP
THEN EDIT FIELD: 1 <Enter> PRIOR CASE MATCHING CPT GROUP (multiple)
  EDIT WHICH PRIOR CASE MATCHING CPT GROUP SUB-FIELD: ALL// .01
<Enter> MATCHING CPT GROUP
  THEN EDIT PRIOR CASE MATCHING CPT GROUP SUB-FIELD: 1 <Enter>
AUTO-DISPLAY?
  THEN EDIT PRIOR CASE MATCHING CPT GROUP SUB-FIELD: 2 <Enter> DAYS
LIMIT/AUTO-DISPLAY
  THEN EDIT PRIOR CASE MATCHING CPT GROUP SUB-FIELD: 3 <Enter>
VERSION LIMIT/AUTO-DISPLAY
  THEN EDIT PRIOR CASE MATCHING CPT GROUP SUB-FIELD: <Enter>
THEN EDIT FIELD: <Enter>
STORE THESE FIELDS IN TEMPLATE: <Enter>
    
```

4. At the following prompt, enter the CPT code or description for the types of current exams you want to alter the route priors logic for. (Enter “?” to see a list of CPT codes and descriptions.)

```
Select MAG RAD PRIOR EXAMS LOGIC CURRENT CASE CPT GROUP:
```

5. At the Select MATCHING CPT GROUP prompt, enter a CPT code that has been previously entered as being a match for the current exam, or enter a new CPT code to match to the current exam.

**Note** Altering the settings for this prompt will affect VistARad’s prefetch function, as well as the auto-route priors capability.

6. Set the following three prompts as desired for automatically routing priors. Details follow.

```

AUTO-DISPLAY: YES//
VERSION LIMIT/AUTO-DISPLAY: 1//
DAYS LIMIT/AUTO-DISPLAY: 1800//
    
```

**AUTO-DISPLAY?**

Set to “YES” if exams that match the MATCHING CPT group selected in step 5 should be considered priors.

**DAYS LIMIT/AUTO-DISPLAY**

The value of this field should be set to an integer number. Studies that precede the current image by more than this number of days will not be candidates for automatic routing. Only studies that are less than the number of specified days will be included.

**VERSION LIMIT/AUTO-DISPLAY**

The value of this field should be set to an integer number. This number indicates

the maximum number of prior studies that will be automatically routed for the current image.

7. Select additional fields to edit, or exit FileMan.

## DICOM Gateway Configuration

Sites that want to send images to other sites using routing will need to set the configuration file for **all** Image and Routing Gateways as described in the following sections.

**Note** No configuration changes are needed for Text Gateways in a routing system.

### Image Gateway Configuration

Image Gateways at a site using automatic routing will need to have their configuration file set as described below.

**Note** The following steps cover only routing-related configuration parameters. For information about other configuration parameters, refer to the DICOM Gateway Installation Guide.

#### To configure Image Gateways

1. Open a terminal window and log into the DICOM Gateway software.
2. Select option 4-2-2 (Update Gateway Configuration Parameters).
3. Set the prompts indicated in bold below to Yes.

```

...
Will this computer be a DICOM Image Gateway? YES// YES

Will this computer be a DICOM Text Gateway? NO// NO

Will this computer be a Routing Gateway? NO// NO

Will this computer be part of a system where autorouting is active?
NO// Yes

Send text to a commercial PACS, Mitra Broker, et cetera? NO// NO
...

```

4. Press **<Enter>** to cycle through the rest of the prompts and to exit the program.

## Routing Gateway Configuration

The system being used as a Routing Gateway will need to have its configuration file set as described below. Completing these steps will make the Routing Gateway menu option and its submenus available in the main DICOM Gateway Menu.

**Note** The following steps cover only routing-related configuration parameters. For information about other configuration parameters, refer to the DICOM Gateway Installation Guide.

### To configure the Routing Gateway

1. Open a terminal window and log into the DICOM Gateway software.
2. Select option 4-2-2 (Update Gateway Configuration Parameters).
3. Set the prompts indicated in bold below to Yes.

```
...
Will this computer be a DICOM Image Gateway? YES// NO

Will this computer be a DICOM Text Gateway? NO// NO

Will this computer be a Routing Gateway? NO// Yes

Will this computer be part of a system where autorouting is active?
NO// Yes

Send text to a commercial PACS, Mitra Broker, et cetera? NO// NO
...
```

4. Press <Enter> to cycle through the rest of the prompts and to exit the program.

## Importing Routing Rules (Route.dic)

This section covers the following topics:

- [Creating and Importing a Routing Rules File](#)
- [Verifying Imported Rules](#)
- [Routing Rules and Multiple Routing Gateways](#)

### Creating and Importing a Routing Rules File

Routing rules are initially defined in the `\DICOM\Dict\Route.dic` file, which is stored on the Routing Gateway. This file can be created and modified using any text-editing program.

Routing rules take effect after `Route.dic` has been imported into a local table used by the Routing Gateway.

### To create and import routing rules

These steps assume that you have prepared your routing rules as described in the previous chapter.

1. On the Routing Gateway, use a text editor to open `x:\DICOM\Dict\Route.dic`, where `x` is the name of the drive used by the Routing Gateway to store dictionary files.

**Note** The first time routing rules are defined, `Route.dic` will need to be created. If you are modifying an existing file, it is recommended that you create a backup copy of the file.

2. Enter your rules.
  - `Route.dic` must end with a line-feed.
  - To ensure proper termination of the last meaningful line, add the following comment lines after the last routing rule, such as:

```
# last update on <date>
# end of file
```

- If you are modifying existing rules, comment out the old rules instead of removing them. This will make it easier to revert to the original set of rules if it becomes necessary.
3. Save the file into the directory noted in Step 1.
  4. On the Routing Gateway, stop the evaluation processor if it is running.
  5. Open a terminal window and log into the DICOM Gateway software.
  6. Select option 3-5 (Import Routing Rules).
  7. When you are prompted to build the Routing Table, enter `Y`.

```
Ready to build the Routing Table? y// y <Enter>
```

8. The file will be imported. If the import is successful, the following will be displayed. You will be prompted to return to the menu.

```
nnn rules stored in the database
Press <Enter> to continue:
```

**Note** If you are using load balancing, importing routing rules will cause internal counters that control load balancing to be reset. For more information, see page [22](#).

**Note** If multiple Routing Gateways are present, the steps for importing the modified rules file must be performed for **all** Routing Gateways, so all Gateways will use the same set of rules.

### Verifying Imported Rules

1. On the gateway where the rules reside, open a terminal window and log into the DICOM Gateway.
2. Select option 3-10 (Display Routing Rules).
3. The current set of routing rules will be displayed:

```
Routing rules:
SEND(IMAGPROVIDER1)
  If: MODALITY=CT
SEND(IMAGPROVIDER2)
  If: MODALITY=CR
SEND(BAL2)
  If: MODALITY=XA
  Priority: HIGH
Press <Enter> to continue...
```

4. After the rules are displayed and double-checked, press <Enter> to return to the menu.

### Routing Rules and Multiple Routing Gateways

If multiple evaluation processors need to be active (as could be the case at a consolidated site), each Routing Gateway can use its own local set of rules.

However, it is usually better for all Routing Gateways to use a single set of rules stored in a shared directory. Using the same set of rules will make maintenance easier (changes to rules need to be made in only one `Route.dic` file, rather than several). This also allows each gateway in the pool to function as a backup for any other gateway.

## VistARad Configuration—Sending Sites

For sites that will be *sending* routed images:

- The MAG VISTARAD SITE PARAMETERS File (#2006.69) needs to be edited.
- A site’s SITE CODE (IMAGING SITE PARAMETERS File (#2006.1)) must be set to a non-null value that will identify the sending site.

### To set routing-related VistARad site parameters

1. Open a terminal window and log into the VistA Hospital Information System.
2. Access the VistARad System Options menu [MAGJ MAIN] and run the “E/E VistARad Site Parameters” option [MAGJ VISTARAD SITE PARAMETERS].
3. Set the field shown in bold below to YES.

