VistA Imaging DICOM Gateway

User Manual

September 2011 – Revision 10
MAG*3.0*49, 99

DICOM Gateway User Manual
VistA Imaging MAG*3.0*49, 99
September 2011

<u>Caution</u>: 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.

Preface

This is a draft of the user guide for the VistA Imaging DICOM Gateway. The purpose of this document is to help users understand the operation of the VistA Imaging DICOM Gateway and to assist them in their daily tasks.

Revision History

1 Sept 2011	Rev 10: Updates for MAG*3.0*49 (Sections 3.1, 3.1.1, 3.6, 3.9.2.1, 4.11.3, 4.17, 10.3.3, and 10.4.2.3) and MAG*3.0* 99 (Sections 4.11.1, 4.11.2, 4.12, 4.13, 4.16, 6.3.5, 10.1, 10.3.3, 10.3.4, 10.4, 10.4.1, 10.4.2, 10.4.2.1, 10.4.2.2, 10.4.2.3, 10.4.2.4, 10.4.2.5, and 10.5) L. Scorza, L. Jenkins.
1 Dec 2010	Rev 9: Updates for MAG*3.0*53 (Sections 1.6, 4.8, 6.1., 6.3.3, 6.3.4, 6.3.5, 6.3.6, 6.3.7, 6.3.8, 6.3.9, 6.3.11, 6.3.12, and 7.9) and MAG*3.0* 66 (Sections 6.4.2 and Appendix A) L. Scorza, L. Jenkins.
20 Oct 2009	Rev 8: Updates for Patch 54. Also removed obsolete information from section 6.2.7. Typo and document convention corrections throughout. A. McFarren, S. Littles.
28 June 2007	Rev 7: updates for Patch 69. Updated content in sections 1.6, 2.1, 2.2.1, 2.3, 3.2, 3.3, 4.1.2, 4.2, 6.2.7, 6.3.2.17, 6.3.2.28-29, 6.4.1, 6.4.2, 6.4.3, 6.4.5, and 12.5. Additional cosmetic updates reflecting shift to Caché made throughout manual. E. deMoel, A. McFarren.
07 May 2007	Rev 6: new material for Patch 65. Added sections 10.6 and 10.7. A. McFarren, J. Christensen.
20 Jul 2006	Rev 5: updates for Patch 50: updates sections 4.16, and 4.16.1. Added new sections: 4.16.5 and 4.16.6. S. Davis, A. McFarren, R. Coney.
30 Jun 2006	Updates for Patch 51, updated section 4.18. A. McFarren, R. Coney.
12 Dec 2005	Rev 4: updates for Patch 57: Updated obsolete screen shots in sections 6.3.1, 6.4.3, 6.4.4, 14.1, 14.4, and 14.7. Removed NT references, verified sensitive data removal throughout. A. McFarren, C. Huesman.
16 Apr 2004	Rev 3: changes for final release of Patch 11
31 Mar 2004	Changes for final release of Patch 11
12 Feb 2004	Changes for final release of Patch 11
12 Nov 2003	Rev 2: changes for final release of Patch 10
3 Nov 2003	Changes for final release of Patch 10
23 June 2003	Changes for final release of Patch 10
13 Nov 2002	Changes for Patch 9 – inserted new chapter on Routing (Chapter 5)
31 Oct 2002	Changes for Patch 10 – replaced references to Clinical Specialties with Healthcare Providers
6 Aug 2002	Changes for Patch 10 – DICOM Interface for Healthcare Providers
21 Mar 2002	Rev 1: Final revision for Version 3.0
12 Sept 2001	Added radiology report corruption error
29 Sept 2000	Final revision for Version 2.5
9 Aug 2000	Add troubleshooting information from Support Database
31 May 2000	Made corrections suggested by Lisa C. Barnett, Mt. Home, TN
2 May 2000	Peter Kuzmak added PACS Image Transfer appendixes
Apr 2000	Extensive editing by Ed de Moel and Pete Kuzmak

24 Feb 2000	Incorporated Peter Kuzmak's review comments
2 Feb 2000	Remove chapter about automated routing, to be re-included when routing will be included in product
28 Jan 2000	Add new site parameter: Send CPT Modifiers
3 Jan 2000	Added more trouble shooting details
18 Aug 1999	Incorporated more of Peter Kuzmak's additions
29 Jul 1999	Added Amy Padgett's Standard Operating Procedures
21 Jul 1999	Incorporated Lucille Barrios' additions, re-arranged menu-options
23 Jun 1999	Incorporated Peter Kuzmak's additions, distributed for comments
10 Jun 1999	Almost complete version, reviewed by Peter Kuzmak
1 Jun 1999	Initial Version

Copyrights and Trademarks

Product names mentioned in this document are trademarks or registered trademarks of their respective companies:

ADAC	ADAC Laboratories, Milpitas, CA
AGFA	Agfa Division of Miles Laboratory, Inc., Ridgefield Park, NJ
ACR-NEMA	National Electrical Manufacturers Association, Rosslyn, VA
Accuson	Accuson Corporation, Mountain View, CA
BRIT	Brit Systems, Dallas, TX
Caché	InterSystems, Corp., Cambridge, MA
Cemax-Icon	Cemax-Icon, a Kodak Company, Fremont, CA
CT/i	General Electric Medical Systems, Milwaukee, WI
DICOM	National Electrical Manufacturers Association, Rosslyn, VA
EasyVision	Philips Medical Systems, Shelton, CT
eMed	eMed Technologies Corporation, Lexington, MA
EndoWorks	Olympus America, Inc., Melville, NY
GEMS	General Electric Medical Systems, Milwaukee, WI
ImageShare	DeJarnette Research Systems, Towson, MD
Lumisys 75	Lumisys, Inc., Sunnyvale, CA
MediShare	DeJarnette Research Systems, Towson, MD
OEC C-Arm	OEC Medical Systems, Inc., Salt Lake City, UT
PACS Broker	Mitra Imaging Inc., Waterloo, Ontario Canada (owned by Agfa)
Siemens	Siemens, Iselin, NJ
TARGA, TGA	Truevision, Inc. Indianapolis, IN
VistA	U.S. Department of Veterans Affairs
Windows 2000, XP, etc.	Microsoft, Redmond, WA

All patient and provider names, as well as all IP addresses used in example scripts are fictional.

Table of Contents

Chapter 1   Introduction

1.1   The System: VistA Imaging

The VistA Imaging System is an extension of the VistA hospital information system that captures clinical images, scanned documents, and other non-textual data files and makes them part of the patient's electronic medical record. Image and text data are provided in an integrated fashion that facilitates the clinician's task of correlating the data and making patient care decisions in a timely and accurate manner. The system serves as a tool to aid communication and consultation among physicians — whether in the same department, in different services, or at different sites.

A hospital imaging system can be implemented all at once or incrementally over time. Even if equipment is purchased and installed at once, it is best to gradually add users and service functionality to the system. It takes time for the IRM staff to be trained and gain experience in how to support imaging technology. It takes time for the initial users of the system to become comfortable enough with the applications to use them during procedures and conferences. Devices within services will need to be connected to workstations to allow image capture. Clinical advocates are very helpful in bringing together clinical image users and IRM staff to implement the capture of new image types. This is an exciting and rewarding endeavor, but one that requires effort on the part of IRM.

Note: All equipment for use with the VistA Imaging system must be tested by the VistA imaging project team for compatibility, reliability, and safe operation. See the VistA Imaging Planning Document (http://vaww.va.gov/imaging/Planning.pdf) for the current list of approved items. This is a requirement set by the VA and the FDA.

> **Attention: The Food and Drug Administration classifies the VistA Imaging DICOM Gateway as a medical device. As such, it may not be changed in any way. Modifications to the software or database may result in an adulterated medical device under 21CFR820, the use of which is considered to be a violation of US Federal Statutes.**

1.2   The VistA Imaging DICOM Gateway

DICOM is the abbreviation for the **D**igital **I**maging and **C**ommunications in **M**edicine standard. DICOM brings open systems technology to the medical imaging marketplace and enables VistA to communicate directly with commercial medical imaging equipment.

The VistA Imaging DICOM Gateway is a suite of VA-developed software that facilitates the transmission of DICOM images between the image acquisition modalities[1] and the equipment on which these images are permanently stored. The images and information about them are stored in the VistA database as a part of the patient record. Once images have been stored in the system, they are available for viewing from any VistA clinical or diagnostic workstation.

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[1] The term "modality" is from the DICOM standard and denotes any equipment that produces images.

The software in the VistA Imaging DICOM Gateway is intended to run on one or more PCs that are loosely coupled with the VistA Hospital Information system. Several functions of this Gateway operate automatically without any user intervention. You control other functions of this Gateway through a series of menus.

The later chapters in this manual will describe the various menu options as well as any additional set-up and fine-tuning features of the VistA Imaging DICOM Gateway.

The menu-tree for the current version of the VistA Imaging DICOM Gateway is shown at the end of this chapter.

1.3   Installation of the VistA Imaging DICOM Gateway

The installation procedure for the VistA Imaging DICOM Gateway is described in the VistA Imaging DICOM Gateway Installation Guide.

The Installation Guide contains a concise set of instructions that depict an initial installation, as well as a detailed set of instructions that describe all tuning parameters that pertain to the VistA Imaging DICOM Gateway.

1.4   How to Get Software and Documentation Updates

This software will be available in the Imaging FTP directory under your site's folder. Installation instructions are included in this document.

Terms of Use: FDA regulations require that each Imaging software distribution is documented and tracked by the VistA Imaging project. To receive this patch, sites must have a Site Agreement filed with and approved by the VistA Imaging Group.

For information concerning the status of a Site Agreement contact the VistA Imaging Team via email (vhaiswimgteam@va.gov).

1.5   Documentation Conventions

The following conventions are used in this manual.

Convention	Description
Bold type	User Keyboard Entry
\<Enter\>	Return key or Enter key
\<Control+x\>	A keystroke that involves pressing the control-key, keeping it depressed, and then pressing another key.
\<**SHIFT**\>	Shift key
\<**ESC**\>	Escape key

1.6   VistA Imaging DICOM Gateway Menu

Chapter 2 General Operation

The VistA Imaging DICOM Gateway runs on a Windows-based workstation as a set of tasks within a Caché™ Server system. To operate the system, the Caché Server needs to be running first. The various subtasks of the VistA Imaging DICOM Gateway then run either invisibly in the background or as telnet sessions connected to the Caché Server process.

2.1   VistA Imaging DICOM Menu

The installation should have added a number of programs to the Windows Start menu.
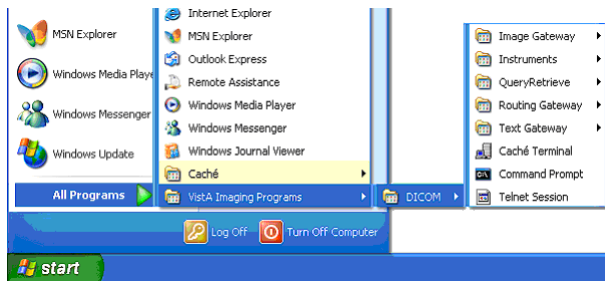
Follow the various menu trees to view all available menu options.

The sections below describe the various application programs in detail.

2.2   High-Level Overview of Components of the VistA Imaging DICOM Gateway

The following section will familiarize you with some of the software components of the VistA Imaging DICOM Gateway.

2.2.1   Caché Cube

The Caché server can be controlled using the Caché Cube. The icon for this purpose is located in the system tray of the Windows Menu Bar, usually in the lower right corner of the display.

When Caché is inactive, this icon is grey:

When Caché is active, this icon is blue:

This icon can be used to start and stop the Caché server. Under normal circumstances, the Caché server is started automatically when the computer is restarted, and users only need to stop and restart Caché when this is needed for maintenance purposes.

2.2.2 Caché Terminal

The icon labeled "Caché Terminal" (and all similar ones) can be used to start telnet sessions with the Caché Server. The various applications of the VistA Imaging DICOM Gateway are all run as terminal-like telnet sessions.

2.2.3 VistA DICOM Viewer

The icon labeled "VistA DICOM Viewer" can be used to launch a program that may be used to view images directly on the PC.

2.2.4 VistA DICOM Storage Provider

The icon labeled "CT Scanner" is used to launch the VistA DICOM Storage provider that is used to acquire images directly from the device. There is one of these icons for each DICOM device sending images to VistA, and each spawns its own Storage Service provider. See Chapter 4 for details.

2.2.5 Command Prompt

 or
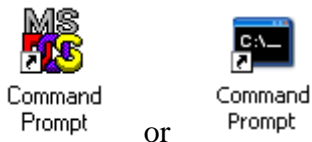
The icon labeled "Command Prompt" provides easy access to an MS-DOS command window. Such windows are used to interact directly with the operating system.

2.3 Starting the Caché Server

The first step in the operation of any component of the VistA Imaging DICOM Gateway is to start the MUMPS Server (Caché Server). Once this program has been started, it should continue to run, until it is explicitly shut down (see Section 2.6).

Right-click the icon for the Caché Cube. This will display a menu that can be used to manipulate the Caché system, in this case to start Caché. Select **Start Caché**:

Note: Once Caché is started, the icon will change from grey to blue, and the selection of available menu options will change.

2.4 VistA Gateway Main Menu

When a telnet session is initiated after Caché is started, a window will open that shows the VistA Imaging DICOM Gateway login dialog.

```
*****************************************************************************
**   VistA DICOM Interface                              Caché Test System  **
**                                                                        **
**   The Food and Drug Administration classifies this software as a medical **
**   device.  Modification of this software may result in an adulterated   **
**   medical device, the use of which is considered to be a violation of   **
**   US Federal Statutes.  Federal law restricts this device to use by or   **
**   on the order of either a licensed practitioner or persons lawfully     **
**   engaged in the manufacture, support, or distribution of the product.   **
**                                                                        **
**   The information in this system is further protected by the Privacy Act **
**   of 1974 (PL93-579).  Unauthorized access to or use of this system is a **
**   serious violation of Federal Law.  Violators will be prosecuted.       **
**                                                                        **
**                  Use of this software is monitored.                      **
*****************************************************************************

ACCESS CODE:
VERIFY CODE:
```

To log in to a DICOM Gateway, you can choose among a number of different access and verify codes.

1. The access and verify codes that were entered as part of the installation procedure are to be used for maintenance on the DICOM Gateway itself. When interaction with the VistA Hospital Information System is required, a different combination of access and verify code is required

2. When you need to interact with the VistA Hospital Information System, a combination of access and verify code must be used that is valid on the VistA system (these codes cannot be maintained or modified on the DICOM Gateway and should be set up on the VistA system using Kernel User Management menu options). Such a combination of access and verify code will identify you as a valid user of the VistA system, and you will have the privileges that the VistA system assigns to the owner of the specified access and verify codes.

Each DICOM Gateway is associated with a location (see 6.3.2.2). When you use credentials that are to be validated on the VistA system, the DICOM Gateway will attempt to set the current division such that it corresponds to the location of the DICOM Gateway. Access to the DICOM Gateway is granted only when the VistA system acknowledges that the specified credentials give access to that division or location.

The procedure to modify access code and/or verify code is, for obvious reasons, protected by a password of its own. See Chapter 8 for a description of this procedure.

When a valid access code and verify code have been entered, the main menu will appear:

```
VistA DICOM Gateway Menu

    1   Text Gateway
    2   Image Gateway
    3   Routing Gateway
    4   System Maintenance
    5   Exit

  OPTION:
```

The later chapters in this manual will describe the functions of the various sub-systems in detail.

2.5   Directory Path Conventions

It is strongly recommended that rather than support separate copies of the dictionary files on each gateway system, the site maintain a single copy of the DICOM dictionary files in a **\DICOM\Dict** directory on a network drive, from which it can be accessed by all the systems.

In this document, the **\DICOM\data1** and **\DICOM\Image_in** directories are shown as being on the **d:** local drive. Also for illustrative purposes, the **\DICOM\Dict** directory is placed on the **f:** networked drive, where it is shared by multiple gateways. Please note that a specific site's configuration may use different drive letters for these directories.

2.6   DICOM Gateway Shutdown

For all DICOM gateways, the normal method for shutting down is to ensure that all processing has stopped. To stop processing, do the following for each active menu process/telnet window on a gateway:

1. Stop the process (use **CTRL**+**C** if needed).
2. Navigate to the main DICOM Gateway menu and enter **5** (Quit).

   *Note***:** This is preferable to using ❌ to close the window.

The normal method for shutting down a Caché system is to right-click the (blue) Caché Cube in the task bar and then select the option **Stop Caché**. After this, a confirmation window will pop up...
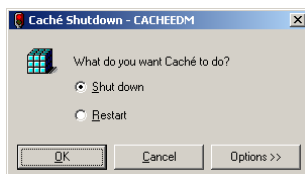
...and the **Shut down** option can be selected.

Either way, the Caché System should always be shut down *before* a PC is to be powered off. **The Caché Database Management software should never be terminated without allowing the Caché software to shut down properly.** Failure to run the Caché System Shut Down procedure may cause the internal database to become corrupted, or may prevent the most recent transactions from being stored permanently.

Chapter 3 Text Gateway

The general function of the Text Gateway is to distribute event data from the VistA Hospital Information System to image acquisition modalities and Picture Archiving and Communication Systems (PACS).

This event data is used to build the database that supports the DICOM Modality Worklist service. The various modalities are able to use this service to obtain information about their respective outstanding orders.

Two different methodologies are used in the VistA Imaging DICOM Gateway to handle the text files. For Modality Worklist, a single process performs both the TCP/IP communications and the message handling. An entirely different technique is used for messages sent to a commercial PACS. In this case, separate processes perform the communications and message handling chores, and prioritized messages queues are used to ensure reliable delivery to multiple destinations. The details of these different methods are described in Chapter 9.

3.1   DICOM Modality Worklist

Modality Worklist is the DICOM service that allows an image acquisition instrument, like a CT scanner, to query a provider system, connected to a hospital information system, to obtain a list of examinations that are to be performed at that unit. The modality worklist query precedes the acquisition of the images so that the electronically obtained data can be copied to the header of each image. Modality Worklist eliminates the manual entry of patient and study data at the acquisition workstation. At least six pieces of information are typically returned in a modality worklist query: patient name, patient ID (social security number), accession number (for example, the radiology date case number in MMDDYY-NNNNN format or in site-specific SSS-MMDDYY-NNNNN format), procedure name, date of procedure, and Study Instance UID. All new DICOM image acquisition devices are required by the VA to support the Modality Worklist service to automatically download selected patient and study information.

There are a variety of different ways for a user (image acquisition instrument) to query a provider of the DICOM Modality Worklist service. The user may ask for the entire list of examinations that can be performed at that unit, or may use the accession number to select just the study of interest. Both are useful, one to get a "heads up" to see how much work there is to do, and the other for drilling down to get specific, detailed information about a particular study. Querying for the entire list of examinations and providing a "pick list" gives too many choices to the technologist and has proven to be error prone in practice. Generally, the accession number query is preferred when dealing with individual examinations, since it gives feedback about the particular case and presents the technologist with the smallest number of possible choices. (See Section 3.9 below for examples of Modality Worklist queries.)

VistA is a provider of the DICOM Modality Worklist service. (This service can also be supplied commercially by a PACS.)

The VistA Modality Worklist Provider originally worked only with radiology devices. DICOM capabilities outside of radiology are now supported in CONSULT/REQUEST TRACKING/CPRS for the healthcare providers in the clinical specialties.

VistA DICOM Image Gateway Modality Interface

Modality Worklist Query

Modality Worklist Response

VistA

HIS

Image Transfer

Imaging
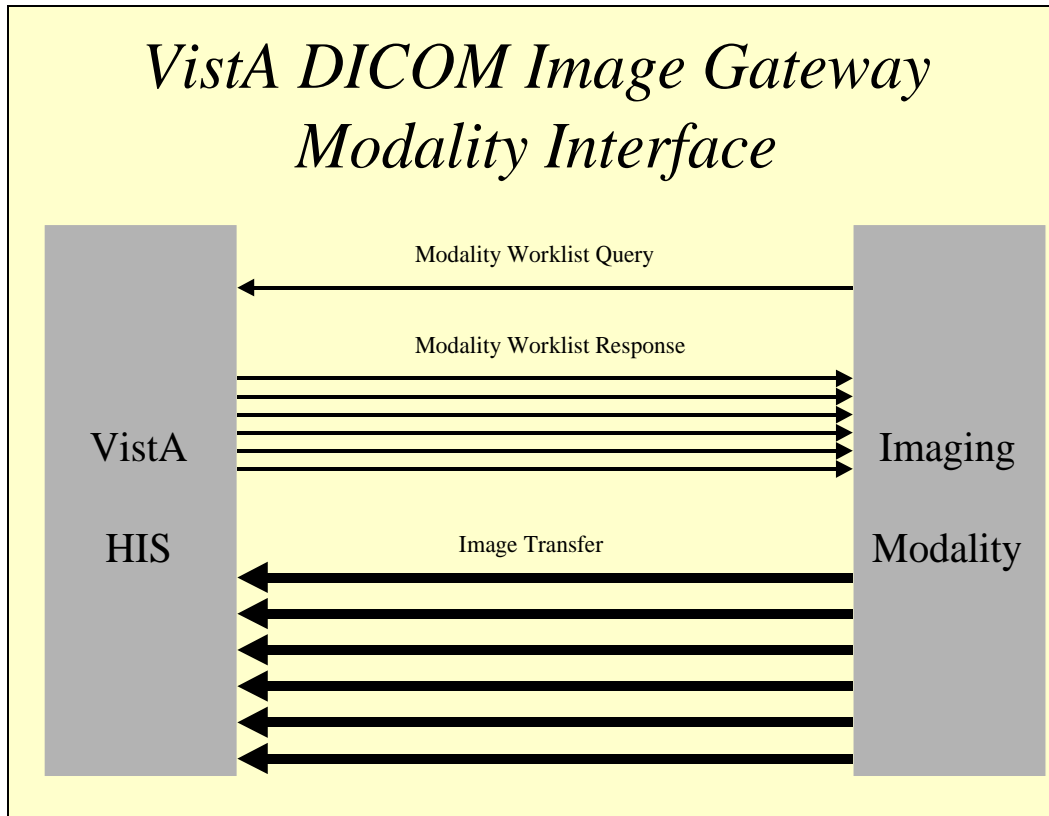
Modality

3.1.1 DICOM Modality Worklist for Radiology

Two events in the radiology department are used to add entries to and delete them from the VistA Modality Worklist database (maintained on the VistA Text Gateway). The "registration of the patient" in the radiology department triggers the sending of the Order Entry HL7 message to the VistA Text Gateway, which adds the study to the VistA Modality Worklist database. At the completion of the examination, the "case edit" of the study in the radiology department, performed by the technologist *after* verifying that all the images can be displayed on VistA, triggers sending of the Exam Verification HL7 message to the VistA Text Gateway. This message causes the study to be deleted from the VistA Modality Worklist database.

While a study is in the VistA Modality Worklist database, it can easily be accessed with an accession number query using the case number (that is, without the leading site and/or date components). When a study is not in the Modality Worklist database, it can be accessed with an accession number query using the date case number or site date case number formats (that is, with the leading case and/or date components). In this situation, the main hospital system database is used to look up the study. This capability is very useful when digitizing film for prior studies.

In the VistA Modality Worklist database, the acquisition instruments are mapped to the radiology studies by physical location and Image Type (radiology package parameter). This means that for a consolidated site, each radiology location is subdivided into general radiology, CTs, MRIs, and so forth. When a query for the entire list of examinations is received, only the subset of cases for that specific site and Image Type are sent back to the acquisition instrument.

Some studies are performed on more than one acquisition instrument; for example, a Barium Enema, which has one procedure step that is performed on a general x-ray (computed radiography (CR) or digital radiography (DX)) device, and another step that is performed via digital radio fluoroscopy (RF). In order to direct the studies to the specific instruments, the entry in the RAD/NUC MED PROCEDURE file (#71), stored in `^RAMIS(71)`, needs to be mapped to the RAD MODALITY DEFINED TERMS file (#73.1) , stored in `^RAMIS(73.1)`. The entry for Barium Enema would need to be mapped to both CR (or DX) and RF, in this example.

Some studies span several days, with multiple examinations (for example, nuclear medicine). A report may be entered after the first examination, causing the entry in the VistA Modality Worklist database to be deleted. In this situation, the accession number query with the site and/or date case number (that is, either SSS-MMDDYY-NNNNN or MMDDYY-NNNNN) should be used on subsequent days to retrieve the patient information for the same study.

3.1.2 DICOM Modality Worklist for Heathcare Providers

The Consult Request Tracking application is used in the clinical specialties for order entry, request tracking, and result reporting. The VistA Appointment Management package (which is separate from CPRS) is used for scheduling clinic visits. The following steps are performed for both consult and procedure requests:

1) The clinician enters an order for a consultation or a procedure.
2) The consult service is notified of the request.
3) The consult service may accept the request with notification sent back to the patient's clinician.
   a. Alternatively, the consult service may forward the request to a different service; or
   b. The consult service can discontinue or cancel the request.
4) The consult service schedules an appointment for the patient.
5) The consult service checks the patient in when the patient arrives for the appointment.
6) The consult service performs the consultation and/or procedure(s) and enters the results.
   a. Image acquisition devices and result reporting systems may be used in this process.
7) The consult service signs the final result, completing the request; results are sent back to patient's primary care provider.
8) The consult service checks the patient out, thus completing the visit and recording billing codes.

The DICOM interface for Healthcare Providers meshes seamlessly with the existing workflow and integrates with the HIS applications being used by the clinical specialties and with VistA Imaging.

To provide the greatest flexibility for different workflow scenarios, the interface is designed to operate entirely from the Consult Request Tracking messages. Many of the Consult Request Tracking steps can be omitted. All the appointment management messages are completely optional.

VistA DICOM Modality Worklist interface receives information from the CPRS Consult/Procedure Request Tracking application and the VistA Appointment Management package during various steps of the workflow. The ordering, accepting, scheduling, check-in, and result entry steps in the workflow are used to create and update the Modality Worklist database, while the completion steps cause entries to be deleted.

A broad modality worklist query produces a list for all the pending and scheduled consults and procedures for that clinical specialty. The DICOM Text Gateway also supports patient or accession number query, which may be more useful.

The VA HIS supports a "Quick PID" alternate patient identification scheme. This is a hash index, which uses an abbreviated identifier consisting of the first letter of the last name follow by the last four digits of the social security number (for example, K1234). This value is then used in either the Patient Name or Patient ID matching key to retrieve all of the consult/procedure requests for the patient.

The accession number identifies the consult/procedure and is displayed on the CPRS screen with the request. This value can be used in either the Accession Number or Requested Procedure ID matching key to retrieve the specific request.

Note: See Chapter 14 - VistA DICOM Interface for Healthcare Providers Operation for detailed information.

3.2   Text Gateway Folder Icons and Screen Layouts

The directory window for the Text Gateway contains the icons shown below. A site may add some site-specific icons, corresponding to the kind of activities at the site.
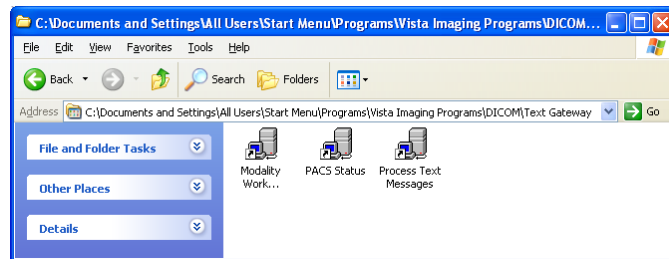
The following figures show how to allocate screen space for all the different DICOM Text Gateway processes running on the desktop.

The figure below illustrates the typical screen layout when there is no commercial PACS and the Text Gateway functions solely as a DICOM Modality Worklist Provider.

Text Gateway without Commercial PACS Screen Layout

**Modality Worklist
Status Window**

**Text Gateway
Window**
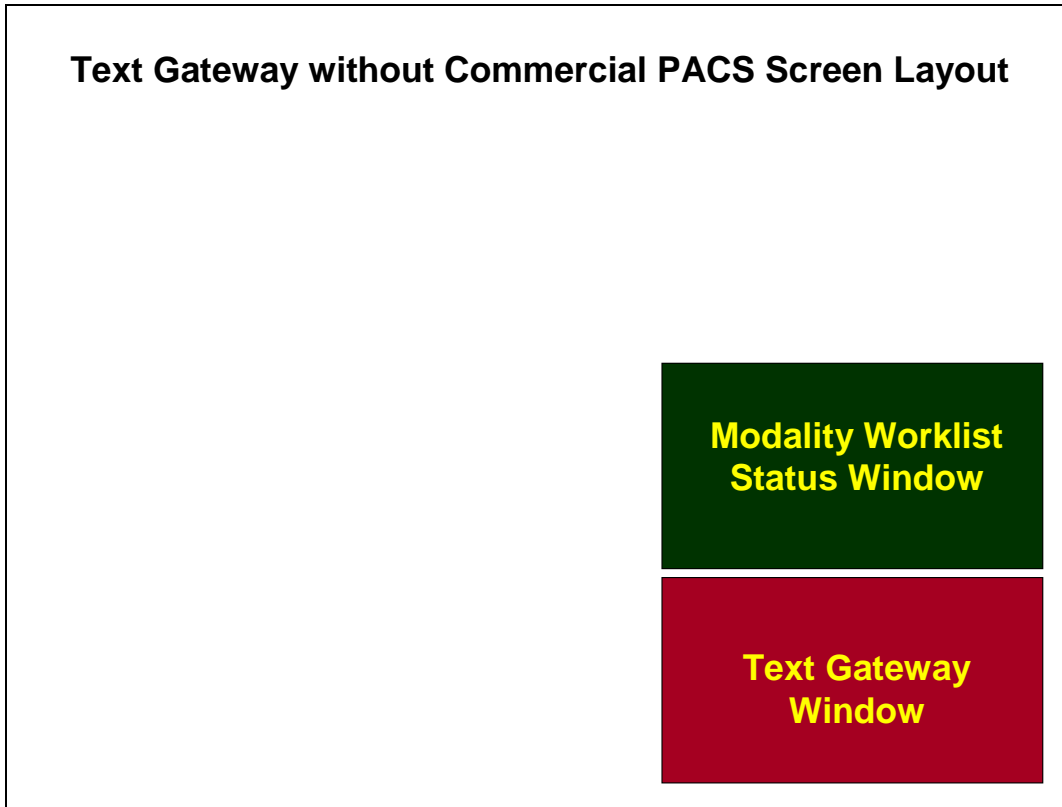
The next figure shows a screen layout where there is a commercial PACS (using the Mitra PACS Broker) and a separate commercial Modality Worklist Provider (the DeJarnette MediShare).

Text Gateway with Commercial PACS Screen Layout

Mitra PACS Broker Communications Window	**Text Gateway Statistics Window**
DeJarnette MediShare Communications Window	**Text Gateway Window**
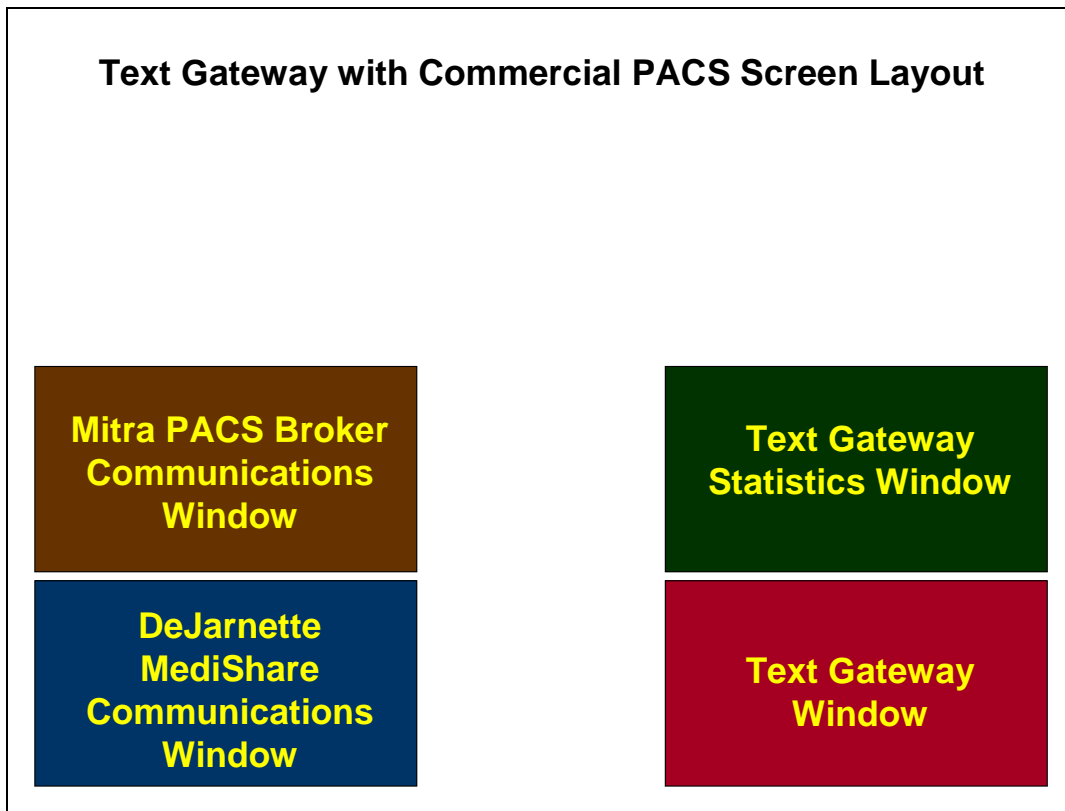
Note: This figure is for screen layout illustration purposes only, and represents what is used at a few older sites. There may no longer be any need for a separate commercial Modality Worklist Provider (i.e., the DeJarnette MediShare or Mitra Modality Worklist products), since this service can be supplied by the VistA DICOM Text Gateway.