```
Select MAG VISTARAD SITE PARAMETERS VISTARAD SITE NAME: DEMO
VISTARAD SITE NAME: DEMO//
...
REMOTE LIST ONLY REMOTE CACHE?: NO//      <obsolete>1
SITE SENDS TO REMOTE CACHE: NO// YES      <required>2
UNREAD LIST PRIORITY SEQ: S,U,P,R//
```

<sup>1</sup> REMOTE LIST ONLY REMOTE CACHE? This field is obsolete, and can be ignored.

<sup>2</sup> SITE SENDS TO REMOTE CACHE? Setting this field to YES turns on extra processing that is needed to manage routed exams properly. One result of setting this field to YES is the addition of the RC column to VistARad’s exam lists. The RC column is described on page [59](#).

**Note** For information about other site parameters, refer to chapter 3 in the VistA Imaging Installation Guide.

4. Use FileMan to check the value of your site’s SITE CODE field (#2006.1,.09). The value entered must not match any of the CacheLocationID values defined at receiving sites (see the next section for details).

```
Select OPTION: E ENTER OR EDIT FILE ENTRIES

INPUT TO WHAT FILE: 2006.1 IMAGING SITE PARAMETERS (1 entry)
EDIT WHICH FIELD: ALL// .09 SITE CODE
THEN EDIT FIELD: <enter>
```

```
Select IMAGING SITE PARAMETERS NAME: `1 TEST SITE  
SITE CODE: TST
```

## VistARad Configuration—Receiving Sites

The following steps must be performed for each VistARad workstation that will be used to display routed exams.

### To set CacheLocationID in MAGJ.INI

1. Log into the VistARad workstation as an administrator.
2. Use Explorer or the Start | Run menu option to open  
C:\Program Files\Vista\Imaging\MAG\_VistaRad\MAGJ.INI.
3. Locate the CacheLocationID line near the beginning of the file.
4. For CacheLocationID, enter the destination name that contains local copies of routed images.
  - The value you enter must match an Imaging destination in the sending site's NETWORK LOCATION File (#2005.2).
  - Partial matching can be used to allow VistARad to access images from multiple Imaging destinations. For more information, see the next section.

```
[General]  
Cachelocationid=DEMO  
! ALL/WARNING/SEVERE  
LogLevel=SEVERE  
[END_SECTION]
```

5. Save and close the file. After this change is made:
  - When a user logs into VistARad, the locally defined CacheLocationID is compared to the SITE CODE (IMAGING SITE PARAMETERS File (#2006.1)) of the site being logged into. If the two values are different, the VistARad software responds as if it were remote relative to the site being logged into, and enables logic for remote reading.
  - Each time an exam is opened, VistARad uses the value of CacheLocationID to find the corresponding entry in the NETWORK LOCATION File of the site being logged into. The storage location for that entry (which is presumably relative to VistARad), is checked for the exam in question. If the images are not present in

that storage location, VistARad will retrieve the images across the WAN instead (i.e., from the primary image storage location).

### Making Multiple Destinations Accessible to VistARad

A VistARad workstation can be used to display images from multiple (local) destinations. This is possible because partial matching is used when the `CacheLocationID` is compared to the names of routing destinations defined in the NETWORK LOCATION File (#2005.2).

For example, if a site is sending images to the destinations shown below, a VistARad workstation with its `CacheLocationID` set to `DEMO` would be able to access both destinations.

`DEMOMain, DEMOBackup`

Note that the partial matching used is based on leading characters. Continuing the above example, a destination named `NewDEMO` would not be treated as a match for workstations using `Telerad` as their `CacheLocationID`.

### Changes Affecting Routing System Configuration

The following table lists situations that will require a change in routing configuration, and outlines the changes that will need to be made.

Routing System Change	Related Configuration Change
Alteration of location, permissions, etc., of a Imaging destination folder	Update NETWORK LOCATION File (#2005.2) entry for the applicable destination.
New destination, or name change of existing Imaging destination	<ul style="list-style-type: none"> <li>Update NETWORK LOCATION File entry for the applicable destination.</li> <li>Update routing rules.</li> <li>Stop and restart transmission processor (if one processor serves all destinations), or start a new instance of the transmission processor for the new destination.</li> <li>Update VistARad workstation MAGJ.INI at receiving site.</li> </ul>
New Image Gateway / imaging modality	<ul style="list-style-type: none"> <li>Configure Image Gateway.</li> <li>Review and update routing rules if needed.</li> </ul>

Routing System Change	Related Configuration Change
Change of radiology staff at sending or receiving site	<ul style="list-style-type: none"> <li>• Review and update routing rules if needed.</li> <li>• Review NETWORK LOCATION File entry for destination and adjust if needed.</li> <li>• Determine if new staff members need on-demand routing privileges.</li> </ul>
Addition of new VistARad workstation	Update VistARad workstation MAGJ.INI.
Retirement of an existing destination	Remove destination reference from rules, stop the transmission processor for that destination, and disable/remove the destination definition parameters. See page <a href="#">52</a> for details.

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# Using Routing

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This chapter explains how to use the Routing Gateway. This chapter covers the following topics:

- [Activating Routing](#)
- [Maintaining Routing](#)
- [Disabling Routing](#)
- [Routing Gateway Menu Options](#)
- [Additional Routing Options](#)

This chapter assumes that the Routing Gateway has been properly installed and configured.



US Federal regulations and VA internal policy prohibit unencrypted transmission of patient information outside the VA's intranet.



Routing can have a significant impact on network traffic. It is the responsibility of sites using routing to properly manage network demands related to routing. Before activating the routing software, notify your network administrator that there will be an increase (often a significant one) in network traffic to routing destinations.

## Activating Routing

The steps below explain how to start the processes that support automatic and on-demand routing.

### Starting the evaluation processor

**Note** If only on-demand routing is being used, the evaluation processor does not need to be started.

1. Verify that Image Gateways in the routing system are processing images. If images are not being processed, no new entries will be added to the evaluation queue.
2. Open a new terminal window and log into the gateway that you want to use to monitor the evaluation processor.
3. Select option 3-3 (Start Evaluation Processor).

4. Position and size the terminal window for subsequent monitoring. (No new information will be shown in the terminal window until the evaluation processor encounters entries in the evaluation queue.)

### Starting a transmission processor (3-1) for Imaging destinations

1. On a Routing Gateway, open a new terminal window and log into the DICOM Gateway software.
2. Select option 3-1 (Start the Transmission Processor).
3. A list of destinations will be displayed. To select all possible destinations, enter an asterisk (\*). To enter a partial list, follow the instructions at the prompt.