Note: Some modalities use the Mitra Broker internally

3.3   Starting the Caché Server

The first step in the operation of any component of the VistA Imaging DICOM Gateway is to start the MUMPS Server (Caché Server). Once this program has been started, it should continue to run, until it is explicitly shut down (see Section 2.6).

Right-click the icon for the Caché Cube. This will display a menu that can be used to manipulate the Caché system, in this case. to start Caché. Select **Start Caché**:

Note: Once Caché is started, the icon will change from grey to blue, and the selection of available menu options will change.

3.4   Text Gateway Menu

Below are the menu options for the Text Gateway software:

1.   Start Processing Text Messages from HIS
2.   Send DICOM Text Messages to Commercial PACS or Broker
3.   Display Text Gateway Statistics
4.   Display Modality Worklist Statistics
5.   Modality Worklist Query
6.   Display a HL7 Message
7.   Display a DICOM Message
8.   Modify the HL7 Message Pointer
9.   Generate a Daily Summary Report
10.   Purge Old Modality Worklist Entries
11.   Purge Old DICOM Message Files
12.   Purge Old HL7 Transaction Global Nodes
13.   Purge Old Audit Records

Note: Caché must be running for any of these menu options to be used.

3.5   Start Processing Text Messages from HIS

The VistA DICOM Text interface receives HL7 messages from the main hospital system, obtains additional data from the main database, and builds the DICOM Modality Worklist database. If a commercial PACS is present, it converts the HL7 message to a DICOM text message, stores it in a file, and sends it to the commercial PACS.

This menu option starts the procedure to read the HL7 messages, build the DICOM Modality Worklist database, and create the DICOM text messages. The sending of these messages is handled by another process.

Within the folder for DICOM Text Gateway, there is a special icon for this menu option. These special icons are created automatically during the installation process. (For a detailed description

of these icons, their function as shortcuts, and the values of their parameters, see the VistA Imaging DICOM Gateway Installation Guide.)

Process Text
Messages

This icon in the DICOM Text Gateway folder will start a Telnet session with the Caché server. When you double-click this icon, a telnet window will open. The title bar of this window will contain the following text:

A convention throughout the VistA Imaging DICOM Gateway is to use the titles of the telnet windows to specify the name of the task and the sequence numbers of the associated menu options. In this case, the title is Text_Interface_1_1. The task name is Text Interface. Select menu option 1 and then submenu option 1 as follows:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #1 (Start Processing Text Messages from HIS).

Once processing of text messages has begun, it will continue until the VistA Imaging DICOM Gateway is shut down. If the processing of HL7 messages needs to be terminated or suspended temporarily, this program may be interrupted by typing **Control+C**.

The nature of the processing for this menu option will vary slightly, depending on whether the system is configured with or without a PACS (and/or broker), as described next.

3.5.1   Configuration with a Commercial PACS and/or Broker

The messages exchanged with a commercial PACS or broker are shown in the table below:

Real World Event	Direction	Detached VA SOP Class & Event Type
Patient Demographic Change	VistA →PACS	Patient Management, Patient Updated
ADT	VistA →PACS	Visit Management, Visit Updated
Order Entry	VistA →PACS	Study Management, Study Created
Exam Change (cancel)	VistA →PACS	Study Management, Study Updated
Exam Verification	VistA →PACS	Study Management, Study Updated
Exam Complete †	PACS→ VistA	N-CREATE of the Study Component Management
Get Image Request †	VistA →PACS	C-MOVE request of Query/Retrieve
Get Image Data †	PACS→ VistA	MAG_C-STORE of Storage Service
Get Image Response†	PACS→ VistA	C-MOVE response of Query/Retrieve
Report Transfer	VistA →PACS	Interpretation Management/Update

† VistA DICOM Image Gateway with commercial PACS

Note: Messages for the DICOM Interface for Healthcare Providers will not be sent to a commercial PACS.

When the local system is configured so that commercial PACS and/or Mitra broker is present, all messages from the HIS will be processed, creating files stored in the First In First Out (FIFO) message queues on the gateway (see Section 3.11). All these messages will be listed in the log. You will first be asked if you are ready to begin processing, as follows:

```
Ready to process HL7 messages and send them to the PACS?  y// <Enter> yes


*******************************************************************
***   PACS Gateway Process Started on MAY 25, 1999 at 13:21:49   ***
*******************************************************************


Tue 13:21 D:\DICOM\Data1\U00000\U0000000 -- EXAM CHANGE -- HL7(461405)
Tue 13:21 D:\DICOM\Data1\U00000\U0000001 -- ORDER ENTRY -- HL7(461406)
Tue 13:21 D:\DICOM\Data1\U00000\U0000002 -- EXAM VERIFICATION -- HL7(461407)
Tue 13:21 D:\DICOM\Data1\W00000\W0000000 -- ADT ADMIT -- HL7(461408)
. . .

Tue 14:17 D:\DICOM\Data1\W00027\W0002738 -- ADT TRANSFER -- HL7(466632)\
```

3.5.2   Configuration without a Commercial PACS or Broker

When the local system is configured such that no commercial PACS or broker is present, only the messages from the HIS related to updating the Modality Worklist database will be processed, and the log will display as follows:

```
Ready to process HL7 messages and send them to the PACS?  y// <Enter> yes

*******************************************************************
***   PACS Gateway Process Started on JUN 07, 1999 at 13:16:06   ***
*******************************************************************


Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466601)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466602)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466603)
Mon 13:16 Update Modality Worklist -- EXAM VERIFICATION -- HL7(466605)
Mon 13:16 Update Modality Worklist -- EXAM VERIFICATION -- HL7(466606)
Mon 13:16 Update Modality Worklist -- EXAM VERIFICATION -- HL7(466607)
Mon 13:16 Update Modality Worklist -- EXAM VERIFICATION -- HL7(466608)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466609)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466610)
Mon 13:16 Update Modality Worklist -- EXAM VERIFICATION -- HL7(466611)
Mon 13:16 Update Modality Worklist -- EXAM VERIFICATION -- HL7(466612)
Mon 13:16 Update Modality Worklist -- EXAM VERIFICATION -- HL7(466613)
Mon 13:16 Update Modality Worklist -- EXAM VERIFICATION -- HL7(466614)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466617)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466618)
Mon 13:16 Update Modality Worklist -- EXAM VERIFICATION -- HL7(466619)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466620)
Mon 13:16 Update Modality Worklist -- EXAM VERIFICATION -- HL7(466622)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466623)
```

```
Mon 13:16 Update Modality Worklist -- EXAM VERIFICATION -- HL7(466624)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466625)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466626)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466627)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466628)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466629)
Mon 13:16 Update Modality Worklist -- ORDER ENTRY -- HL7(466630)
Mon 13:16 Update Modality Worklist -- EXAM VERIFICATION -- HL7(466631)\
```

3.6   Send DICOM Text Messages to Commercial PACS or Broker

Note: The functionality described in this section has been superseded by the PACS HL7 messaging functionality introduced in Patch MAG*3.0*49. It is retained for legacy purposes only.

This menu option sends previously created DICOM files (see Section 3.5.1) to a commercial PACS and/or Broker.

Note: If there is no commercial PACS or Broker, this option is not used.

Within the folder for the Text Gateway, there are special icons for each external system that receives DICOM messages. This list of external systems is defined in the master file named **PortList.DIC**.

The icon could look like one of these:

DeJarnette   Mitra Broker
MediShare

Each of these icons with their associated menu options will start the transmission of DICOM messages from the VistA Imaging DICOM Gateway to the external system, such as a PACS or an information broker.

When you double-click this icon, a telnet window will open. The title bar of this window will contain the following text:

Telnet - PACS_INTERFACE_1_2_1
Connect Edit Terminal Help
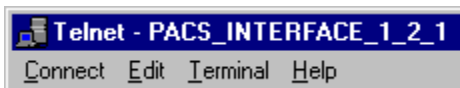
Follow the convention to select:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #2 (Send DICOM Text Messages to Commercial PACS or Broker).
3. Within the program for that menu option, select destination #1 (PACS Interface).

When the "PACS INTERFACE" menu option is started, a list of "TCP/IP Port Applications" is displayed, and you are prompted to select the destination.

The list of "TCP/IP Port Applications" that is presented is defined in the master file named **PortList.DIC**.

```
DICOM TCP/IP Port Applications

   1  PACS INTERFACE ------------------------- Port #60040
   2  PERRY POINT CR ------------------------- Port #60041
   3  FT. HOWARD CR -------------------------- Port #60042

  OPTION:  1


Beginning communications with the PACS INTERFACE

Ready to transfer DICOM messages via TCP/IP?  y// <Enter> yes


************************************************************************
***   Provider Process (Job #7) Started on OCT 25, 1999 at 07:28:17  ***
************************************************************************

Socket Available on Port 60041
*****************************************************************************
***   Connection with 11.22.33.40,IS~BROKER on OCT 25, 1999 at 07:29:16  ***
*****************************************************************************

Recving PDU Type: 01H (A-ASSOCIATE-RQ) PDU len=486
D:\DICOM\Data1\LOGIMA.007\INCOMING.PDU

********************************************************************
***   Receiving A-ASSOCIATE-REQUEST on OCT 25, 1999 at 07:29:16  ***
********************************************************************


PDU Type: 01H (A-ASSOCIATE-RQ)                              Length=486
Version=1   Called AE: "VARIS"            Calling AE: "BROKER"
ITEM Type: 10H (Application Context Item)                   Length=21
Application Context: 1.2.840.10008.3.1.1.1  (DICOM Application Context Name)
ITEM Type: 20H (Presentation Context Item)                  Length=46
Presentation Context ID: 1          Result=0
                -- Transfer Syntax(es) --
SUBITEM Type: 30H (Abstract Syntax Sub-Item)               Length=17
Presentation Context: 1.2.840.10008.1.1  (Verification SOP Class)
SUBITEM Type: 40H (Transfer Syntax Sub-Item)              Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                -- End of Transfer Syntax(es) --
ITEM Type: 20H (Presentation Context Item)                  Length=53
Presentation Context ID: 3         Result=0
                -- Transfer Syntax(es) --
SUBITEM Type: 30H (Abstract Syntax Sub-Item)               Length=24
Presentation Context: 1.2.840.113754.3.1.2.1.1   (VA Detached Patient Management SOP
Class)
SUBITEM Type: 40H (Transfer Syntax Sub-Item)              Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                -- End of Transfer Syntax(es) --
ITEM Type: 20H (Presentation Context Item)                  Length=53
Presentation Context ID: 5         Result=0
                -- Transfer Syntax(es) --
SUBITEM Type: 30H (Abstract Syntax Sub-Item)               Length=24
```

```
Presentation Context: 1.2.840.113754.3.1.2.2.1   (VA Detached Visit Management SOP
Class)
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                 Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                   -- End of Transfer Syntax(es) --
ITEM Type: 20H (Presentation Context Item)                   Length=53
Presentation Context ID: 7          Result=0
                   -- Transfer Syntax(es) --
SUBITEM Type: 30H (Abstract Syntax Sub-Item)                 Length=24
Presentation Context: 1.2.840.113754.3.1.2.3.1   (VA Detached Study Management SOP
Class)
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                 Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                   -- End of Transfer Syntax(es) --
ITEM Type: 20H (Presentation Context Item)                   Length=53
Presentation Context ID: 9          Result=0
                   -- Transfer Syntax(es) --
SUBITEM Type: 30H (Abstract Syntax Sub-Item)                 Length=24
Presentation Context: 1.2.840.113754.3.1.2.5.1   (VA Detached Results Management SOP
Class)
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                 Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                   -- End of Transfer Syntax(es) --
ITEM Type: 20H (Presentation Context Item)                   Length=53
Presentation Context ID: 11         Result=0
                   -- Transfer Syntax(es) --
SUBITEM Type: 30H (Abstract Syntax Sub-Item)                 Length=24
Presentation Context: 1.2.840.113754.3.1.2.6.1  (VA Detached Interpretation Management
SOP Class)
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                 Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                   -- End of Transfer Syntax(es) --
ITEM Type: 50H (User Information Item)                        Length=54
SUBITEM Type: 51H (Maximum Length Sub-Item)             Length=4
Maximum PDU length: 100000
ITEM Type: 52H (Implementation Class UID Sub-Item)           Length=18
Implementation Class: 1.2.124.113532.1.1   (*** Unknown UID: <<1.2.124.113532.1.1>>
***)
ITEM Type: 53H (Asynchronous Operations Window Sub-Item)     Length=4
Max # operations invoked=1          Max # operations performed=1
ITEM Type: 55H (Implementation Version Name)                 Length=12
Implementation Version Name: MITRA22JAN97
****************************************
***  Calling: BROKER  Called: VARIS  ***
****************************************


**********************************************
***  Sending A-ASSOCIATE-ACCEPT to BROKER  ***
**********************************************


PDU Type: 02H (A-ASSOCIATE-AC)                               Length=322
Version=1   Called AE: "VARIS"            Calling AE: "BROKER"
ITEM Type: 10H (Application Context Item)                    Length=21
Application Context: 1.2.840.10008.3.1.1.1  (DICOM Application Context Name)
ITEM Type: 21H (Presentation Context Item)                   Length=25
Presentation Context ID: 1          Result=0 (acceptance)
                   -- Transfer Syntax(es) --
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                 Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                   -- End of Transfer Syntax(es) --
ITEM Type: 21H (Presentation Context Item)                   Length=25
Presentation Context ID: 3          Result=0 (acceptance)
                   -- Transfer Syntax(es) --
```

```
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                        Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                    -- End of Transfer Syntax(es) --
ITEM Type: 21H (Presentation Context Item)                          Length=25
Presentation Context ID: 5          Result=0 (acceptance)
                    -- Transfer Syntax(es) --
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                        Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                    -- End of Transfer Syntax(es) --
ITEM Type: 21H (Presentation Context Item)                          Length=25
Presentation Context ID: 7          Result=0 (acceptance)
                    -- Transfer Syntax(es) --
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                        Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                    -- End of Transfer Syntax(es) --
ITEM Type: 21H (Presentation Context Item)                          Length=25
Presentation Context ID: 9          Result=0 (acceptance)
                    -- Transfer Syntax(es) --
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                        Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                    -- End of Transfer Syntax(es) --
ITEM Type: 21H (Presentation Context Item)                          Length=25
Presentation Context ID: 11         Result=0 (acceptance)
                    -- Transfer Syntax(es) --
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                        Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                    -- End of Transfer Syntax(es) --
ITEM Type: 50H (User Information Item)                              Length=51
SUBITEM Type: 51H (Maximum Length Sub-Item)                        Length=4
Maximum PDU length: 32768
ITEM Type: 52H (Implementation Class UID Sub-Item)                 Length=22
Implementation Class: 1.2.840.113754.2.1.1.0  (VA DICOM V2.5)
ITEM Type: 55H (Implementation Version Name)                       Length=13
Implementation Version Name: VA DICOM V2.5


Sending PDU Type: 02H (A-ASSOCIATE-AC)  Length: 322
D:\DICOM\Data1\LOGIMA.007\OUTGOING.PDU


Sending PDU Type: 04H (P-DATA-TF)  Length: 1330 (1330)
D:\DICOM\Data1\U00107\U0010738.DCM      PDU len=168   PDV hdr=3, pc=7, len=162
Mon 07:30                               PDU len=1000  PDV hdr=0, pc=7, len=994
Mon 07:30                               PDU len=180   PDV hdr=2, pc=7, len=174


Sending PDU Type: 04H (P-DATA-TF)  Length: 1412 (1412)
D:\DICOM\Data1\U00107\U0010739.DCM      PDU len=168   PDV hdr=3, pc=7, len=162
Mon 07:30                               PDU len=1000  PDV hdr=0, pc=7, len=994
Mon 07:30                               PDU len=262   PDV hdr=2, pc=7, len=256

Recving PDU Type: 04H (P-DATA-TF)       PDU len=166   PDV hdr=3, pc=7, len=160
D:\DICOM\Data1\V00107\V0010736.TMP      PDU len=102   PDV hdr=2, pc=7, len=96

Recving PDU Type: 04H (P-DATA-TF)       PDU len=166   PDV hdr=3, pc=7, len=160
D:\DICOM\Data1\V00107\V0010737.TMP      PDU len=102   PDV hdr=2, pc=7, len=96


Sending PDU Type: 04H (P-DATA-TF)  Length: 1326 (1326)
D:\DICOM\Data1\U00107\U0010740.DCM      PDU len=168   PDV hdr=3, pc=7, len=162
Mon 07:30                               PDU len=1000  PDV hdr=0, pc=7, len=994
Mon 07:30                               PDU len=176   PDV hdr=2, pc=7, len=170

Recving PDU Type: 04H (P-DATA-TF)       PDU len=166   PDV hdr=3, pc=7, len=160
D:\DICOM\Data1\V00107\V0010738.TMP      PDU len=102   PDV hdr=2, pc=7, len=96
```

If the transmission of images needs to be terminated or suspended temporarily, this program may be interrupted by typing **Control**+**C** without any risk of data loss.

3.7   Display Text Gateway Statistics

This application displays statistics about the numbers of files and events that have been processed by the DICOM Text Gateway. In particular, this application allows you to check whether all messages have been sent to a commercial PACS. It also keeps a daily running tally of the number of different kinds of messages handled.

PACS Status

When you double-click this icon, a telnet window will open. The title bar of this window will contain the following text:

Follow the convention to select:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #3 (Display Text Gateway Statistics).

When this menu option is started, a list of TCP/IP Port Applications is displayed, and you are requested to select the application for which statistics are to be displayed. More than one application can be monitored, if additional telnet sessions are invoked.

The list of TCP/IP Port Applications is defined in the master file named **PortList.DIC**. Once an application is selected, the statistics for that application will be compiled and displayed.

The top of the display shows the current pointers for the various queues. (An initial value of 9999999 typically indicates that no activity has occurred for that queue at all). The rest of the display shows the event statistics: a count that indicates the number of occurrences of each event and the time of the last.

Every 30 seconds, an updated set of statistics will be displayed. After each set of statistics, the program will ask whether or not to exit. If this question is not answered with **Yes**, the program will continue indefinitely.

```
Real-Time DICOM Communications Statistics

   1  DEJARNETTE MEDISHARE INTERFACE ------------ Port #60042

   OPTION:  1 <Enter>

*******************************************************************************
* DEJARNETTE    Priority     PACS          PACS         Hospital     Hospital      *
*  MEDISHARE     Level      Request       Response       Request     Response      *
*  HL7 Delay     Name        Queue         Queue          Queue       Queue        *
*                                                                                  *
*    <none>      HIGH       A:9999999     B:9999999      U:0020204   V:0020204     *
*                MEDIUM     C:9999999     D:9999999      W:0019674   X:0019674     *
*  Space: 67%    LOW        E:9999999     F:9999999      Y:9999999   Z:9999999     *
*******************************************************************************
                      Events:   Count    Time
                      ------    -----    ----
                  ADT ADMIT: <none>
              ADT DISCHARGE: <none>
               ADT TRANSFER: <none>
  PATIENT DEMOGRAPHIC CHANGE: <none>
               ORDER ENTRY:     63   (12:16)
               EXAM CHANGE: <none>
          EXAM VERIFICATION:     39   (12:07)
              EXAM COMPLETE: <none>
RELEASED (not verified) REPORT:     72   (12:22)
           APPROVED REPORT:      4   (10:29)
Exit?  no // y <Enter>
```

There are four things to monitor on this status display: The HL7 Delay (top, left-hand side), the U/V and W/X Hospital Request/Response Queues (top, right side), the daily message tally (lower, center), and Space (center, left side).

The HL7 Delay indicates how far behind is the gateway in processing HL7 messages from the main hospital system. Most messages should be processed almost immediately, and only in the worst case should this number be behind. Pushing back the HL7 message pointer (see Section 3.12), will cause a significant delay as the gateway catches up.

The U/V and W/X Hospital Request/Response Queues tell how many messages have been created (U and W) and how many have been transmitted (V and X) -- Please see Table 3.11 for the definition of the queue letters. When everything is caught up, the response numbers should equal the request numbers. Otherwise, they will be less and the communications is behind (Check to see if perhaps the commercial PACS is down).

The daily message tally lists the last time and number of each kind of message. The Space field indicates the amount of free available disk space for new messages.

3.8   Display Modality Worklist Statistics

The DICOM Modality Worklist service transfers patient and study information to the image acquisition devices, so this information does not have to be keyed in manually. This information is later placed in the DICOM header of the image so it can be matched with the patient's record.

The MUMPS Modality Worklist Provider process is a user-defined network service that is launched by the application startup program `^ZSTU` whenever a TCP/IP connection request is

received on port 60010. Each modality worklist request starts out by making a TCP/IP connection to port 60010, launching its MUMPS provider process to run in the background.

This procedure displays statistics about the Modality Worklist Queries that have been processed by the DICOM Text Gateway. There are two parts to the display. The first gives a history of the outstanding open cases. This is useful for quickly seeing how many studies are currently active for each imaging type. The ones that are old have probably not been case edited, so they remain on the worklist. The second part of the display gives a daily running tally of number of queries from each instrument, and the number of successful hits. This is useful for debugging problems with the modality worklist service.

When you double-click this icon, a telnet window will open. The title bar of this window will contain the following text:
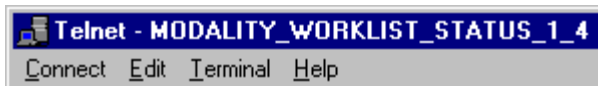
Follow the convention to select:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #4 (Display Modality Worklist Statistics).

When this menu option is started, the statistics for the site will be compiled and displayed. The first table to display shows the numbers of exams per day for the various imaging types in reverse chronological order (most recent date first).

The list of Instrument Names that are presented are Application Entities defined in the master file named **WorkList.DIC**.

Every 30 seconds, an updated set of statistics will be displayed. After each set of statistics, the program will ask whether or not to exit. If this question is not answered with **Yes**, the program will continue indefinitely.

```
Compiling modality worklist statistics for WICHITA-MC

  Exam                       Imaging Type
  Date                       -------------
                   CT    MRI    NM    RAD    US
JUN 01             4      3     12     2      5
MAY 31             1
MAY 27                                        2
MAY 26                                        3
MAY 25                                1        7
. . .
JAN 26                                1        2
JAN 25                                         2
JAN 22                                         2
JAN 20                                         7
JAN 19                                2        1
JAN 16                                1


                 Modality Worklist Activity
                 --------------------------


  Instrument Name    Queries      Time     Matches
  ---------------    -------      ----     -------
          IM_CR      <none>
          MS_FCR     <none>
        SCANNER1     <none>
     WIC-RADSCAN     <none>
     WORKLIST_PIC      3        10:17:13       5
Exit?  no // y
```

In the last part of this report, all information relates to activity that took place that day. The column labeled **Queries** displays the numbers of queries processed "today." The column labeled **Time** shows the time-stamp for the most recent query, and the column labeled **Matches** shows the number of entries returned in that query.

3.9   Modality Worklist Query

Note: This function is primarily used to test the VistA Imaging Modality Worklist Service, and is somewhat involved. It is used to simulate exactly how a commercial imaging modality would generate a query and thereby exercise VistA. It is meant as a testing tool, and not for operational use.

Prerequisites:

- VistA Hospital Information System (for historical radiology only, where the data resides on the main hospital system). It is not needed for looking up active radiology and CPRS consult request tracking studies, as these are stored locally in a global in the gateway database.

This procedure generates queries against the local VistA Imaging DICOM Modality Worklist provider, and will display records from the response that match the arguments specified in the query request.

Use the Caché Terminal icon to start a session to simulate a Modality Worklist User.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #5 (Modality Worklist Query).

The program first asks for the name of the Modality Worklist provider that is to be queried. The list of DICOM Service Class Providers that can be called from VistA is defined in the master file named **SCU_List.DIC**. (In the case of the example below, the Modality Worklist Provider is identified as "**LOCAL MODALITY WORKLIST**".)

You are then asked to identify the Modality Application Entity[2] to be simulated. The list of Application Entities that is presented is defined in the master file named **WorkList.DIC**.

Next, you must select the type of query to be used. A query can be…

• By patient
• By study
• By modality
• By date/time

In the examples below, all names of patients and physicians have been replaced by "scrambled" names.

3.9.1   Query by Patient

The identity of the patient is entered, and then information will be returned for all patients and studies that match.

It is not necessary to type the complete name of the patient: all names that start with the characters entered will match the query (i.e., just hitting <Enter> will select all patients). You can also enter the VA Quick PID (that is, the initial of the last name followed by the last four digits of the social security number). The Quick PID can be entered in either the patient name or patient id fields.

---

[2] The term "Application Entity" is from the DICOM standard and refers to any provider or user of a DICOM service.

3.9.1.1   Query by Patient using Initial of Last Name

```
Modality Worklist Query
Service Class Providers
-----------------------
  1 -- LOCAL IMAGE STORAGE
  2 -- LOCAL MODALITY WORKLIST

Select the provider application (1-2): 2// 2 <Enter>

Select the Application Entity Title: ? <Enter>
AE Titles in the WORKLIST.DIC file
---------------------------------
ALI_SCU
IMCR_1
SCANNER1
TEST

Select the Application Entity Title: TEST <Enter>
```

First Screen
```
              PATIENT NAME (1) :
                PATIENT ID (2) :
          ACCESSION NUMBER (3) :
    REQUESTED PROCEDURE ID (4) :
                  MODALITY (5) :
                START DATE (6) :
                START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: 1
Enter the Patient Name:  L
```

Second Screen
```
              PATIENT NAME (1) : L
                PATIENT ID (2) :
          ACCESSION NUMBER (3) :
    REQUESTED PROCEDURE ID (4) :
                  MODALITY (5) :
                START DATE (6) :
                START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: q
Performing Query...
Sending the PDU to the SCP
 completed!

There are 8 matches... Push <Enter> for list

    Social Sec#  Patient's Name        Case#   Procedure Description
    -----------  --------------        -----   --------------------
 1) 000-01-9676  IMAGPATIENT,ONE M.     1025 CR CHEST 2 VIEWS PA&LAT
 2) 000-02-7748  IMAGPATIENT,TWO N.      687 US ECHOGRAM RETROPERITONEAL COMPLE
 3) 000-02-7748  IMAGPATIENT,TWO N.      688 US ECHOGRAM PELVIC B-SCAN &/OR REA
 4) 000-05-1613  IMAGPATIENT,THREE O.    975    INTRODUCTION OF CATHETER, AORTA
 5) 000-05-1613  IMAGPATIENT,THREE O.    976    AORTO ABDOMEN CATH W/SERIAL FIL
 6) 000-05-1613  IMAGPATIENT,THREE O.    977    X-RAY EXAM OF ABDOMEN 1 VIEW, P
 7) 000-05-1613  IMAGPATIENT,THREE O.    978    SEDATION WITH OR WITHOUT ANALGE
 8) 000-05-1613  IMAGPATIENT,THREE O.    979 CR ANGIO EXTREMITY BILAT S&I
```

```
Enter 1-8 to see study details: 1 <Enter>
        Patient Name: IMAGPATIENT,ONE M.
         Patient Sex: M
 Patient Identifier: 000-01-9676
       Date of Birth: 10 December 1924

   Accession Number: 102198-1025          Requested Proc ID: 1025
  VA Procedure Code: 58        Name: CHEST 2 VIEWS PA&LAT
            CPT Code: 71020    Name: CHEST X-RAY
  Scheduled Starting: 21 November 1998 at 12:48:38
        Requested By: IMAGPROVIDER,ONE M.
 Requesting Service: PRIMARY CARE
Referring Physician: <unknown>
           Study UID: 1.2.840.113754.1.4.523.7018978.8751.1.102198.1025
    Reason for Study: <See the Additional Patient History field>

------------------------------ Medical History ------------------------------
73 Y/O MALE PRESENTS TO URGENT CARE C/O CHEST PAIN AFTER TRAUMA WITH AIRBAG
YESTERDAY DURING MVA.DENIES SOB,HEMOPTYSIS OR COUGH.PAIN WORSENS WITH
INSPIRATION.R/O FX
-----------------------------------------------------------------------------

Is this the correct Patient and Study?  n// y <Enter>

Push <Enter> to continue...
```

3.9.1.2   Query by Patient using Quick PID

```
Modality Worklist Query
Service Class Providers
-----------------------
  1 -- LOCAL IMAGE STORAGE
  2 -- LOCAL MODALITY WORKLIST

Select the provider application (1-2): 2// 2 <Enter>

Select the Application Entity Title: ? <Enter>
AE Titles in the WORKLIST.DIC file
---------------------------------
ALI_SCU
IMCR_1
SCANNER1
TEST

Select the Application Entity Title: TEST <Enter>
```

First Screen
```
                PATIENT NAME (1) :
                  PATIENT ID (2) :
          ACCESSION NUMBER (3) :
    REQUESTED PROCEDURE ID (4) :
                    MODALITY (5) :
                  START DATE (6) :
                  START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: 1
Enter the Patient Name:  I9676
```

<u>Second Screen</u>
```
              PATIENT NAME (1) : I9676
                PATIENT ID (2) :
         ACCESSION NUMBER (3) :
  REQUESTED PROCEDURE ID (4) :
                 MODALITY (5) :
               START DATE (6) :
               START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: q
Performing Query...
Sending the PDU to the SCP
 completed!


       Patient Name: IMAGPATIENT,ONE M.
        Patient Sex: M
 Patient Identifier: 000-01-9676
      Date of Birth: 10 December 1924

  Accession Number: 102198-1025         Requested Proc ID: 1025
 VA Procedure Code: 58        Name: CHEST 2 VIEWS PA&LAT
          CPT Code: 71020    Name: CHEST X-RAY
 Scheduled Starting: 21 November 1998 at 12:48:38
       Requested By: IMAGPROVIDER,ONE M.
 Requesting Service: PRIMARY CARE
Referring Physician: <unknown>
          Study UID: 1.2.840.113754.1.4.523.7018978.8751.1.102198.1025
   Reason for Study: <See the Additional Patient History field>

----------------------------- Medical History -------------------------------
73 Y/O MALE PRESENTS TO URGENT CARE C/O CHEST PAIN AFTER TRAUMA WITH AIRBAG
YESTERDAY DURING MVA.DENIES SOB,HEMOPTYSIS OR COUGH.PAIN WORSENS WITH
INSPIRATION.R/O FX
------------------------------------------------------------------------------

Is this the correct Patient and Study?  n// y <Enter>

Push <Enter> to continue...
```

3.9.2   Query by Study

In DICOM, there are two different ways that a "by study" query may be performed:

- By Accession Number
- By Requested Procedure ID

Note: In VistA, the two queries are handled identically.

3.9.2.1   Query by Accession Number

Within the VA's Radiology Package, the DICOM Accession Number is defined to be site-specific, that is, the Site-Date-Case Number.

The current Radiology Package supports three Accession Number formats:

- Site-Date-Case Number (SSS-MMDDYY-NNNNN) like 660-022411-353,
- Date-Case Number (MMDDYY-NNNNN) like 022411-353, and
- Case Number (NNNNN) like 353.

The Case Number can also be entered as the Requested Procedure ID.

The Site-Date-Case Number (SSS-MMDDYY-NNNNN) Accession Number format was introduced in RA*5.0*47. Previously, the Accession Number could only be in the formats : Date-Case Number (MMDDYY-NNNNN) or the shorter Case Number (NNNNN).

Users can turn on the Site-Date-Case Number in the Radiology package. Once turned on, the format is applied for the entire site. We recommend using the site-specific format only with HL7 v.2.4 interfaces.

If the site-specific accession number is enabled for HL7 v. 2.1 interfaces, some subscriber systems will get the old MMDDYY- NNNNN format while others will get the SSS-MMDDYY-NNNNN format for the same study, and they will not match.

In the example below, the Date-Case Number and the Accession Number for the requested study is **102198-1025**.

Either the complete Date-Case Number or the shorter Case Number can be used for the Accession Number argument of the query. In both instances, the system will search the local database (i.e., the `^MAGDWLST` global), and if a matching study is found, the information is returned. If no matching study is found in the local database for a \case number query, a null is returned and the search ends.

For a date-case number query, however, an additional search is performed for the study in the main VistA system database (RAD/NUC MED PATIENT File (#70), stored in `^RADPT`). If the study is found there, that information is returned. This capability is very useful when digitizing film for old studies.