```
Possible destinations are:
 125: KANSAS at \\TELERAD3\wichita
 152: ST LOUIS CR at \\vhastlvistarad
 164: IMAGPROVIDER1 at C:\REMOTE\IMAG1\
 166: LEAVENWORTH, KS at C:\REMOTE\LVW\
 167: IMAGPROVIDER2 HOME at C:\REMOTE\IMAG2\
 168: ST. LOUIS, MO at C:\REMOTE\STL\

Select destinations by:
==> Enter their number(s), separated by commas
==> Enter an asterisk (*) to select all possible destinations
Prefixing an entry with a dash deselects the listed destinations

Enter a period when the selection is complete.
---> *
```

4. The destinations you selected will be displayed. Enter a period when you are finished.
5. Position and size the terminal window for subsequent monitoring.
6. To start additional transmission processors, repeat steps 1 – 6 in a new terminal window.

### Starting a transmission processor (2-8-2) for DICOM Storage SCP destinations

**Note** It is recommended that this option (Transmit DICOM Images to a Storage SCP) be run on an Image Gateway, and not on a Routing Gateway (where the Start Transmission Processor process is running).

1. Wait until there is an entry in the DICOM IMAGE OUTPUT File (#2006.574) for each destination that you want served by this instance of the Transmit DICOM processor. To do this, review the log file for the evaluation processor; see page [51](#) for details.

2. On the Image Gateway that you want so use, open a new terminal window and log into the DICOM Gateway software.
3. Select option 2-8-2 (Transmit DICOM Images to a Storage SCP).
4. At the Ready to send DICOM Images from VistA? prompt, enter Y.

**Tip** The “Transmit DICOM” processor can be stopped and restarted later to add any additional destinations that need to be serviced. (This logic does not apply to the transmission processor for Imaging destinations.)

5. If entries from other locations are present, you will be prompted to select which entries you want to process.

**Note** In this context, “location” is relative. For entries for automatically routed images, location is based on Instrument Name in `instrument.dic`. For images routed on-demand, location is based on the location specified in the configuration of the VistARad workstation or Image Gateway from which the image was routed.

```
There are entries in the transmission queue for other locations
than the one that is currently served by this DICOM Gateway.
Enter any number from the list below to include this location
in the current selection (prefix a number with a - (minus sign)
to remove it from the current selection.
  660: SALT LAKE CITY
Add to or remove from selection: 660 <Enter>

There are entries in the transmission queue for other locations
than the one that is currently served by this DICOM Gateway.
Enter any number from the list below to include this location
in the current selection (prefix a number with a - (minus sign)
to remove it from the current selection.
  660: SALT LAKE CITY (Selected)
Add to or remove from selection: <Enter>
```

7. Position and size the terminal window for subsequent monitoring.

## Maintaining Routing

This section provides a summary of maintenance tasks for a routing system and explains how to access routing-related log files.

### Periodic Maintenance

The following tasks should be performed periodically to control the size of the transmission queue and to detect potential routing problems.

Task	Interval	Menu Seq.
Check terminal windows for evaluation and transmission processors.	2-3 times daily	N/A
Review log files for error messages.	Daily	4-1-2
Re-queue all failed entries in the transmission queue*.	As needed based on routing volume	3-8
Purge completed and expired entries in the transmission queue*.	Monthly	3-7
Remove obsolete entries from transmission queue*.	Monthly	3-9
Monitor available free space in Imaging destinations using the Background Processor's Network Location Manager.	As needed	N/A
Confirm access to routing destinations.	As needed	N/A
Disable/delete entries for obsolete destinations.	As needed	See page <a href="#">52</a> for details.

\* Imaging destinations only.

### Using Routing Log Files

A log file is created for each evaluation and transmission processor session. Use these logs to review routing processes and to ensure that no errors have occurred.

**Note** A DICOM Gateway retains the 20 most recently generated log files.

### Displaying log files

1. On the Gateway where the process in question was run from, open a terminal window and log into the DICOM Gateway software.
2. Select option 4-1-2 (Display DICOM Message Log).

3. At the `Historical Log` or `New Activity?` prompt, enter `H`.
4. Enter the number of the log you want to view.
  - The transmission processor for Imaging destinations will have a description of `Transmission Processor`.
  - The transmission processor for DICOM Storage SCPs will have a description of `Send images to <scp_name>`.

### Deactivating Destinations

When destinations are no longer needed, their definitions in VistA should be deactivated or removed. Deactivated destinations will not be available for either automatic or on-demand routing.

#### To deactivate an Imaging destination

To clear an Imaging destination (such as a storage folder for remote VistARad workstations), do the following:

1. On the Routing Gateway, use option 3-10 (`Display Routing Rules`) to ensure that all references to the destination in routing rules are either removed or commented out.
2. On the Routing Gateway, make sure the destination is not being serviced by any transmission processors.
3. Using the Background Processor (**Edit | Network Location Manager**) or FileMan, set the destination OFFLINE, and clear the ROUTER field (set to NO if using FileMan).

**IMPORTANT** Do not leave a destination (i.e., a Network Location intended for routing) online after clearing the ROUTER field. If you do so, the Background Processor may attempt to write images to the destination. For more information, see the *Background Processor User Manual*.

4. After the retention period for the destination has expired, use option 3-7 (`Purge completed and expired entries in the Transmission Queue`) to clear any remaining entries for that destination from the queue.

### To deactivate a DICOM Storage SCP Destinations

To remove all DICOM Storage SCP destinations for a decommissioned gateway, use the “Clean Up Gateway (DICOM destinations)” option in the DICOM Menu Options menu [MAGD DICOM MENU] on VistA.

To remove specific destinations:

1. On the Routing Gateway, use option 3-10 (Display Routing Rules) to ensure that all references to the destination in routing rules are either removed or commented out.
2. On the Image Gateway, make sure that the destination in question is not being served by any transmission processors (2-8-2).
3. On the Image Gateway, open `SCU_List.dic`, and ensure that any references to the destination are removed or commented out.
4. Load and update `SCU_List.dic` on all Image Gateways using option 4-2-6 (Update SCU\_LIST.DIC).
5. Ensure that the destinations have been removed by checking the DICOM TRANSMIT DESTINATION File (#2006.587) on VistA, or by logging into VistARad and checking the contents of the Route To box (be sure to start a new session for this).
6. If the entry is not cleared, use FileMan to manually remove the entries from the DICOM TRANSMIT DESTINATION File.

**Note** The destination could appear multiple times in the file, one entry for each gateway. Delete all entries for that destination. Note that this process could take several minutes to complete.

```
Select VA FileMan Option: Enter or Edit File Entries

INPUT TO WHAT FILE: // DICOM TRANSMIT DESTINATION
EDIT WHICH FIELD: // ALL

Select DICOM TRANSMIT DESTINATION SERVICE NAME: TEST_DEST
SERVICE NAME: TEST_DEST Replace @

ARE YOU SURE YOU WANT TO DELETE THE ENTIRE 'TEST_DEST' DICOM TRANSMIT
DESTINATION? Yes
SINCE THE DELETED ENTRY MAY HAVE BEEN 'POINTED TO' BY ENTRIES IN THE
'IMAGE' FILE, ETC.,
DO YOU WANT THOSE POINTERS UPDATED (WHICH COULD TAKE QUITE A WHILE)?
No// Yes
WHICH DO YOU WANT TO DO? --
    1) DELETE ALL SUCH POINTERS
    2) CHANGE ALL SUCH POINTERS TO POINT TO A DIFFERENT 'DICOM
TRANSMIT DESTINATION' ENTRY
```

```
CHOOSE 1) OR 2): 1
DELETE ALL POINTERS? Yes//  Yes
      (DELETION WILL OCCUR WHEN YOU LEAVE 'ENTER/EDIT' OPTION)
...HMMM, HOLD ON...
DEVICE: HOME//  INCOMING TELNET DEVICE
```

## Disabling Routing

### Short-Term Routing Shutdown

If routing needs to be disabled for a short period of time, the easiest thing to do is to stop all transmission processors. When this is done, images will still be evaluated and queued, but they will not be transmitted until the transmission processors are restarted.

Before restarting routing:

- Use option 3-9 (Remove Obsolete Entries from Transmission Queue) to remove any entries for Imaging destinations.
- Optionally, use option 2-8-4 ((Re)Initialize Image Transmission Queue) to clear *all* entries for DICOM Storage SCP destinations (there is no way to selectively clear entries).

### Long-Term Routing Shutdown

If routing needs to be disabled for an extended period, perform the following:

- Stop the evaluation processor.
- Stop all transmission processors.
- Alter the configuration files for all Image Gateways to indicate that they are *not* part of a routing system (see page [35](#) for more information).
- If you do not want images that are already queued for transmission to be routed when routing is re-enabled, remove entries from all transmission queues.
  - For Imaging destinations, wait until the retention period is expired, then use option 3-7 (Purge completed and expired entries in the Transmission Queue).
  - For DICOM Storage SCPs, run option 2-8-4 ((Re)Initialize Image Transmission Queue). Because there is no retention setting, this can be run immediately.

## Routing Gateway Menu Options

This section describes the menu options associated with the Routing Gateway. Routing Gateway menu options are accessed by entering 3: Routing Gateway from the DICOM Gateway main menu.