3.9.2.1.1 Query by Case Number

```
Modality Worklist Query
Service Class Providers
-----------------------
  1 -- LOCAL IMAGE STORAGE
  2 -- LOCAL MODALITY WORKLIST

Select the provider application (1-2): 2// 2 <Enter>

Select the Application Entity Title: TEST// <Enter> TEST
```
First Screen
```
              PATIENT NAME (1) :
                PATIENT ID (2) :
          ACCESSION NUMBER (3) :
```

```
         REQUESTED PROCEDURE ID (4) :
                     MODALITY (5) :
                   START DATE (6) :
                   START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: 3
Enter the Accession Number:  1025
```

Second Screen

```
              PATIENT NAME (1) :
                PATIENT ID (2) :
          ACCESSION NUMBER (3) : 1025
   REQUESTED PROCEDURE ID (4) :
                  MODALITY (5) :
                START DATE (6) :
                START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: q
Performing Query...
Sending the PDU to the SCP
completed!


       Patient Name: IMAGPATIENT,ONE M.
        Patient Sex: M
 Patient Identifier: 000-01-9676
      Date of Birth: 10 December 1924

  Accession Number: 102198-1025          Requested Proc ID: 1025
 VA Procedure Code: 58      Name: CHEST 2 VIEWS PA&LAT
          CPT Code: 71020    Name: CHEST X-RAY
 Scheduled Starting: 21 November 1998 at 12:48:38
       Requested By: IMAGPROVIDER,ONE M.
 Requesting Service: PRIMARY CARE
Referring Physician: <unknown>
          Study UID: 1.2.840.113754.1.4.523.7018978.8751.1.102198.1025
   Reason for Study: <See the Additional Patient History field>

------------------------------ Medical History ------------------------------
73 Y/O MALE PRESENTS TO URGENT CARE C/O CHEST PAIN AFTER TRAUMA WITH AIRBAG
YESTERDAY DURING MVA.DENIES SOB,HEMOPTYSIS OR COUGH.PAIN WORSENS WITH
INSPIRATION.R/O FX
-----------------------------------------------------------------------------

Is this the correct Patient and Study?  n// y <Enter>

Push <Enter> to continue...
```

3.9.2.1.2 Query by Accession (Date-Case) Number

```
Modality Worklist Query
Service Class Providers
-----------------------
  1 -- LOCAL IMAGE STORAGE
  2 -- LOCAL MODALITY WORKLIST

Select the provider application (1-2): 2// 2 <Enter>

Select the Application Entity Title: TEST// <Enter> TEST
```

First Screen

```
              PATIENT NAME (1) :
                PATIENT ID (2) :
          ACCESSION NUMBER (3) :
    REQUESTED PROCEDURE ID (4) :
                 MODALITY (5) :
               START DATE (6) :
               START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: 3
Enter the Accession Number:  102198-1025
```

Second Screen

```
              PATIENT NAME (1) :
                PATIENT ID (2) :
          ACCESSION NUMBER (3) : 102198-1025
    REQUESTED PROCEDURE ID (4) :
                 MODALITY (5) :
               START DATE (6) :
               START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: Q
Performing Query...
Performing Query...
Sending the PDU to the SCP
completed!
        Patient Name: IMAGPATIENT,ONE M.
         Patient Sex: M
 Patient Identifier: 000-01-9676
       Date of Birth: 10 December 1924

  Accession Number: 102198-1025         Requested Proc ID: 1025
  VA Procedure Code: 58        Name: CHEST 2 VIEWS PA&LAT
            CPT Code: 71020    Name: CHEST X-RAY
 Scheduled Starting: 21 November 1998 at 12:48:38
        Requested By: IMAGPROVIDER,ONE M.
 Requesting Service: PRIMARY CARE
Referring Physician: <unknown>
           Study UID: 1.2.840.113754.1.4.523.7018978.8751.1.102198.1025
   Reason for Study: <See the Additional Patient History field>

----------------------------- Medical History -------------------------------
73 Y/O MALE PRESENTS TO URGENT CARE C/O CHEST PAIN AFTER TRAUMA WITH AIRBAG
YESTERDAY DURING MVA.DENIES SOB,HEMOPTYSIS OR COUGH.PAIN WORSENS WITH
INSPIRATION.R/O FX
-----------------------------------------------------------------------------

Is this the correct Patient and Study?  n// Y

Push <Enter> to continue...
```

3.9.2.2   Query by Requested Procedure ID

Within the VA's Radiology Package, the DICOM Requested Procedure ID is defined to be the Case Number, formatted **nnnnn**.

In the example below, the Case Number and the Requested Procedure ID for the requested study is **1025**.

In VistA, Requested Procedure ID query is handled exactly like an Accession Number query.

```
Modality Worklist Query
Service Class Providers
-----------------------
  1 -- LOCAL IMAGE STORAGE
  2 -- LOCAL MODALITY WORKLIST

Select the provider application (1-2): 2// 2 <Enter>
Select the Application Entity Title: TEST// <Enter> TEST
```

First Screen

```
                PATIENT NAME (1) :
                  PATIENT ID (2) :
           ACCESSION NUMBER (3) :
    REQUESTED PROCEDURE ID (4) :
                    MODALITY (5) :
                  START DATE (6) :
                  START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: 4
Enter the Requested Procedure ID:  1025
```

Second Screen

```
                PATIENT NAME (1) :
                  PATIENT ID (2) :
           ACCESSION NUMBER (3) :
    REQUESTED PROCEDURE ID (4) : 1025
                    MODALITY (5) :
                  START DATE (6) :
                  START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: q
Performing Query...


Sending the PDU to the SCP
completed!
       Patient Name: IMAGPATIENT,ONE M.
        Patient Sex: M
 Patient Identifier: 000-01-9676
      Date of Birth: 10 December 1924

  Accession Number: 102198-1025         Requested Proc ID: 1025
  VA Procedure Code: 58       Name: CHEST 2 VIEWS PA&LAT
           CPT Code: 71020    Name: CHEST X-RAY
 Scheduled Starting: 21 November 1998 at 12:48:38
       Requested By: IMAGPROVIDER,ONE M.
 Requesting Service: PRIMARY CARE
Referring Physician: <unknown>
          Study UID: 1.2.840.113754.1.4.523.7018978.8751.1.102198.1025
   Reason for Study: <See the Additional Patient History field>

------------------------------ Medical History -------------------------------
73 Y/O MALE PRESENTS TO URGENT CARE C/O CHEST PAIN AFTER TRAUMA WITH AIRBAG
YESTERDAY DURING MVA.DENIES SOB,HEMOPTYSIS OR COUGH.PAIN WORSENS WITH
INSPIRATION.R/O FX
------------------------------------------------------------------------------


Is this the correct Patient and Study?  n// <Enter> no patient selected


Push <Enter> to continue...
```

3.9.3 Query by Modality

The type of modality is identified by its two-character abbreviation. Valid codes are shown below:

AS = Angioscopy (retired)
AU = Audio
BI = Biomagnetic imaging
CD = Color flow Doppler
CF = Cinefluorography (retired)
CP = Colposcopy (retired)
CR = Computed Radiography
CS = Cystoscopy (retired)
CT = Computed Tomography
DD = Duplex Doppler
DF = Digital fluoroscopy (retired)
DG = Diaphanography
DM = Digital microscopy (retired)
DS = Digital Subtraction Angiography (retired)
DX = Digital Radiography
EC = Echocardiography (retired)
ECG = Electrocardiography
EPS = Cardiac Electrophysiology
ES = Endoscopy
FA = Fluorescein angiography (retired)
FS = Fundoscopy (retired)
GM = General Microscopy
HC = Hard Copy
HD = Hemodynamic Waveform
IO = Intra-oral Radiography
IVUS = Intravascular Ultrasound
LP = Laparoscopy (retired)

LS = Laser surface scan
MA = Magnetic resonance angiography (retired)
MG = Mammography
MR = Magnetic Resonance
MS = Magnetic resonance spectroscopy (retired)
NM = Nuclear Medicine
OT = Other
PR = Presentation State
PT = Positron emission tomography (PET)
PX = Panoramic X-Ray
RF = Radio Fluoroscopy
RG = Radiographic imaging (conventional film/screen)
RTDOSE = Radiotherapy Dose
RTIMAGE = Radiotherapy Image
RTPLAN = Radiotherapy Plan
RTRECORD = RT Treatment Record
RTSTRUCT = Radiotherapy Structure Set
SM = Slide Microscopy
SR = SR Document
ST = Single-photon emission computed tomography (SPECT)
TG = Thermography
US = Ultrasound
VF = Videofluorography (retired)
VL = Visible Light (VA Addition)
XA = X-Ray Angiography
XC = External-camera Photography

```
Modality Worklist Query
Service Class Providers
-----------------------
  1 -- LOCAL IMAGE STORAGE
  2 -- LOCAL MODALITY WORKLIST

Select the provider application (1-2): 2// 2 <Enter>

Select the Application Entity Title: TEST// <Enter> TEST
```

First Screen

```
            PATIENT NAME (1) :
              PATIENT ID (2) :
        ACCESSION NUMBER (3) :
  REQUESTED PROCEDURE ID (4) :
                MODALITY (5) :
              START DATE (6) :
              START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: 5
Enter the Patient Name:  CR
```

Second Screen
```
              PATIENT NAME (1) :
                PATIENT ID (2) :
         ACCESSION NUMBER (3) :
   REQUESTED PROCEDURE ID (4) :
                  MODALITY (5) : CR
                START DATE (6) :
                START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: q
Performing Query...


Performing Query...
Sending the PDU to the SCP
 completed!

    Social Sec#   Patient's Name        Case#     Procedure Description
    -----------   --------------        -----     ---------------------
 1) 000-01-9676   IMAGPATIENT,ONE M.     1025     CR CHEST 2 VIEWS PA&LAT
 2) 000-06-1318   IMAGPATIENT,FOUR P.     962     CR CHEST 2 VIEWS PA&LAT
 3) 000-62-3667   IMAGPATIENT,FIVE K.    1041     CR CHEST 2 VIEWS PA&LAT
 4) 000-03-0904   IMAGPATIENT,SIX         778     CR CHEST SINGLE VIEW
 5) 000-80-6542   IMAGPATIENT,SEVEN E.   1044     CR CHEST 2 VIEWS PA&LAT
 6) 000-76-4891   IMAGPATIENT,EIGHT K     692     CR CHEST 2 VIEWS PA&LAT
 7) 000-72-7867   IMAGPATIENT,NINE L.    1038     CR CHEST 2 VIEWS PA&LAT
 8) 000-86-3557   IMAGPATIENT,TEN N.     1024     CR SPINE CERVICAL MIN 2 VIEWS
 9) 000-70-5463   IMAGPATIENT,ELEVEN F.  1035     CR HAND 1 OR 2 VIEWS
10) 000-70-5463   IMAGPATIENT, ELEVEN F. 1036     CR FINGER(S) 2 OR MORE VIEWS
11) 000-52-3902   IMAGPATIENT,TWELVE S.  1029     FLUORO CHEST(SEPARATE PROCEDURE


Enter 1-11 to see study details: 1 <Enter>
       Patient Name: IMAGPATIENT,ONE M.
        Patient Sex: M
 Patient Identifier: 000-01-9676
      Date of Birth: 10 December 1924


  Accession Number: 102198-1025          Requested Proc ID: 1025
  VA Procedure Code: 58        Name: CHEST 2 VIEWS PA&LAT
          CPT Code: 71020     Name: CHEST X-RAY
 Scheduled Starting: 21 November 1998 at 12:48:38
       Requested By: IMAGPROVIDER,ONE M.
 Requesting Service: PRIMARY CARE
Referring Physician: <unknown>
          Study UID: 1.2.840.113754.1.4.523.7018978.8751.1.102198.1025
   Reason for Study: <See the Additional Patient History field>


------------------------------ Medical History -------------------------------
73 Y/O MALE PRESENTS TO URGENT CARE C/O CHEST PAIN AFTER TRAUMA WITH AIRBAG
YESTERDAY DURING MVA.DENIES SOB,HEMOPTYSIS OR COUGH.PAIN WORSENS WITH
INSPIRATION.R/O FX
------------------------------------------------------------------------------


Is this the correct Patient and Study?  n// y <Enter>


Push <Enter> to continue...
```

3.9.4 Query by Modality and Date/Time

The starting date/time for the examination can also be used, particularly with the modality query, to narrow the query.

From the date/time range, a starting date/time, and an ending date/time are calculated. All studies of the selected type falling in the selected interval will match the query. When no ending date/time is entered, all studies later than the starting date/time will match the query. Date/time ranges are entered as two values separated by a dash.

```
Modality Worklist Query
Service Class Providers
-----------------------
  1 -- LOCAL IMAGE STORAGE
  2 -- LOCAL MODALITY WORKLIST

Select the provider application (1-2): 2// 2 <Enter>

Select the Application Entity Title: TEST// <Enter> TEST
```

First Screen
```
              PATIENT NAME (1) :
                PATIENT ID (2) :
          ACCESSION NUMBER (3) :
    REQUESTED PROCEDURE ID (4) :
                  MODALITY (5) :
                START DATE (6) :
                START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: 5
Enter the Patient Name:  CR
```

Second Screen
```
              PATIENT NAME (1) :
                PATIENT ID (2) :
          ACCESSION NUMBER (3) :
    REQUESTED PROCEDURE ID (4) :
                  MODALITY (5) : CR
                START DATE (6) :
                START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: 6
Enter Start Date (yyyymmdd or yyyymmdd-yyyymmdd): 19981121
```

Third Screen
```
              PATIENT NAME (1) :
                PATIENT ID (2) :
          ACCESSION NUMBER (3) :
    REQUESTED PROCEDURE ID (4) :
                  MODALITY (5) : CR
                START DATE (6) : 19981121
                START TIME (7) :
Enter 1-7 to change an item above, "R" to refresh, "Q" to query: q
```

```
Performing Query...

Performing Query...
Sending the PDU to the SCP
 completed!

    Social Sec#  Patient's Name         Case#    Procedure Description
    -----------  --------------         -----    ---------------------
 1) 000-01-9676  IMAGPATIENT,ONE M.      1025    CR CHEST 2 VIEWS PA&LAT
 2) 000-06-1318  IMAGPATIENT,FOUR P.      962    CR CHEST 2 VIEWS PA&LAT


Enter 1-2 to see study details: 1 <Enter>
       Patient Name: IMAGPATIENT,ONE M.
        Patient Sex: M
 Patient Identifier: 000-01-9676
      Date of Birth: 10 December 1924

  Accession Number: 102198-1025         Requested Proc ID: 1025
  VA Procedure Code: 58      Name: CHEST 2 VIEWS PA&LAT
           CPT Code: 71020    Name: CHEST X-RAY
 Scheduled Starting: 21 November 1998 at 12:48:38
       Requested By: IMAGPROVIDER,ONE M.
 Requesting Service: PRIMARY CARE
Referring Physician: <unknown>
          Study UID: 1.2.840.113754.1.4.523.7018978.8751.1.102198.1025
    Reason for Study: <See the Additional Patient History field>

----------------------------- Medical History -------------------------------
73 Y/O MALE PRESENTS TO URGENT CARE C/O CHEST PAIN AFTER TRAUMA WITH AIRBAG
YESTERDAY DURING MVA.DENIES SOB,HEMOPTYSIS OR COUGH.PAIN WORSENS WITH
INSPIRATION.R/O FX
-----------------------------------------------------------------------------

Is this the correct Patient and Study?  n// y <Enter>

Push <Enter> to continue...
```

3.10   Display a HL7 Message

This procedure displays the contents of HL7 messages for debugging purposes.

Use the Caché Terminal icon to start a session for this menu option.

After login, select the following menu options:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #7 (Display a HL7 Message).

There are two display formats:

- Short
- Long

The short format outputs the text of the messages as they are stored within the VistA ^MAGDHL7 global (condensed, all optional spaces removed, all separator characters visible). The long format outputs the messages so that all fields are labeled and displayed on separate lines. The long format also identifies each message segment.

3.10.1   Short Format

```
Enter output device ("S" for screen or "F" for file): S// <Enter> Screen
Format (Long or Short)  S// S <Enter>


Enter HL7 subscript: 461405 <Enter>
MSH^~|\&^RA-SERVER-IMG^523^MAGD-CLIENT^523^19981014000017^^ORM~O01^3789535^P^2.1
...1^^^^^USA
PID^^000-07-4067^93092~4~D99^^IMAGPATIENT~FIVE~Q^^19220514^M^^^^^^^^^^000074067
ORC^CA^^^^CA^^^^19981014000017
OBR^^^7018986.8646-1~101398-495~L^71021~CHEST X-RAY~CPT4~59~CHEST APICAL LORDOTI
...IC~99RAP^^^19981014000017^""^"^""^^^^^""^^16661~IMAGPROVIDER~TWO~N^^9B/TELM^^32~GI
... SUITE~523~BOSTON, MA^RAD~GENERAL RADIOLOGY^19981014000017
OBX^^CE^P~PROCEDURE~L^^59~CHEST APICAL LORDOTIC~L^^^^^^""
OBX^^TX^M~MODIFIERS~L^^None^^^^^^""
OBX^^TX^H~HISTORY~L^^This is a 76 yo wm pmh of 3v cabg 12/97, cad, afib presents
...s to medicine with^^^^^^""
OBX^^TX^H~HISTORY~L^^dizziness, chest pressure.  A previous exam on 10/2 and 10/
.../3 demonstrates a^^^^^^""
OBX^^TX^H~HISTORY~L^^right apical opacity measuring 2cm that was not further wor
...rked up.  The pt has^^^^^^""
OBX^^TX^H~HISTORY~L^^been admitted repeatedly for the same chest pressure of unc
...clear etiology.  The^^^^^^""
OBX^^TX^H~HISTORY~L^^pain does not appear to be cardiac in origin.  Please perfo
...orm lordotic cxr to^^^^^^""
OBX^^TX^H~HISTORY~L^^further evaluate rul opacity.  Thanks.  ^^^^^^""


Enter HL7 subscript:

Push <Enter> to continue...
```

3.10.2   Long Format

```
Enter output device ("S" for screen or "F" for file): S// <Enter> Screen
Format (Long or Short)  S// L <Enter>

Enter HL7 subscript: 461405 <Enter>

HL7 Message (Subscript = 461405)

MSH -- Message Header Segment
  1                  Field Separator = ^
  2              Encoding Characters = ~|\&
  3              Sending Application = RA-SERVER-IMG
  4                 Sending Facility = 523
  5            Receiving Application = MAGD-CLIENT
  6               Receiving Facility = 523
  7             Date/Time of Message = 19981014000017
```

```
   9                     Message Type = ORM~O01
  10               Message Control ID = 3789535
  11                    Processing ID = P
  12                       Version ID = 2.1
  17                     Country Code = USA


PID -- Patient Identification Segment
   2          Patient ID (External ID) = 000-07-4067
   3          Patient ID (Internal ID) = 93092~4~D99
   5                     Patient Name = IMAGPATIENT~FIVE~Q
   7                    Date of Birth = 19220514
   8                              Sex = M
  19              SSN Number - Patient = 000074067


ORC -- Common Order Segment
   1                    Order Control = CA
   5                  Order Status ID = CA
   9         Date/Time of Transaction = 19981014000017


OBR -- Observation Request
   3              Filler Order Number = 7018986.8646-1~101398-495~L
   4             Universal Service ID = 71021~CHEST X-RAY~CPT4~59~CHEST APICAL L
ORDOTIC~99RAP
   7            Observation Date/Time = 19981014000017
   8        Observation End Date/Time = ""
   9                Collection Volume = ""
  14      Specimen Received Date/Time = ""
  16                Ordering Provider = 16661~IMAGPROVIDER~TWO~N
  18                Placer field #1 = 9B/TELM
  20                Filler field #1 = 32~GI SUITE~523~BOSTON, MA
  21                Filler field #2 = RAD~GENERAL RADIOLOGY
  22    Results Rpt/Status Chng Date/T = 19981014000017


OBX -- Observation Segment
   2                       Value Type = CE
   3            Observation Identifier = P~PROCEDURE~L
   5               Observation Value = 59~CHEST APICAL LORDOTIC~L
  11                                  = ""


OBX -- Observation Segment
   2                       Value Type = TX
   3            Observation Identifier = M~MODIFIERS~L
   5               Observation Value = None
  11                                  = ""


OBX -- Observation Segment
   2                       Value Type = TX
   3            Observation Identifier = H~HISTORY~L
   5               Observation Value = This is a 76 yo wm pmh of 3v cabg 12/97,
 cad, afib presents to medicine with
  11                                  = ""


OBX -- Observation Segment
   2                       Value Type = TX
   3            Observation Identifier = H~HISTORY~L
   5               Observation Value = dizziness, chest pressure.  A previous e
xam on 10/2 and 10/3 demonstrates a
  11                                  = ""


OBX -- Observation Segment
   2                       Value Type = TX
   3            Observation Identifier = H~HISTORY~L
   5               Observation Value = right apical opacity measuring 2cm that
```

```
was not further worked up.  The pt has
 11                                     = ""

OBX -- Observation Segment
  2                     Value Type = TX
  3           Observation Identifier = H~HISTORY~L
  5              Observation Value = been admitted repeatedly for the same ch
est pressure of unclear etiology.  The
 11                                     = ""

OBX -- Observation Segment
  2                     Value Type = TX
  3           Observation Identifier = H~HISTORY~L
  5              Observation Value = pain does not appear to be cardiac in or
igin.  Please perform lordotic cxr to
 11                                     = ""

OBX -- Observation Segment
  2                     Value Type = TX
  3           Observation Identifier = H~HISTORY~L
  5              Observation Value = further evaluate rul opacity.  Thanks.
 11                                     = ""


Enter HL7 subscript:

Push <Enter> to continue...
```

3.11   Display an Unprocessed DICOM Message

When the VistA DICOM Text Gateway software processes binary encoded DICOM messages, it automatically produces text files (*.TXT) containing the information in human-readable form. These files can be viewed from Windows Explorer[TM] using **notepad**[TM] . An easy way to launch Windows Explorer is to push the Windows+E key, which is next to the Alt keys on the bottom row of the keyboard.

In order to view these text files from Explorer, you first have to know where they are located. The PACS message files are stored as **D:\DICOM\Data1\Qnnnn\Qnnnnnnn.txt**, where **Q** is the letter assigned to the first-in-first-out (FIFO) queue, and **nnnnnnn** is the seven-digit file number. The FIFO queues are illustrated in Table 3.11.

The Modality Worklist queries and responses are stored under **D:\DICOM\Data1\LOGxxx.nnn**, where **xxx** is the three-letter system name, and **nnn** is the job number. (This information can be obtained from the DICOM application message log – see Section 6.2.2.) The acquired image files are stored in D:\DICOM\Image_in\Lnnnnnnn.dcm. (You may also want to refer to Chapter 9.)

First-In-First-Out Data Queues

Direction	Queue Letter	Type	Priority	Usage
INCOMING Device ∧ Gateway	A	Request	High	Reserved
	B	Response		
	C	Request	Medium	Reserved
	D	Response		
	E	Request	Low	Reserved
	F	Response		
	G	Request	Immediate	DICOM Echo
	H	Response		
In	I	Imaging		\dicom\image_in\Annnnnnn.dcm
OUTGOING Gateway ∧ Device	S	Request	Immediate	DICOM Echo
	T	Response		
	U	Request	High	Orders, Changes to Orders, and Exam Verification
	V	Response		
	W	Request	Medium	ADT, Patient Demographics, and Reports
	X	Response		
	Y	Request	Low	Pull Lists and Clinic Scheduling (to be done)
	Z	Response		

Table 3.11

This menu option is used to manually invoke the same DICOM-to-text conversion routine and can be used to view unprocessed DICOM messages. It may be more convenient to use than Explorer, since it automatically performs the navigation to view the files. This capability is especially useful for looking at image headers (see Section 4.17).

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #7 (Display a DICOM Message).

The example below shows the formatted output of the information in the file D:\DICOM\Data1**W**00000\W000000**1**.DCM.

The name of this file can be entered using the queue letter **W** and file number **1** as a shortcut.

```
Ready to read a DICOM file?  y// y <Enter>

Enter output device ("S" for screen or "F" for file): S// <Enter> Screen

Enter the queue letter (a-h or s-z), or I for image (or '^' to exit):  W// W <Enter>

Enter file number (or path): 1 <Enter>

DUMP of DICOM file D:\DICOM\Data1\W00000\W0000001.DCM

   O   G   E   L                       Created at 10:37 AM on 17-JUN-1999
   f   r   l   e
   f   o   e   n
   s   u   m   g
   e   p   e   t
   t       n   h   A t t r i b u t e       V a l u e
           t       ---------------------------------
000000:0000,0000 UL 0004 Group Length              "130 (0x00000082)"
00000C:0000,0001 UL 0004 Length to End             "872 (0x00000368)"
000018:0000,0002 UI 0018 Affected SOP Class UID    "1.2.840.113754.3.1.2.2.1"
                                                    VA Detached Visit Management SOP Class
000038:0000,0100 US 0002 Command Field             "256 (0x0100)"
000042:0000,0110 US 0002 Message ID                "2 (0x0002)"
00004C:0000,0700 US 0002 Priority                  "0 (0x0000)"
000056:0000,0800 US 0002 Data Set Type             "3 (0x0003)"
000060:0000,1000 UI 001C Affected SOP Instance UID "1.2.840.113754.1.3.523.79836"
000084:0000,1002 US 0002 Event Type ID             "3 (0x0003)"
00008E:0008,0012 DA 0008 Instance Creation Date     "19981020"
00009E:0008,0013 TM 0006 Instance Creation Time     "175150"
0000AC:0008,0014 UI 0016 Instance Creator UID       "1.2.840.113754.1.0.523"
0000CA:0008,0082 SQ FFFF Institution Code Sequence 1
0000D2:FFFE,E000 SQ FFFF >Item Begin                1.1
0000DA:0008,0100 SH 0000 >Code Value                "<unknown>"
0000E2:0008,0102 SH 0000 >Coding Scheme Designator "<unknown>"
0000EA:0008,0104 LO 0000 >Code Meaning              "<unknown>"
0000F2:FFFE,E00D SQ 0000 >Item End                  1.1
0000FA:FFFE,E0DD SQ 0000 >Sequence End              1
000102:0008,1120 SQ FFFF Referenced Patient Sequen 1
00010A:FFFE,E000 SQ FFFF >Item Begin                1.1
000112:0008,1150 UI 0018 >Referenced SOP Class UID "1.2.840.113754.3.1.2.1.1"
                                                    VA Detached Patient Management SOP Class
000132:0008,1155 UI 001C >Referenced SOP Instance  "1.2.840.113754.1.1.523.79836"
000156:FFFE,E00D SQ 0000 >Item End                  1.1
00015E:FFFE,E0DD SQ 0000 >Sequence End              1
000166:0009,0010 LO 0008 Owner of Group             "VA DHCP"
000176:0009,1010 SQ FFFF Referring Physician Seque 1
00017E:FFFE,E000 SQ FFFF >Item Begin                1.1
000186:0008,0090 PN 0000 >Referring Physician's Na "<unknown>"
00018E:0008,0092 ST 0000 >Referring Physician's Ad "<unknown>"
000196:0008,0094 SH 0000 >Referring Physician's Te "<unknown>"
00019E:0008,0100 SH 0000 >Code Value                "<unknown>"
0001A6:0008,0102 SH 0000 >Coding Scheme Designator "<unknown>"
0001AE:FFFE,E00D SQ 0000 >Item End                  1.1
0001B6:FFFE,E0DD SQ 0000 >Sequence End              1
0001BE:0009,1020 SQ FFFF Performing Physician Sequ 1
0001C6:FFFE,E000 SQ FFFF >Item Begin                1.1
0001CE:0008,0100 SH 0000 >Code Value                "<unknown>"
0001D6:0008,0102 SH 0000 >Coding Scheme Designator "<unknown>"
0001DE:0008,1050 PN 0000 >Performing Physician's N "<unknown>"
0001E6:FFFE,E00D SQ 0000 >Item End                  1.1
0001EE:FFFE,E0DD SQ 0000 >Sequence End              1
```

```
0001F6:0010,0010 PN 0012 Patient's Name           "IMAGPATIENT^TWO^N"
000210:0010,0020 LO 000C Patient ID               "000-02-7748"
000224:0010,0021 LO 0004 Issuer of Patient ID     "523"
000230:0010,0030 DA 0008 Patient's Birth Date     "19330315"
000240:0010,0040 CS 0002 Patient's Sex            "M"
00024A:0010,1000 LO 0006 Other Patient IDs        "L7748"
000258:0010,1040 LO 0000 Patient's Address        "<unknown>"
000260:0010,2160 SH 0000 Ethnic Group             "<unknown>"
000268:0010,21B0 LT 0000 Additional Patient Histor "<unknown>"
000270:0038,0008 CS 0008 Visit Status ID          "ADMITTED"
000280:0038,0020 DA 0008 Admitting Date           "19981020"
000290:0038,0021 TM 0006 Admitting Time           "175150"
00029E:0038,0030 DA 0000 Discharge Date           "<unknown>"
0002A6:0038,0032 TM 0000 Discharge Time           "<unknown>"
0002AE:0039,0010 LO 0008 Owner of Group           "VA DHCP"
0002BE:0039,1010 SQ FFFF Current Patient Location  1
0002C6:FFFE,E000 SQ FFFF >Item Begin              1.1
0002CE:0008,0100 SH 0000 >Code Value              "<unknown>"
0002D6:0008,0102 SH 0000 >Coding Scheme Designator "<unknown>"
0002DE:0038,0300 LO 0000 >Current Patient Location "<unknown>"
0002E6:FFFE,E00D SQ 0000 >Item End                1.1
0002EE:FFFE,E0DD SQ 0000 >Sequence End            1
0002F6:0039,1020 SQ FFFF Patient's Institutional R 1
0002FE:FFFE,E000 SQ FFFF >Item Begin              1.1
000306:0008,0100 SH 0000 >Code Value              "<unknown>"
00030E:0008,0102 SH 0000 >Coding Scheme Designator "<unknown>"
000316:0038,0400 LO 0000 >Patient's Institution Re "<unknown>"
00031E:FFFE,E00D SQ 0000 >Item End                1.1
000326:FFFE,E0DD SQ 0000 >Sequence End            1
00032E:FFFD,0010 LO 0008 Owner of Group           "VA DHCP"
00033E:FFFD,1010 ST 003A Message Handle           "ADT ADMIT"
"D:\DICOM\Data1\W00000\W0000001.DCM"
"HL7(466004)"

End of File D:\DICOM\Data1\W00000\W0000001.DCM  (printed 10:45 AM  17-JUN-99)


Enter file number (or path): <Enter>

Enter the queue letter (a-h or s-z), or I for image (or '^' to exit):  W// ^ <Enter>

Push <Enter> to continue...
```

When more than a screenful of information is to be displayed is, the program will pause with the prompt "more…". If you wish to terminate the display, this question can be answered with **^**, **No**, **Quit** or **Exit** (this response is not case sensitive).

```
The *.TXT file that is automatically generated when the *.DCM file is
processed contains the exactly the same data.
```

3.12   Modify the HL7 Message Pointer

Use the Caché Terminal icon to start a session for this menu option.

After login, select the following menu options:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #8 (Modify the HL7 Message Pointer).

HL7 messages are sequentially stored in chronological order in the VistA Database in the PACS MESSAGES File (#2006.5), stored in `^MAGDHL7(2006.5,…)`. Very rarely, because of unforeseen operational difficulties, it is necessary to change the order of processing of the HL7 messages.

The VistA Imaging DICOM Gateway maintains a pointer to the last HL7 message that has been processed (i.e., its internal entry number). This pointer value may be modified to resume processing at a different position in the queue.

Decrementing this pointer will result in old HL7 messages in the VistA Hospital Information System being processed again (Reprocessing HL7 messages has no adverse side-effects). Incrementing this pointer will result in HL7 messages being skipped, and associated data will not be sent to the destination (This should not be done).

You can enter either the message number or a date. When the message number is entered, it should be one less than that of the next HL7 message to be processed. When a date is entered, the pointer is moved to the last record that precedes this date.

The dialog for this menu option may appear as follows:

```
Current HL7 Pointer Value: 465230 (OCT 19, 1998@23:24:00)
Enter new value of HL7 pointer or date: 466000 <Enter>

New HL7 Pointer Value: 466000 (OCT 20, 1998@17:42:00)

Push <Enter> to continue...
```

or like this:

```
Current HL7 Pointer Value: 466000 (OCT 20, 1998@17:42:00)
Enter new value of HL7 pointer or date: 18 oct 1998<Enter>

New HL7 Pointer Value: 464083 (OCT 17, 1998@23:53:00)

Push <Enter> to continue...
```

or like this:

```
Current HL7 Pointer Value: 464083 (OCT 17, 1998@23:53:00)
Enter new value of HL7 pointer or date: t-5<Enter>

New HL7 Pointer Value: 466632 (OCT 21, 1998@13:42:00)

Push <Enter> to continue...
```

3.13   Generate a Daily Summary Report

This menu option may be used to produce a report that shows how often the following events have been processed.

- ADT ADMIT
- ADT DISCHARGE
- ADT TRANSFER
- PATIENT DEMOGRAPHIC CHANGE
- ORDER ENTRY
- EXAM CHANGE
- EXAM VERIFICATION
- EXAM COMPLETE
- RELEASED (not verified) REPORT
- APPROVED REPORT
- GET IMAGE REQUEST (Only if a PACS is sending images)
- GET IMAGE REPLY (Only if a PACS is sending images)

The report will show the counts for the various events per day, starting from the first day for which statistics were recorded.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #9 (Generate a Daily Summary Report).

```
Generate Audit Report?  y// <Enter> yes

Enter output device ("S" for screen or "F" for file): S// <Enter> Screen

              A: ADT ADMIT
              B: ADT DISCHARGE
              C: ADT TRANSFER
              D: PATIENT DEMOGRAPHIC CHANGE
              E: ORDER ENTRY
              F: EXAM CHANGE
              G: EXAM VERIFICATION
              H: EXAM COMPLETE
              I: RELEASED (not verifed) REPORT
              J: APPROVED REPORT


              A     B     C     D     E     F     G     H     I     J
06/03/99
06/04/99      5     1     1          12     1     1
06/07/99    509   212    98        1652   100  1473                1683
06/11/99      3           1           1     1     1

Push <Enter> to continue...
```

This data may be used to monitor the different kinds of messages that were transmitted over a long time period.

3.14   Purge Old Modality Worklist Entries

This menu option may be used to remove old entries in the DICOM Modality Worklist from the VistA Imaging DICOM Gateway. (When a study is case edited, an Exam Verification HL7 message is generated and sent to the VistA Imaging DICOM Gateway. This message then causes the corresponding study to be removed from the DICOM Modality Worklist. These old entries may still be present because they were never "case edited" in the radiology package, and no Exam Verification HL7 message was generated.) When this menu option is executed, entries older than the specified number of days will be deleted.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #10 (Purge Old Modality Worklist Entries).