```
1 Start the Transmission Processor
2 Stop the Transmission Processor
3 Start the Evaluation Processor
4 Stop the Evaluation Processor
5 Import Routing Rules
6 Purge all completed entries in the Transmission Queue
7 Purge completed and expired entries in Transmission Queue
8 Re-Queue all Failed Entries in the Transmission Queue
9 Remove Obsolete Entries from Transmission Queue
10 Display Routing Rules
```

### Start the Transmission Processor (3-1)

Use this option to start an instance of the transmission processor to service one or more Imaging destinations.

**Note** As the transmission processor sends exams to Imaging destinations, it will map and un-map certain drives. For more information, see page [63](#).

If a single transmission processor cannot manage a site's routing workload, additional transmission processors, each sending images to a subset of destinations, can be started using this option. For detailed steps, see page [48](#).

**Note:** At sites where routing is used, it is recommended that the Transmit DICOM Images to a Storage SCP process be run on an Image Gateway, and not on a Routing Gateway where the Start Transmission Processor process is running.

### Stop the Transmission Processor (3-2)

Use this option to stop all running instances of transmission processors for Imaging destinations.

**Note** Using this option can result in an incomplete exam being sent to a destination. If this occurs, the remainder of the exam will be transmitted when a transmission processor is re-started, provided that the applicable entries are still present in the transmission queue.

### Start the Evaluation Processor (3-3)

When this option is executed, an instance of the evaluation processor is started. Note that the evaluation processor is run on VistA, not on the Routing Gateway itself. However,

the state of the evaluation processor can be monitored by leaving the appropriate terminal window open on the Routing Gateway.

After it is started, the evaluation processor will examine routing-specific entries in the evaluation queue (a subset of the IMAGE BACKGROUND QUEUE File (#2006.03)). This file is populated by Image Gateways (provided that Image Gateways are configured as part of a routing system).

The evaluation processor uses the evaluation queue and routing rules to determine which images are automatically routed. Entries for images that should be routed are added to the appropriate transmission queue. Entries for images that should not be automatically routed are deleted.

Typically, only a single instance of the evaluation processor is needed for all automatic routing.

For consolidated sites, an instance of the evaluation processor should be started for each division. (In this situation, a division is also called “place” and equates to an entry in the IMAGING SITE PARAMETERS File (#2006.1).) An evaluation processor uses the set of rules defined on the gateway that the processor was started on.

### **Stop the Evaluation Processor (3-4)**

When this option is executed, a flag is set that the evaluation processor will recognize as “stop evaluating.” The evaluation processor checks this flag after analyzing each image file against the routing rules.

### **Import Routing Rules (3-5)**

When this option is executed, the rules in `\DICOM\Dict\Route.dic` will be loaded into the Routing Gateway’s local database. For detailed steps about importing routing rules, see page [41](#).

Be sure to stop the evaluation processor before importing new or edited routing rules.

### **Purge all completed entries in the Transmission Queue (3-6)**

Use this option to reduce the size of the transmission queue. Executing this option will remove entries for files that have been transmitted successfully.

**Note** If this option is used, routed images will be “orphaned” at an Imaging destination rather than being deleted automatically (after the defined retention period); the images will remain until deleted manually.

To purge completed entries without orphaning routed images, use the option described in the following section.

### **Purge completed and expired entries in the Transmission Queue (3-7)**

Use this option to control the size of the transmission queue for Imaging destinations. Executing this option will remove entries if both of the following conditions are met:

- The status of the entry indicates that an image file has been transmitted successfully.
- The entry is older than the `RETENTION PERIOD` (number of days) for the applicable destination.

This option should be run once a month as part of a Routing Gateway's periodic maintenance cycle.

### **Re-Queue all failed entries in the Transmission Queue (3-8)**

Use this option to try to re-send routed images that could not be sent within the number of attempts specified for that Imaging destination.

This option should be run periodically as part of a Routing Gateway's maintenance cycle. Sites that route a large number of exams, or that route high priority exams, should run this option daily. Sites that route a lower volume of exams may only need to run this option once a week.

### **Remove obsolete entries from Transmission Queue (3-9)**

Use this option when there is a backlog of outdated entries in the transmission queue for Imaging destinations. When this option is executed, you will be prompted to enter a cutoff date (the date can be entered using FileMan conventions). After the date is entered, all unprocessed queue entries older than the specified date will be removed.

This option should be run once a month as part of a Routing Gateway's periodic maintenance cycle.

### **Display Routing Rules (3-10)**

Use this option to display the current set of routing rules. This option is useful immediately after using option 5 to import a new set of rules.

**Note** When this command is used to display a list of rules, the “if” command is used for conditions. In an actual rule, either `if` or `when` can be used to indicate a list of conditions.

## Additional Routing Options

In addition to the Routing Gateway, there are some routing-related features that reside on the DICOM Image Gateway and the VistARad workstation software.

The following routing-related options are present on the DICOM Image Gateway Menu:

- 2-8-1 Select DICOM Images for Transmission
- 2-8-2 Transmit DICOM Images to a Storage SCP
- 2-8-3 Stop Image Transmission Queue Processor
- 2-8-4 (Re)initialize Image Transmission Queue

These options are referenced where appropriate in this document. For detailed information about these options, see the *VistA Imaging DICOM Gateway User Guide*.

Routing-related features available in VistARad are described in detail in the next chapter.

# Using VistARad in a Routing System

This chapter explains how to use the VistARad diagnostic workstation software at sites that are part of a routing system. This chapter covers the following topics:

- [Displaying Routed Exams](#)
- [VistARad and On-Demand Routing](#)

## Displaying Routed Exams

When VistARad is configured to be used with routing, an additional column is displayed in the Manager's exam lists. This column, the RC (remote cache) column, indicates which Imaging destinations, if any, an exam has been routed to.

Remote Cache Indicator

Case #	Lock	Patient Name	ID #	Priority	Procedure	Image Date/Time	Status	# Img	Onl	RC	Mod
040600-28		IMAGPATIENT1011,...	11011	4-Rout	CHEST SINGLE VIEW	08/01/2000@10:58	EXAMIN	1	Y		CR
092802-123		IMAGPATIENT1011,...	11011	4-Rout	CT ABDOMEN W/CONT	09/26/2002@18:03	EXAMIN	112	Y		CT
112403-176		IMAGPATIENT1201,...	11201	4-Rout	CHEST 2 VIEWS PA&LAT	11/24/2003@17:07	EXAMIN	2	Y	Route1	CR
112403-175		IMAGPATIENT1201,...	11201	4-Rout	CT THORAX W/CONT	11/25/2003@09:43	EXAMIN	66	Y	Route1	CT
112403-179		IMAGPATIENT1202,...	11202	4-Rout	CHEST 2 VIEWS PA&LAT	11/25/2003@10:30	EXAMIN	2	Y		CR
112403-180		IMAGPATIENT1203,...	11203	4-Rout	SHOULDER 2 OR MORE ...	11/25/2003@10:40	EXAMIN	6	Y		CR
112403-181		IMAGPATIENT1203,...	11203	4-Rout	MAGNETIC IMAGE,UPPE...	11/25/2003@10:53	EXAMIN	93	Y		MR
112403-183		IMAGPATIENT1204,...	11204	4-Rout	ABDOMEN 3 OR MORE ...	11/25/2003@11:08	EXAMIN	4	Y		CR
112403-182		IMAGPATIENT1204,...	11204	4-Rout	CHEST 2 VIEWS PA&LAT	11/25/2003@11:19	EXAMIN	2	Y		CR
112403-184		IMAGPATIENT1204,...	11204	4-Rout	CT ABDOMEN W/CONT	11/25/2003@11:27	EXAMIN	113	Y		CT

Note that the RC column only indicates Imaging destinations specified in the NETWORK LOCATION File (#2005.2). The RC column does not indicate if an exam has been routed to a DICOM Storage SCP.

When VistARad is being used for remote reading, exam lists are automatically filtered to show only those exams that are stored locally relative to the VistARad workstation (in the example above, the Remote Read Filter is cleared).