The default number of days to retain messages is specified as site parameter **Purge-Retention Days PACS File** in the IMAGING SITE PARAMETERS File (#2006.1).

```
Ready to remove old DICOM Worklist entries?  y// <Enter> yes

Delete DICOM Worklist entries that are older than how many days?  20// <Enter> 20

Deleting for BOSTON, MA

Deleting for BOSTON OC, MA

Push <Enter> to continue...
```

3.15   Purge Old DICOM Message Files

The **HIS to DICOM Text Interface** menu option program (see Section 3.5) will automatically invoke this purge function when the amount of available free disk space drops below a minimum level, whose value is specified in the site parameter **Pct Free Space DICOM msgs** the IMAGING SITE PARAMETERS File (#2006.1).

The default number of days to retain messages is specified in the site parameter **Retention Days DICOM msgs** in the IMAGING SITE PARAMETERS File (#2006.1).

This menu option may be used to remove old DICOM message files from the VistA Imaging DICOM Gateway PC. When this menu option is executed, message files will be deleted if they are older than the specified number of days. (This option is usually not necessary, as old messages should be purged automatically. You might want to use it to recover additional disk space.)

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #11 (Purge Old DICOM Message Files).

```
Ready to remove old DICOM files from servers?  y// <Enter> yes

Delete DICOM files that are older than how many days?  20// <Enter> 20

Scanning the A queue
D:\DICOM\Data1\A*.  *** Not on file ***

Scanning the B queue
D:\DICOM\Data1\B*.  *** Not on file ***

Scanning the C queue
D:\DICOM\Data1\C*.  *** Not on file ***
```

```
Scanning the D queue
D:\DICOM\Data1\D*.  *** Not on file ***          These directories are empty.

Scanning the E queue
D:\DICOM\Data1\E*.  *** Not on file ***

Scanning the F queue
D:\DICOM\Data1\F*.  *** Not on file ***

Scanning the G queue
D:\DICOM\Data1\G*.  *** Not on file ***

Scanning the H queue
D:\DICOM\Data1\H*.  *** Not on file ***

Scanning the S queue
D:\DICOM\Data1\S*.
Save Directory: S99999                           These directories are too new to delete.
Save Directory: S99998
Save Directory: S99997


Scanning the T queue
D:\DICOM\Data1\T*.  *** Not on file ***

Scanning the U queue
D:\DICOM\Data1\U*.
Save Directory: U00032                           These directories are too new to delete.
Save Directory: U00031
Save Directory: U00030

Scanning the V queue
D:\DICOM\Data1\V*.  *** Not on file ***

Scanning the W queue
D:\DICOM\Data1\W*.
Save Directory: W00025                           These directories are too new to delete.
Save Directory: W00024
Save Directory: W00023

Scanning the X queue
D:\DICOM\Data1\X*.  *** Not on file ***

Scanning the Y queue
D:\DICOM\Data1\Y*.  *** Not on file ***

Scanning the Z queue
D:\DICOM\Data1\Z*.  *** Not on file ***

Scanning the A queue
D:\DICOM\Data2\A*.  *** Not on file ***

Scanning the B queue
D:\DICOM\Data2\B*.  *** Not on file ***          These directories are empty.
```

```
Scanning the C queue
D:\DICOM\Data2\C*.  *** Not on file ***

Scanning the D queue
D:\DICOM\Data2\D*.  *** Not on file ***

Scanning the E queue
D:\DICOM\Data2\E*.  *** Not on file ***

Scanning the F queue
D:\DICOM\Data2\F*.  *** Not on file ***

Scanning the G queue
D:\DICOM\Data2\G*.  *** Not on file ***

Scanning the H queue
D:\DICOM\Data2\H*.  *** Not on file ***

Scanning the S queue
D:\DICOM\Data2\S*.
Save Directory: S99999                These directories are too new to delete.
Save Directory: S99998
Save Directory: S99997

Scanning the T queue
D:\DICOM\Data2\T*.  *** Not on file ***

Scanning the U queue
D:\DICOM\Data2\U*.  *** Not on file ***

Scanning the V queue
D:\DICOM\Data2\V*.  *** Not on file ***

Scanning the W queue
D:\DICOM\Data2\W*.  *** Not on file ***      These directories are empty.

Scanning the X queue
D:\DICOM\Data2\X*.  *** Not on file ***

Scanning the Y queue
D:\DICOM\Data2\Y*.  *** Not on file ***

Scanning the Z queue
D:\DICOM\Data2\Z*.  *** Not on file ***

Push <Enter> to continue...
```

3.16   Purge Old HL7 Transaction Global Nodes

This menu option may be used to remove old HL7 messages from the VistA Hospital
Information System. When this menu option is executed, messages will be deleted if they are
older than the specified number of days. The purge should be done monthly.

The number of days that is used is the value that is entered for the site parameter called "**Purge-
Retention Days PACS File**" in the IMAGING SITE PARAMETERS File (#2006.1).

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #12 (Purge Old HL7 Transaction Global Nodes).

```
Ready to remove old HL7 transaction global nodes?  y// <Enter> yes
..................

Push <Enter> to continue...
```

3.17   Purge Old Audit Records

This menu option may be used to remove old audit records from the VistA Hospital Information System. This menu option removes only audit records that are related to the VistA PACS transactions. When this menu option is executed, audit records will be deleted if they are older than the date that is entered (records created on the date entered will remain in the database). This might be done annually.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #13 (Purge Old Audit Records).

After login, select the following menu options:

1. In the first menu, select #1 (Text Gateway).
2. In the second menu, select #5 (Modality Worklist Query).

```
The database currently contains audit data related to VistA-PACS Transactions
covering the period from 7-Jan-1997 until 19-Jul-1999.
Purge all audit data up to... 7-Jan-1997//6-jul-99<Enter>
Purging...

Press <Enter> to continue:
```

Chapter 4 Image Gateway

4.1   Overview of the DICOM Image Storage Process

The DICOM Storage Service (technically known as MAG_C-STORE) is used to transfer image files from an acquisition modality or a commercial PACS to VistA, or from VistA to workstations or commercial PACS. Images are always transferred from the user of the storage service to the provider of the storage service. At different times, the same physical system can operate as either a provider of the storage service or as a user of the storage service. A VistA DICOM Image Gateway, for example, functions as a storage service class provider when it receives images from an image acquisition modality (e.g., CT), but it functions as a storage service class user when it sends images to a commercial PACS.

4.1.1   VistA Implementation of DICOM Storage Service

In the VistA DICOM implementation, each instrument (Application Entity) sending images to VistA has its own dedicated storage service class provider. A VistA storage service class provider consists of a pair of processes: a low-level, high-speed network image file transfer process (**MAG_CSTORE.EXE**) written in C, operating with a high-level DICOM storage control process written in MUMPS. These two processes are tightly coupled and communicate with each other via TCP/IP.

Images are received from the instrument by the `MAG_CSTORE.EXE` image file transfer process running in the foreground. The C routine has just enough intelligence to receive an image from the modality and write it to disk, and relies on the MUMPS process running in the background to handle all the higher-level DICOM responsibilities (such as association negotiation, handling storage service messages, and naming the image files).

The MUMPS DICOM storage controller is a user-defined network service that is launched whenever a TCP/IP connection request is received on port 60000. Each `MAG_CSTORE.EXE` process creates a TCP/IP connection to port 60000 when it starts up, launching its MUMPS surrogate process to run in the background. MUMPS begins the session by obtaining the instrument mnemonic from the foreground C process and returning the corresponding listening port number (60100-60999) from the dictionary in **nstrument.DIC** dictionary.

After this initial handshake, the foreground `MAG_CSTORE.EXE` process listens on its designated port for image storage association requests generated by the instruments. When they are presented, they are passed to the MUMPS DICOM storage controller for validation and negotiation. Once the association is established, the instruments send image storage requests to VistA. These are received by the foreground `MAG_CSTORE.EXE` process, and again passed onto the MUMPS process. The MUMPS process determines the name of the file (from the ^MAGDINPT global, typically D:\DICOM\image_in\Lnnnnnnn.dcm), passes the name back, and image transfer to storage proceeds. After the image transfer is complete, the instrument terminates the association, and the two processes go back to their "listening" state.

4.1.2   VistA Storage Server Processes

Each individual image acquisition instrument must be defined in the master file named **Instrument.DIC**. There is a shortcut (to MAG_CSTORE.EXE) in the DICOM Instruments folder for every image acquisition instrument that can send images to the system.

The shortcuts in the folder **%ALLUSERSPROFILE%\Start Menu\Programs\VistA Imaging Programs\DICOM\Instruments** correspond to the entries in the master file **Instrument.DIC**.
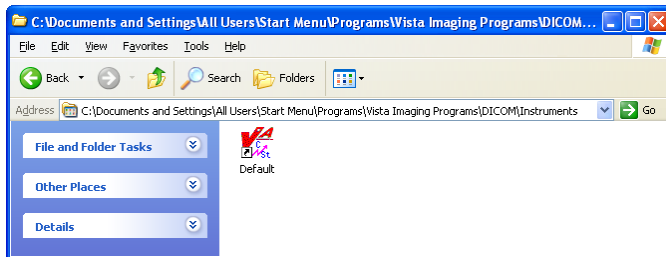
Note: You will usually see more instruments than shown above. This folder is populated using menu option **4-2-9** (Create Shortcuts for Instruments); see section 6.3.10.

The folder for the Image Gateway contains the shortcuts shown below. A site may add some site-specific icons, corresponding to the kind of image acquisition equipment at the site.
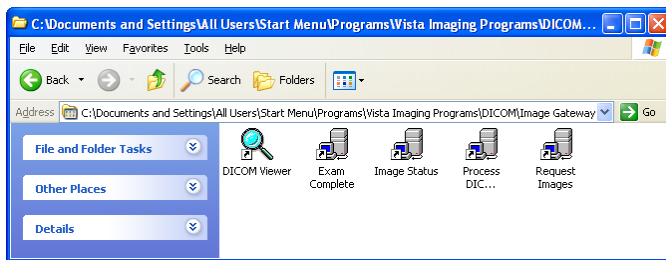
Note: Refer to the VistA Imaging DICOM Gateway Installation Guide for information on how to modify the setup parameters for these shortcuts.

The following two figures show how to allocate screen real estate for all the different DICOM Image Gateway process running on the desktop. (The various processes shown are started by clicking the corresponding icons in the DICOM Image Gateway folder. See Section 4.5 for positioning instructions.)

The first figure illustrates the typical image gateway screen layout, where all of the modalities send their images directly to VistA. Note that only the acquisition devices that are sending images to this gateway have visible icons in the DICOM Instruments folder.

Typical Image Gateway Screen Layout
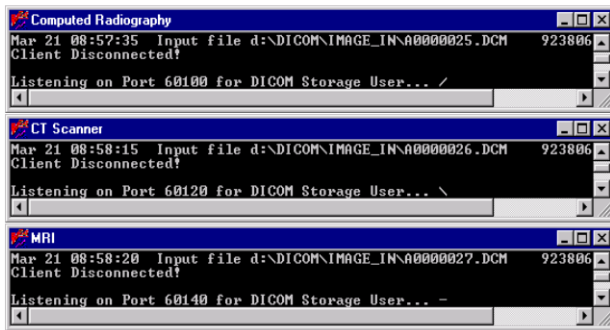
The next figure illustrates the screen layout when VistA is configured to receive images from a commercial PACS.

Note: Not all PACS use this method. Some just autoroute images to VistA and do not require these additional processes

In this example, the icons in the DICOM Image Gateway folder have been rearranged to include the "Receive Exam Complete" and "Request Image Transfer" shortcuts.

Also, since the PACS is the only acquisition device sending images to VistA, its shortcut has been moved into the DICOM Image Gateway folder.
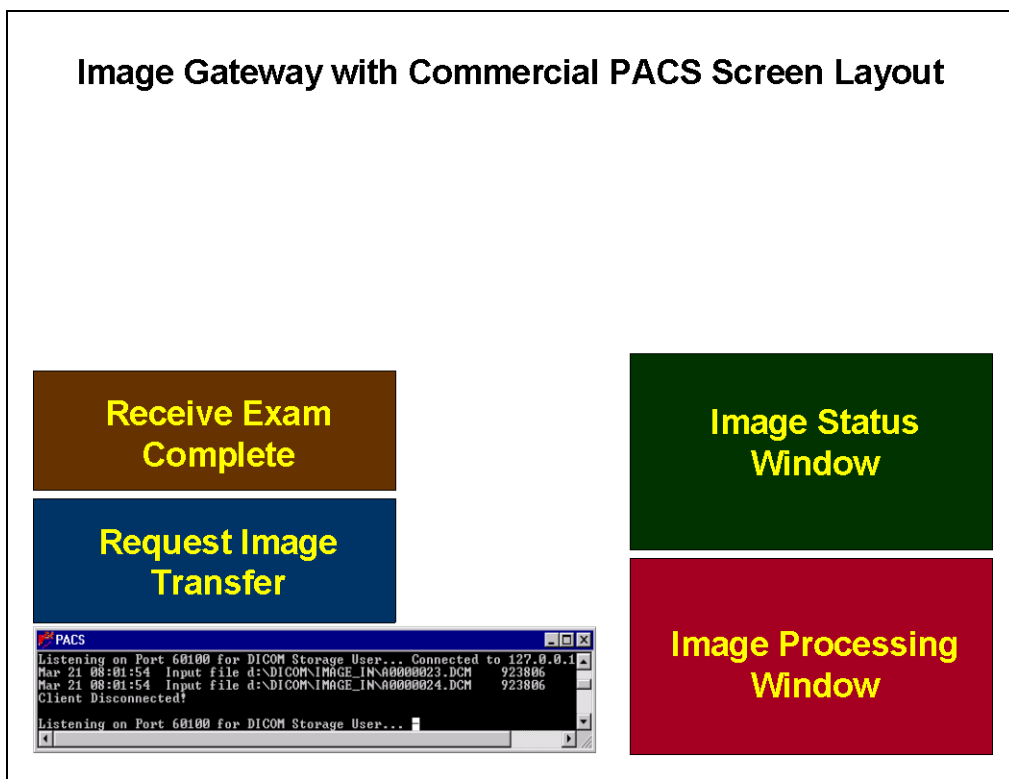
4.2   Starting the Caché Server

The first step in the operation of any component of the VistA Imaging DICOM Gateway is to start the MUMPS Server (Caché Server). Once this program has been started, it should continue to run, until it is explicitly shut down (see Section 2.6).

Right-click the icon for the Caché Cube. This will display a menu that can be used to manipulate the Caché system, in this case to start Caché. Select **Start Caché**:

Note: Once Caché is started, the icon will change from grey to blue, and the selection of available menu options will change.

4.3   Starting a Storage Server for an Instrument

After the Caché Server process has been started, the storage server for each image acquisition device may be started by double-clicking its icon in the DICOM Instruments window. This will launch an instance of the `MAG_CSTORE.EXE` program for each instrument. Upon starting, each `MAG_CSTORE.EXE` will connect to its own MUMPS DICOM storage controller and obtain the specific configuration parameters (the port number, for example) for its instrument.

See the VistA Imaging Error Message Guide for error-conditions that may occur at this stage and how to resolve them.

Note: To monitor the MUMPS DICOM Storage Controller, use the Display DICOM Message Log capability (see Section 6.2.2). Messages describing the activity of the MAG_CSTORE.EXE program can be displayed using this feature.

Once the `MAG_CSTORE.EXE` program has been started, it starts "listening" on the designated port number, waiting for the acquisition device to send images. Some time later, when the acquisition device is ready to transfer images, it will initiate a TCP/IP connection to the `MAG_CSTORE.EXE` program, establish an association, send one or more images, terminate the association, and then disconnect.

This is what will appear on the monitor when an instrument icon is clicked:
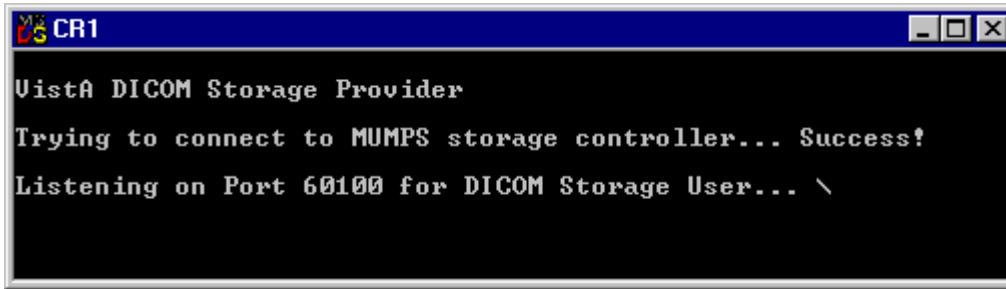
The port number assigned to the image acquisition instrument, **60100** in this example, is supplied to the `MAG_CSTORE.EXE` program by the MUMPS DICOM storage controller and is specified in the **Instrument.DIC** master file.