### To display a routed exam

1. Using VistARad, log into the site or division that the routed exam was sent from.
2. Use an exam list to locate the routed exam you want to open. By default, only exams routed to you are shown.

- If the Remote Read Filter button is not present at all, there are no routed exams in local storage. Even if you have the proper routing security keys, this button will display only if routed exams are available.
  - Exams routed to VistARad workstations are automatically deleted after a certain number of days. If a routed exam was deleted before you had a chance to review or interpret it, contact your Imaging Coordinator to have the exam re-routed or to have the retention period increased.
  - You can view all exams (routed and non-routed) by clearing the checkbox in the Remote Read Filter area near the top of the Manager window. However, any non-routed exams, if opened, will take longer to load because the images are not stored locally.
3. Double-click the exam, or select the exam and click **Open**. A routed exam can be locked and marked as interpreted in the same manner as any other exam.

## VistARad and On-Demand Routing

For on-demand routing to function:

- A VistARad user must be logged into a site that has a Routing Gateway.
- At the site being logged into, the VistA Imaging host, the Routing Gateway, and storage folders must be set up as described in this manual.
- A transmission processor must be servicing the applicable destinations.
- The user performing on-demand routing must have the MAGJ DEMAND ROUTE security key or the MAGJ DEMAND ROUTE DICOM security key.



US Federal regulations and VA internal policy prohibit unencrypted transmission of patient information outside the VA's intranet.



On-demand routing can have a significant impact on network traffic. It is the responsibility of sites using routing to properly manage network demands related to routing.

## Using On-Demand Routing

On-demand routing lets you send copies of exams to existing routing destinations. Use on-demand routing when you need to route exams that do not satisfy existing routing rules, or where automatic routing is not used.

**Note** If you are frequently using on-demand routing for the same sorts of exams, contact your Imaging Coordinator and request that a change or addition be made to the rules used for automatic routing.

**Note** You can also route exams on-demand using a DICOM gateway using option 2-8-1 (Select DICOM Images for Transmission). See the *DICOM User Guide* for details.

Any exam that appears in a VistARad exam list can be routed on-demand. However, newly acquired exams should not be routed until they have a status of “examined” in VistARad’s exam lists (indicating that they have been QCed or case edited by a technologist).

### To use on-demand routing

1. Using VistARad, log into a site that has a Routing Gateway.

**Note** If you have access to more than one division, log into the division where the exams to be routed were acquired.

2. Use the exam lists in the Manager window to select the exams you want to send.
3. Click the **Route Exams** button, located in the upper right corner of the exam list.

**Note** If the **Route Exams** button is not present, your user account does not have any of the security keys for on-demand routing assigned.

4. When the Route Request dialog opens, make sure all the exams you selected are shown.

**Note** If a selected exam is not “online” (not available in short-term storage), a message will appear at the bottom of the Route Request window indicating that exam has been requested from the jukebox (long-term storage). Once the exam is available in short-term storage, you can select it for on-demand routing.

Case #	Patient	Procedure	Image Date/Time	Status	Route To	Priority
080504-255	IMAGPATIENT1011,...	TIBIA & FIBULA 2 VIEWS	AUG 5,2004@13:51	EXAMINED	ROUTESITE1	Medium
080504-256	IMAGPATIENT1011,...	KNEE 2 VIEWS	AUG 5,2004@13:51	EXAMINED	[Do Not Route]	Medium

Default Route To: [Do Not Route]      Default Priority: [Medium]

OK      Cancel

5. For each exam, click the **Route To** field to select where you want to send the exam.

- In the **Route To** field, the first destinations listed are Imaging destinations (such as remote VistARad workstations).
  - If there are any DICOM Storage SCP destinations available (such as film printers), they will appear at the bottom of the **Route To** list and will be preceded by dcm.
  - Use the **Default Route To** box near the bottom of the dialog to choose a single destination for all listed exams.
6. For each exam, use the **Priority** field to select the priority used to send the exam.
    - Use the **Default Priority** box near the bottom of the dialog to choose a single priority for all listed exams.
    - The priority assigned to exams for on-demand routing is not related to the exam priority indicated in VistARad's exam lists.
  7. Confirm that the settings in the Route Request dialog are correct.
    - You can choose not to route a listed exam by selecting the **Route To** box for that exam and choosing the [Do Not Route] option.
    - You can click **Cancel** to close the Route Request dialog without routing any exams.
  8. Click **OK** to route the exams.
  9. When the exam is routed, the RC column entry for that exam will show the name of the receiving site. (Note that this only applies to exams routed to Imaging destinations. The RC column will not indicate if an exam has been routed to a DICOM Storage SCP.)

# Troubleshooting Routing

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This chapter covers the following topics:

- [Troubleshooting FAQs](#)
- [Routing Support](#)

## Troubleshooting FAQs

The table below outlines some commonly encountered routing issues. Refer to the indicated page for details.

Problem	See...
Can't start evaluation processor—"rule evaluator is already running"	<a href="#">below</a>
Can't select an Imaging destination for the transmission processor (3-1)	page <a href="#">64</a>
Images not arriving at a destination	page <a href="#">63</a>
Routed images slow to arrive at destination	page <a href="#">64</a>
Drive letters for Imaging destinations change intermittently	page <a href="#">64</a>
Only part of an exam has been routed	page <a href="#">65</a>
In VistARad, some images in a routed exam take a long time to open	page <a href="#">65</a>
In VistARad, the RC column does not show all destinations	page <a href="#">66</a>
In VistARad, "retired" destinations are still selectable for on-demand routing	page <a href="#">66</a>
An exam was routed more than once to the same destination	page <a href="#">66</a>
Images cannot be purged/path could not be found	page <a href="#">66</a>

### Can't start evaluation processor—"rule evaluator is already running"

If a "rule evaluator is already running" message is displayed when you try to start the evaluation processor, run option 3-4 (Stop the Evaluation Processor), then re-try option 3-3 (Start the Evaluation Processor).

**Tip** The evaluation processor is started from a Routing Gateway, but actually is executed on VistA. It will not be apparent that the evaluation processor is actually running if it was started from a different gateway, or if the terminal window showing evaluation processor activity is closed.

If the message persists, there may be a lock issue on VistA that is preventing the process from starting. Check for lock on `^MAGDICOM(2006.563,1,"EVAL",location)` where `location` is the internal entry number in File #4 for the location of the DICOM Gateway. Contact Clinical Product Support if assistance is needed.

### **Can't select an imaging destination for the transmission processor (3-1)**

When option 3-1 (Start the Transmission Processor) is run, a list of available Imaging destinations is displayed. If a destination is missing, first determine if any other instances of the transmission processor are running, and if so, determine if they are already servicing the destination in question.

If the destination isn't already selected, there may be a lock issue on VistA that is preventing the destination from being selected. Check for lock on `^MAGQUEUE` ("ROUTE", location, destination) where `location` is the internal entry number in File #4 for the location of the DICOM Gateway, and `destination` is the internal entry number in File #2005.2 for the destination. Contact Clinical Product Support if assistance is needed for this.

### **Images not arriving at a destination**

If this is the first time routing is being used, verify that all configuration steps have been completed. (Configuration checklists are available in [Appendix A](#).)

If routing has been in use and the destination has worked in the past:

1. Verify that the destination is online, that it is accessible, and that it has sufficient storage space available. If the destination is an Imaging destination, use the steps for testing folders on page [28](#).
2. Ensure that the images in question have been processed by the Image Gateways.
3. If the destination is an Imaging destination, try to re-send images by running option 3-8 (Re-Queue all failed entries in the Transmission Queue). For details, see page [57](#).
4. Review the routing log files to determine if the images were transmitted successfully. (If you have just used the re-queue failed entries option, wait 15-20 minutes before opening the log files.) See page [51](#) for steps on accessing log files.
5. Check the routing rules for any recent changes by running option 3-10 (Display Routing Rules). See page [57](#) for steps on reviewing routing rules.

### **Routed images slow to arrive at destination**

Given a T1 connection and light to moderate network traffic, the first images in a routed exam will typically begin arriving at a destination within minutes. However, any of the following can impact the delivery of routed exams:

- A backlog of images at the Image Gateway, which is responsible for adding entries to the evaluation queue.

- A backlog of entries in the transmission queues. If numerous large exams are flagged for routing in a brief period of time, there will be a delay while all the images in the exam are transmitted. In situations where multiple destinations are being used, additional transmission processors may be used to alleviate delays.
- Problems connecting to destinations. For Imaging destinations, the routing software will attempt to re-connect or retransmit the number of times specified for each destination in the NETWORK LOCATION File (#2005.2). For DICOM Storage SCP destinations, retry attempts are part of the DICOM transmission protocol. Failed connection or transmission attempts are logged by the Routing Gateway.
- The routing priority of a particular exam. For more information, see page [66](#).

### **Drive letters for Imaging destinations change intermittently**

For each Imaging destination that it sends exams to, the transmission processor (3-1) will map a drive using the following progression of drive letters: Q – Z, then G – P. If a drive letter (Q, for example) is not available, it will move to the next letter (R, for example) and so on. When all entries for a particular destination have been processed, the applicable drive is unmapped.

This logic is not used for DICOM Storage SCP destinations.

### **Only part of an exam has been routed**

The Routing Gateway transmits data on an image-by-image basis. If a transmission processor is disabled when an exam is partially transmitted, the exam is usually treated as “unrouted” until a transmission processor is re-started for that destination. If the proper entries are still in the appropriate transmission queue, the rest of the exam will be sent.

In some situations, such as the presence of multiple Image Gateways or the use of on-demand routing, images from one exam will interrupt the transmission of images of an exam that is partially routed. This can occur because entries are added to the rule evaluation and transmission queues for each image, rather than for each exam. Usually, this behavior is invisible to the user.

### **In VistARad, some images in a routed exam take a long time to open**

If a partially routed exam is opened from VistARad, the VistARad software will first attempt to retrieve images from the local storage location identified in the MAGJ.INI file for that workstation. Images not found in local storage will be retrieved from their originating site.

An exam may be partially routed because it has been interrupted by the transmission of a higher-priority exam. If this has happened, the rest of the images in the interrupted exam will be routed after routing of the higher-priority exam is complete.

Also, the RC (Remote Cache) column may show that the exam has been routed before all images have been received. This can occur because the value in the RC column is dependent on a specific "representative image" in the routed exam. A "representative image" is the last image processed by an Image Gateway for a given exam. Typically, the representative image is also the last image in an exam's clinical sequence. However, images are processed on a first-in, first-out basis. If images are sent to the Image Gateways in an order other than the expected clinical sequence, that is also the order in which the images will be routed.

### **In VistARad, the RC column does not show all destinations**

The RC column in VistARad's exam lists will report the names of Imaging destinations. However, destinations that are DICOM Storage SCPs are considered "outside" the VistA system and their names are not reported in the RC column.

### **In VistARad, 'retired' destinations are still selectable for on-demand routing**

At sites where multiple versions of `SCU_List.dic` are used, DICOM Storage SCP destinations (shown with 'dcm' prefixes in VistARad) may linger after being removed from `SCU_List.dic`. See page [52](#) for information about disabling a destination.

### **An exam was routed more than once to the same destination**

For Imaging destinations, the transmission processor (3-1) will check to see if the image to be routed is already present at the destination. If a duplicate of the image is found, the transmission processor removes the redundant entry from the transmission queue, and moves on to the next entry in the queue.

For DICOM Storage SCP destinations, image management and duplicate checking is the responsibility of the destination system.

### **Images cannot be purged/path could not be found**

Images sent to DICOM Storage SCP destinations are not purged.

Images sent to Imaging destinations (such as a remote VistARad workstation) are purged after the retention period specified for that destination in the NETWORK LOCATION File (#2005.2).

If the purge process for an Imaging destination fails, “Path cannot be found” messages will appear in the transmission processor (3-1) log files. The purge process will fail if the storage location specified for the destination is powered down or otherwise inaccessible.

The purge process will also fail if the files that the process is attempting to delete are no longer present. This can happen if the files were deleted manually, or if the hardware or Physical Reference value in the NETWORK LOCATION File has been changed. To address the problem, the original directory structure needs to be recreated to allow the purge process to function normally. For assistance doing this, contact Clinical Product Support.

## **Routing Support**

If additional assistance is needed, contact your Imaging Coordinator or local support staff. If the problem cannot be resolved locally, open a Remedy ticket, or contact CPS (Clinical Product Support) at 1-888-596-4357.

Urgent after-hours service requests can be directed to the Expertise Center at 1-800-299-7282.

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## Appendix A: Routing Worksheets

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This appendix contains worksheets that can be used while setting up a routing system. They can also be used for record-keeping purposes. The following worksheets are provided:

[Imaging Destination Worksheet](#)

[DICOM Storage SCP Destination Worksheet](#)

[Routing Rule Definition Worksheet](#)

[Routing Setup Checklist](#)

## Imaging Destination Worksheet

*Use this worksheet to record information about a specific Imaging destination. A sample Network Location File definition is provided on the next page.*

Destination name<sup>1</sup> \_\_\_\_\_

Site served by destination \_\_\_\_\_

General purpose of this destination \_\_\_\_\_

Alternate/backup destination \_\_\_\_\_

Storage folder name \_\_\_\_\_

Destination computer/share name<sup>2</sup> \_\_\_\_\_

User name/password for destination \_\_\_\_\_

Associated user group (if any)<sup>2</sup> \_\_\_\_\_

File types transmitted to destination (circle those that apply)<sup>3</sup>      Abstract / Full / Text / Big

Retention period? (in days)<sup>3</sup> \_\_\_\_\_

---

<sup>1</sup> Specified in the .01 field in the NETWORK LOCATION file. Referenced in routing rules (Route.dic), and in the CacheLocationID parameter for VistARad workstations at receiving sites.

<sup>2</sup> Specified by receiving sites when creating a storage folder. Referenced sending site's NETWORK LOCATION file.

<sup>3</sup> Specified in sending site's NETWORK LOCATION file.

## NETWORK LOCATION File Sample

For detailed information about specific fields, see page [31](#).

```

Select NETWORK LOCATION: TESTDEST
  Are you adding 'TESTDEST' as a new NETWORK LOCATION (the 11TH)?
No// Y

PLACE: <blank>
PHYSICAL REFERENCE: \\VHAxxxxxx\images$
STORAGE TYPE: MAG  MAGNETIC
TOTAL SPACE: <blank>
SPACE USED: <blank>
FREE SPACE: <blank>
OPERATIONAL STATUS: 1  On-Line
HASH SUBDIRECTORY: <set as appropriate for your site>
ABSTRACT: N  No
FULL: Y  Yes
BIG: Y  Yes
TEXT: Y  Yes
DICOM: N  No
COMPRESSION: <blank or J2K >
USER NAME: <Use the "routing user name" here>
PASSWORD: <Use the "routing password" here>
MAINTAINCONNECTION: <blank>
MAX # RETRY ON CONNECT: 3
MAX # RETRY ON TRANSMIT: 5
SYNTAX: U  UNC
SUBDIRECTORY: <blank>
Select USER  <blank>
RETENTION PERIOD: 5
LAST PURGE DATE: <do not change>
SITE: <set as appropriate for your site>
ROUTER: Y  YES
TIME OFFLINE: <blank>
MUSE SITE #: <blank>
MUSE VERSION #: <blank>

```

## DICOM Storage SCP Destination Worksheet

*Use this worksheet to record information about a specific DICOM Storage SCP destination.*

Destination name<sup>1</sup> \_\_\_\_\_

Site served by destination \_\_\_\_\_

General purpose of this destination \_\_\_\_\_

Alternate/backup destination \_\_\_\_\_

Calling AE Title \_\_\_\_\_

Called AE Title \_\_\_\_\_

IP address/hostname \_\_\_\_\_

Socket/port \_\_\_\_\_

Presentation Context / Transfer Syntax (list all used)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

---

<sup>1</sup> Specified as the Application in the SCU\_List.dic file, and referenced in routing rules (Route.dic).

## DICOM Storage SCP Destination Sample

For detailed information about specific fields, see page [36](#).

```
# User Application List
# Format:
# line 1:App Name|Called AE|Calling AE|Destination IP Address|Socket
# line 2:|Presentation Context Name|Transfer Syntax Name
# line 3:|Transfer Syntax Name (if there are more than one)
#
MERGE EFILM|VistA_Storage|VistA_Send_Image|111.222.33.44|4006
|Modality Worklist Information Model - FIND|Implicit VR Little Endian
|Verification SOP Class|Implicit VR Little Endian
```



List conditions that will trigger the execution of the rule (fill in all that apply):

a Exam modality of: \_\_\_\_\_

b Off hours/holiday coverage (specify hours/days)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

c Other \_\_\_\_\_

---

**Rule Impact/Review** (to be completed by Imaging Coordinator)

Estimated amount of storage needed at each destination for this rule: \_\_\_\_\_

Bandwidth available between sending and receiving sites: \_\_\_\_\_

Total number of exams expected to be transmitted per month: \_\_\_\_\_

Rule adheres to routing policies established by sending site (circle one): Yes No

Rule adheres to routing policies established by receiving site (circle one): Yes No

**Rule Implementation** (to be completed by staff responsible for Routing G/W)

Rule as entered into the Route.dic file: (sample rules listed below)

---

---

---

---

---

---

---

---

Route.dic imported to Routing Gateway (circle one): Yes No

Rule tested and found to be functional (circle one): Yes No

Date \_\_\_\_\_

## Sample Rules

The following sample rules use the fictional destinations listed below:

Imaging destinations (entered in the NETWORK LOCATION File (#2005.2))

```
Archive
Contractor1
Contractor2
Contractor3
ContractingReader
LocalJukeBox
LogBook
```

DICOM Storage SCP destinations (entered in the DICOM TRANSMIT DESTINATION File (#2005.587) via SCU\_List.dic):

```
E-FilmApplication
LaserShare
```

### Example #1:

```
# auto-route all images from a specific modality to a
# contractor who reads this type of images, using standard
# copy for transmission

Send("ContractingReader")
  When MODALITY="CT"
```

### Example #2:

```
# auto-route all images to an archive, using standard copy
# for transmission

Send("Archive")
  When MODALITY="*"
```

### Example #3:

```
# auto-route all images from a remote site back to local
# storage at that site, using standard copy for
# transmission

Send("LocalJukeBox")
  When MODALITY="*"
  SOURCE="StElseWhere"
```

### Example #4:

```
# auto-route all important studies to an internal
# workstation, using standard copy for transmission

Send("LogBook")
```

```
When MODALITY="*"
    URGENCY="STAT"
```

**Example #5:**

```
# auto-route all images from a specific modality to three
# contractors, balancing the load, so that each contract
# receives a pre-determined fraction of the studies and
# leaving a pre-determined fraction for interpretation by
# local staff, using standard copy for transmission
```

```
Balance("Contractor1"=20%, "Contractor2"=40%,
"Contractor3"=20%, <LOCAL>=20%)
    When MODALITY="XA"
```

**Example #6:**

```
# auto-route all images from a specific modality to a
# contractor who reads this type of images, using standard
# copy for transmission and giving these transmissions a
# high priority
```

```
Send("ContractingReader")
    When MODALITY="XA"
    Priority High
```

**Example #7:**

```
# auto-route all images from a specific modality to a
# printer, using the DICOM protocol for transmission and
# giving these transmissions a low priority
```

```
Send("LaserShare")
    When MODALITY="CT"
    Priority Low
```

**Example #8:**

```
# auto-route all images from a specific modality to a DICOM
# repository, using the DICOM protocol for transmission and
# including images from prior studies
```

```
Send("E-FilmApplication")
    When MODALITY="CT"
    PriorStudy Yes
```

## Routing Setup Checklist

### Imaging Destination Setup

- a User name and password available for each destination? \_\_\_\_\_
- b Folders created and shared for each destination? \_\_\_\_\_
- c Ability to access and write to each storage folder verified? \_\_\_\_\_
- d Network location entry defined for each destination? \_\_\_\_\_
- e VistARad site parameters set up at sending site? \_\_\_\_\_
- f CacheLocationID set on workstations at receiving sites? \_\_\_\_\_

### DICOM Storage SCP Destination Setup

- a Destination information added to `SCU_List.dic`? \_\_\_\_\_
- b `SCU_List.dic` updated on DICOM Gateway? \_\_\_\_\_
- c Destination application accessible? \_\_\_\_\_

### DICOM Gateway Setup

- a Image Gateways configured properly? \_\_\_\_\_
- b Routing Gateway configured properly? \_\_\_\_\_

### Routing Rule Setup

- a Rules defined in `Route.dic`? \_\_\_\_\_
- b `Route.dic` imported successfully? \_\_\_\_\_

### Routing Activation

- a Image Gateways processing images? \_\_\_\_\_
- b Routing Gateway evaluation processor activated? \_\_\_\_\_

- c** Transmission processor(s) for all destinations activated? \_\_\_\_\_
- d** Images routed successfully? \_\_\_\_\_
- e** Images at receiving site purged at end of retention period (Imaging dests. only) \_\_\_\_\_

## Appendix B: Using MAG\_Decompressor

---

This section explains how to install and configure the Automatic Decompression Service (MAG\_Decompressor).

MAG\_Decompressor can be installed on a system serving as an Imaging destination (such as a VistARad workstation). MAG\_Decompressor cannot be used on DICOM Storage SCP destinations, or on a DICOM Gateway.

Once it is configured, MAG\_Decompressor runs in the background and will de-compress routed images as they are received by the destination system.

This service does not need to be installed on systems that receive only uncompressed routed images.

### Licensing

You will need to purchase an Aware JPEG2000 Toolkit **client** license for each system that is receiving routed images. Even if that system serves as a centralized temporary storage for multiple workstations, only a single client license is needed. For each system (DICOM Gateway) that is transmitting compressed routed images, you will need to purchase an Aware JPEG2000 **server** license. For more information, contact Clinical Product Support.

### Setup

#### Distribution

The decompression software installation file, MAG\_Decompressor\_Setup.exe, is distributed with the DICOM Gateway software, and is also available at the Imaging FTP site.

#### Installation

1. As an administrator, log onto the system that will be receiving compressed images.
2. Copy MAG\_Decompressor\_Setup.exe to a local location and double-click the file.
3. As the InstallShield script is executed, click on **Next**, **OK** and **Finish** as appropriate. The software will be installed into its own folder under C:\Program Files\VistaA Imaging.

4. Use Windows Explorer to create a folder named <drive>\Complog, where <drive> is the drive where routed images are stored.
5. Make sure the administrative user has write permission to this folder. (Right-click the new folder, click **Properties**, click the **Security** tab, and check the permissions list on the tab.)
6. In the new \Complog folder, create a new file named log.txt. This “seed file” will become the decompression log file once the decompression service is started.
7. Open the Environment Variables dialog as follows:
  - a. Right-click **My Computer**, and choose **Properties**.
  - b. In the System Properties dialog, click the Advanced tab, then click **Environment Variables**.
8. For each variable below, select the variable, click **Edit**, then change the value as follows:

**DECOMP\_LOG\_FSPEC**

Enter the full path and file name of the log file created in steps 6 and 7 above.  
decompression service log file.

**DECOMP\_LOG\_FILE\_MBYTES**

Set the maximum size permitted for the decompression service log file. The recommended value is 10MB. When the stated limit is reached, a new instance of the log file will be generated. (The 10 most recent files are retained).

**DECOMP\_WATCH\_DIR**

Specify the root folder to be monitored by the decompression service (the folder that is receiving compressed images).

**DECOMP\_DELAY\_MS**

Optionally, you can set the number of milliseconds that the service will wait after detecting a compressed file before beginning the decompression process. The default of 50ms is usually sufficient.

9. Click **OK** to step back through the various dialogs and to apply your changes.
10. Activate MAG\_Decompressor as follows
  - a. Open a command line window (click **Start | Run**, then enter **cmd**), then switch to the MAG\_Decompressor installation folder:

```
cd \Program Files\Vista\Imaging\MAG_Decompressor <Enter>
```

- b. Enter **dir** at the prompt and verify that the files shown below are present.

```
04/13/2005  07:16a                856,064  awj2k.dll
05/02/2005  08:39a                53,248  MAG_Decompressor.exe
```

**Note** If the DLL file is not present, contact the Imaging Group for information about acquiring a toolkit license. The decompression software will not work without the DLL file.

- c. Enter the following command to activate the program (The command will complete without any warning or error messages.)

```
Mag_Decompressor -install <Enter>
```

- d. Close the command window.

11. Reboot the system.

### Service Startup

On the system receiving routed images, start the decompression service as follows:

1. In the Control Panel, double-click **Administrative Tools**, then double-click **Services**.
2. In the window that opens, locate the entry for the MAG J2K Decompressor Service.
3. Right-click on the entry and select Start. Wait until the status display shows that the service is started.
4. Right-click again on the entry and select **P**roperties.
5. In the Properties window, select **A**utomatic as the startup type, then click **O**K.
6. Verify that the status display shows that the service is Automatic, and close all remaining Control Panel windows.

After activation, compressed routed files will be automatically decompressed as they are received.

### Logging

The decompression software will run automatically when needed. If problems are encountered, review the log files generated by the MAG\_Decompressor software.

Log files are stored in the location specified in the DECOMP\_LOG\_FSPEC system variable. The 10 most recently generated log files are retained.

**Sample log entry:**

```
2005-04-19 16:59:01 -----
-----
2005-04-19 16:59:01 S T A R T E D Directory-Watch/Decompression Service over
C:\test_img_cache\
2005-04-19 17:01:10 C:\test_img_cache\MAG_EyeClot.J2K Status -> SUCCESS (0)
2005-04-19 17:01:11 C:\test_img_cache\MAG_Skull.J2K Status -> SUCCESS (0)
2005-04-19 17:01:19 C:\test_img_cache\MAG_Spine.J2K Status -> SUCCESS (0)
2005-04-20 13:32:59 C:\test_img_cache\MAG_Spine.J2K Status -> OutFile Already
Exists, InFile Removed
....
....
2005-04-21 13:34:32 S T O P E D Directory-Watch/Decompression Service over
C:\test_img_cache\ (status=ok)
```

**Selected log file error codes:**

1..999 Aware JPEG2000 library errors

1000... Application errors:

- 2006: EIFILEREMOVE-- input file remove error (access violation)
- 3000: EOFILEEXISTS-- output file already exists
- 3001: EOFILEOPEN-- error while opening the output file
- 3003: EOFILEWRITE-- problem attempting to write the data to the output file
- 3004: EOFILERENAME-- error while renaming output file from .tmp to .<ext>

# Glossary

---

**automatic routing** The automatic delivery of selected images to one or more destinations. Automatic routing functions are managed using the Routing Gateway.

**destination** A recipient of routed images. Destinations can be Imaging destinations, such as VistARad workstations, or DICOM Storage SCPs, such as a film printer or external PACS.

**DICOM IMAGE OUTPUT File (#2006.574)** The FileMan file where transmission queue entries for DICOM Storage SCP destinations are stored. Entries can be added to this file by the evaluation processor (for automatic routing) or using Imaging Gateway option 2-8-1 (Select DICOM Images for Transmission).

**DICOM TRANSMIT DESTINATION File (#2006.587)** The FileMan file where information about DICOM Storage SCP destinations is stored. This file should not be edited directly; to update the contents of this file, use the DICOM Gateway to update the `SCU_List.dic` file.

**evaluation processor** The process responsible for managing the evaluation queue and for determining whether a newly acquired image should be automatically routed.

**IMAGE BACKGROUND QUEUE File (#2006.03)** A multipurpose FileMan file where evaluation queue entries are stored. Entries intended for use by other processes are also stored in this file.

**locks** Used on a VistARad workstation to prevent more than one radiologist from interpreting the same exam. A radiologist who opens a locked exam will be notified that the exam is locked. This radiologist will be able to display the exam, but not to update its status.

**NETWORK LOCATION File (#2005.2)** The FileMan file where entries for all physical storage devices in the Imaging system, including Imaging destinations for routing, are stored.

**on-demand routing** The transmission of manually selected exams to one or more destinations.

**Route.dic** The DICOM Gateway dictionary file used to store routing rules.

**routing** In the VistA system, the process responsible for sending images across a WAN to one or more remote locations. Routing can be performed automatically or on-demand.

**Routing Gateway** A DICOM Gateway that is configured to manage the routing of images in the VistA system. A Routing Gateway is typically run on a dedicated

computer. Also, the set of menu options in the DICOM Gateway software specific to routing.

**routing rules** The information used by the Routing Gateway to select images for automatic routing.

**routing system** All of the software and hardware components related (but not necessarily limited to) routing. Parts of the routing system include the Routing Gateway, Image Gateways, and VistARad workstations.

**evaluation queue** The queue used to determine whether newly acquired images will be automatically routed. This queue is populated by Image Gateways. Entries in this queue are compared to routing rules by the evaluation processor. Entries that meet the criteria in routing rules are added to the transmission queue.

**SCU\_List.dic** A dictionary file used by the DICOM Gateway that stores information about each DICOM Storage SCP that can receive routed DICOM images from VistA Imaging.

**SEND QUEUE (#2006.035)** The FileMan file where transmission queue entries for Imaging destinations are stored. Entries can be added to this file by the evaluation processor (for automatic routing) or by a VistARad user (for on-demand routing).

**transmission processor** The generic term for either of the two processes responsible for sending routed images to destinations. Imaging destinations are served by one or more instances of the transmission processor 3-1 (Start the Transmission Processor) associated with the Routing Gateway. DICOM Storage SCP destinations are served by one of more transmission processors 2-8-2 (Transmit DICOM Images to a Storage SCP) associated with the Image Gateway.

**transmission queue** The generic term for either of two queues used by transmission processors. Entries in these queues identify images to be routed and where the images are to be sent. See also: SEND QUEUE File (#2006.035) and DICOM IMAGE OUTPUT File (#2006.574).

**VistARad** The software used to display and interpret radiology exams. VistARad is also the primary tool used to display routed exams and to route exams on-demand.

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