Each time a new image is being received, the MAG_C-Store program communicates with the MUMPS server to create an entry in the VA-FileMan table **DICOM Raw Image** (stored in `^MAGDINPT(2006.571,…)`). This database contains the full file name (typically in the **D:\DICOM\Image_In** directory), the abbreviation for the instrument that created the image, and a flag that indicates whether the file was received completely. The file name is then passed back to the MAG_C-Store program, which uses it to save the image.

4.4   Normal Progress
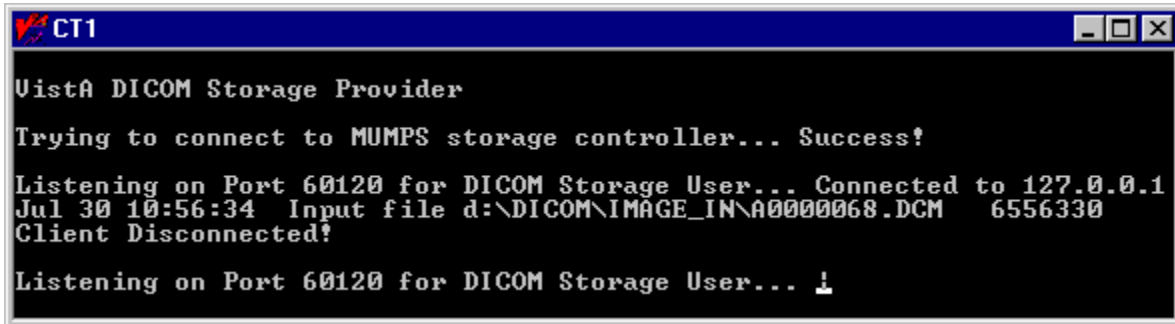
As images are transmitted from an instrument to its Storage Provider, the display in the windows for the providers will start out as follows:
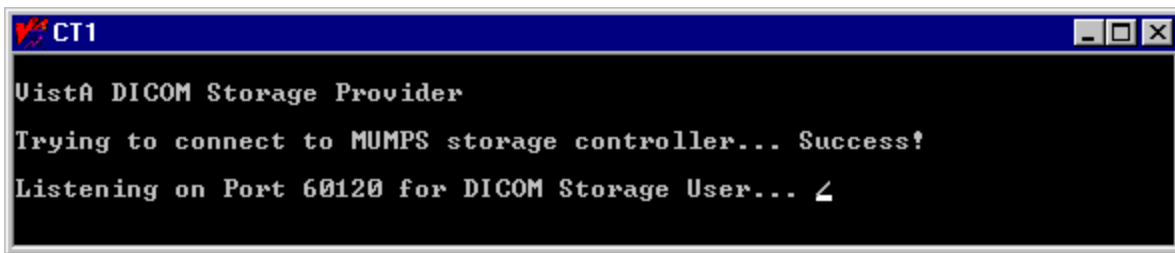
As the image is being received:
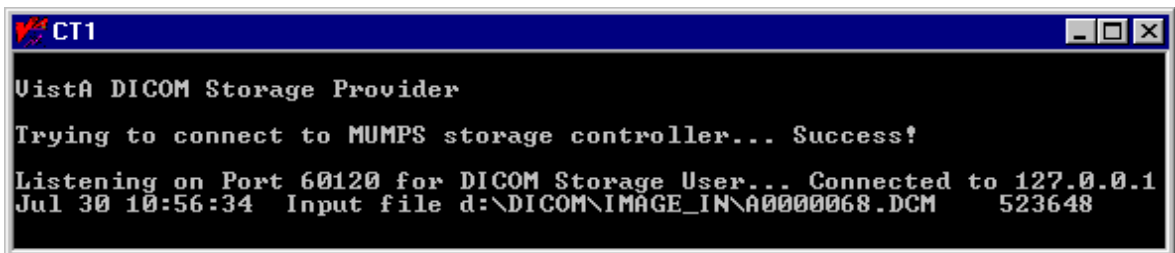
After the image is received and the instrument terminates the association:

As the images are acquired, they are chronologically stored in sequential files in the image input directory (for example **d:\DICOM\IMAGE_IN**).

4.5   Sizing and Positioning the Image Acquisition Window

Note: The size and location of the each image acquisition window can easily be fixed so that each always appears on the same place on the screen. First manually size and position the window for each instrument on the screen. Second, right-click the window's active title bar to open the properties window. Click the Layout tab as shown below.
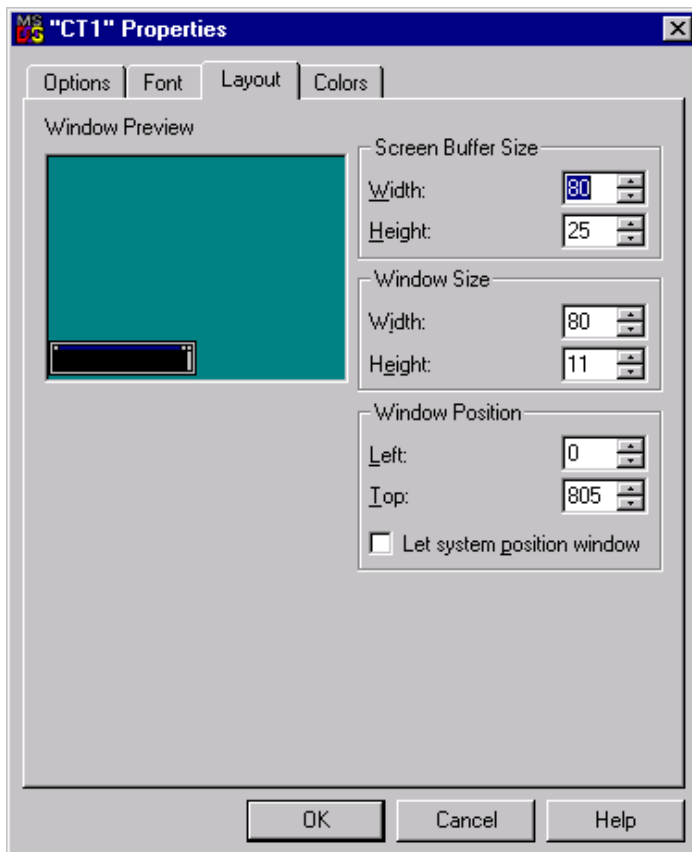
Third, clear the **Let system position window** box and click **OK**.
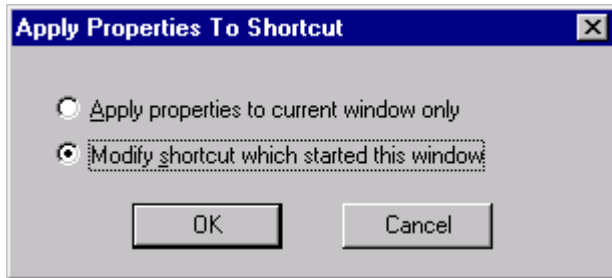
The Apply Properties to Shortcut dialog will appear. Select the **Modify shortcut which started this window** option and click **OK**.

The window properties will then be applied to the shortcut.

4.6 Viewing Images on the Gateway

The **VistA DICOM Viewer** in the DICOM Image Gateway folder displays the images that have been acquired and stored in the **D:\DICOM\Image_In** directory. This software is provided for the Imaging site support staff to view the image DICOM header information and image display ability, and is generally used when interfacing new image acquisition devices. This software should be installed only on a VistA Imaging DICOM Gateway and not on any Clinical Display workstation.

To facilitate its use, set the "Start in" path on the Properties Shortcut window to **D:\DICOM\Image_In** as shown below:
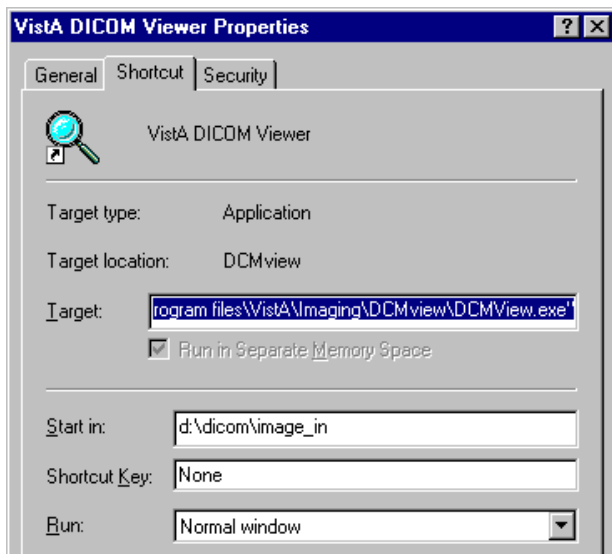
It is also very useful to associate the ".dcm" filename extension with "DICOM" and the VistA **DICOM Viewer**. The procedure for doing this is listed below.

Initially, the *.dcm files will not be associated, and the Explorer listing will look something like this:

Contents of 'D:\dicom\image_in'					
Name	Size	Type	Modified	Attributes	
A0000001.dcm	1,051KB	dcm File	4/27/2000 8:30 AM	A	
A0000002.dcm	1,051KB	dcm File	4/27/2000 8:35 AM	A	
A0000003.dcm	1,051KB	dcm File	4/27/2000 10:01 AM	A	

Click one of the .dcm files. The Open With dialog will display. Enter DICOM as the description of the .dcm files.
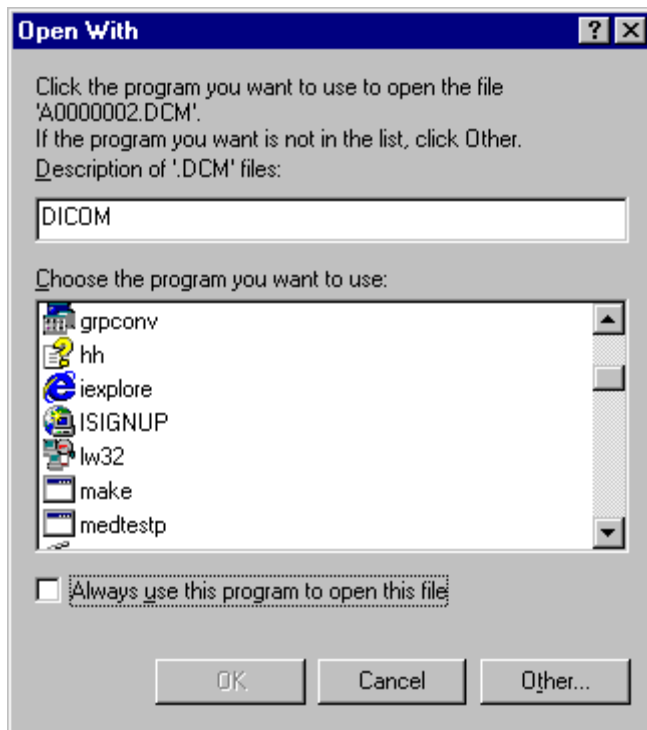
Then click **Other**. The Open With dialog will display. Select the **c:\program files\VistA\Imaging\DICOM\DCMview\DCMview.exe** program, then click **Open**.
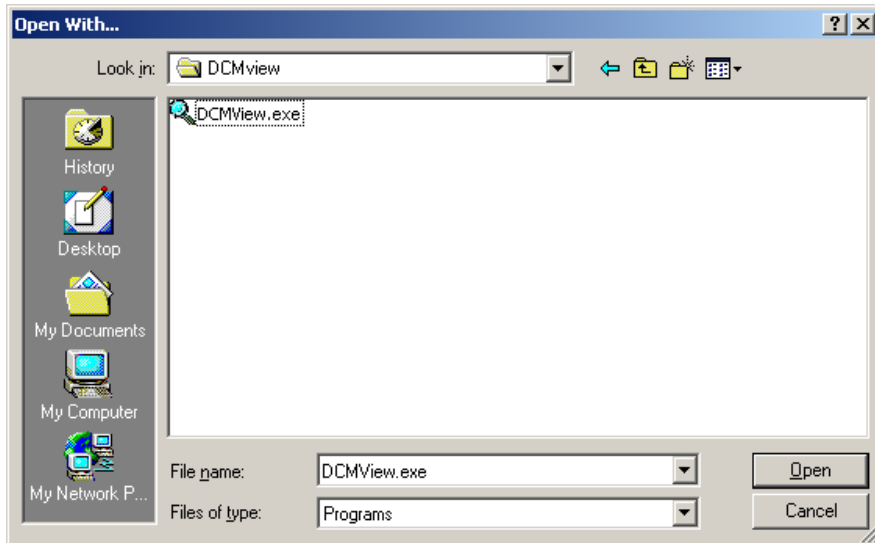
Once you have completed these steps, Explorer should identify every DICOM file and always launch the VistA **DICOM Viewer** for every DICOM image.
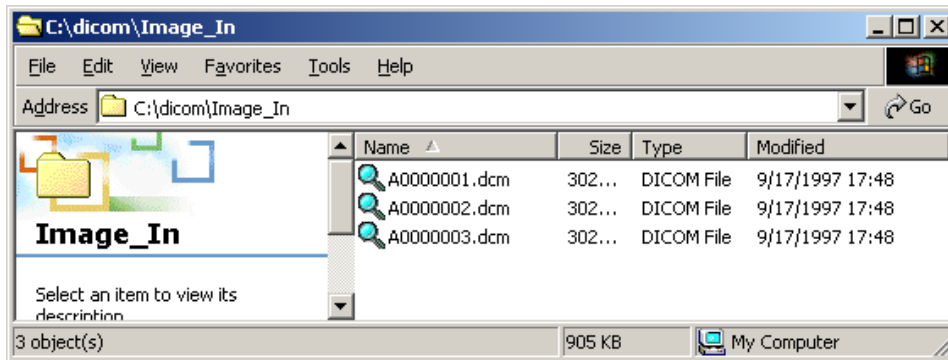
4.7   Testing the communications

A number of utility programs are available to test and verify that the communication between the various instruments and their storage servers is working. These utility programs are described in Chapter 11.

4.8   Image Gateway Menu

The menu options for the Image Gateway software are:

1.   Receive PACS Exam Complete Messages
2.   Send PACS Request Image Transfer Messages
3.   Process DICOM Images
4.   Increment DICOM Image Input Pointer
5.   Display Real-Time Storage Server Statistics
6.   Display Cumulative Storage Server Statistics
7.   Display Daily Image Processing Statistics
8.   Send DICOM Images to Another Storage Server
    1.   Select DICOM Images for Transmission
    2.   Transmit DICOM Images to a Storage SCP
    3.   Stop Image Transmission Queue Processor
    4.   (Re)Initialize Image Transmission Queue
    5.   Batch Export VistA Radiology Images
    6.   Display Batch Export Statistics
9.   Display a DICOM Image Header
10.   Re-Transmit Images from PACS
    1.   Start Querying the PACS
    2.   Stop Querying the PACS
    3.   Maintain Set-Up Parameters
11.   Purge Incomplete Image Information
12.   Import DICOM Objects
    1.   Import DoD studies that were transmitted directly to the VA
    2.   Import Outside Contracted studies
    3.   CD/DVD Import Unordered studies from DoD facilities
    4.   (CD/DVD Import Unordered studies from other VA facilities)
    5.   CD/DVD Import Unordered studies from non-VA/DoD facilities
    6.   Correct local studies with bad PID and/or study information
    7.   Build Radiology Procedure File
    8.   Build Radiology Modifiers File
    9.   Modify Exam/Report Status Update Parameters
        1.   Display Exam/Report Status Update Parameters
        2.   Modify Radiology Technologist
        3.   Modify Film Entry
        4.   Modify Diagnostic Code
        5.   Modify Camera/Equipment Room
        6.   Modify CPT Modifier
        7.   Modify All the above Parameters
13.   Validate Failed Image Table

4.9 Receive PACS Exam Complete Messages

This menu option is available only when the VistA Imaging DICOM Gateway is configured to receive Exam Complete messages from a commercial PACS. The Exam Complete message signals the gateway to retrieve images from the commercial PACS. (This mechanism is described in detail in Chapter 12.)

Exam Complete

When you double-click the above icon, a telnet window will open. The title bar of this window will contain the following text:
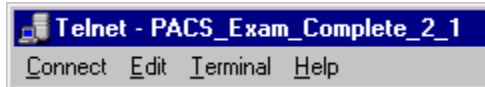
A convention throughout the VistA Imaging DICOM Gateway is to use the titles of the telnet windows to specify the name of the task and the sequence numbers of the associated menu options. In this case, the title is PACS_Exam_Complete_2_1. The task name is PACS_Exam_Complete. Select menu option 2, and then submenu option 1 as follows:

- In the first menu, select #2 (Image Gateway).
- In the second menu, select #1 (Receive PACS Exam Complete Messages).

In practice, the query/retrieve process is commercial PACS implementation-specific, and not totally standardized. The program that is invoked for this menu option is specific to the different kinds of commercial PACSs.

Note: See Chapter 12 for the implementation for EMED, GE PACS and other commercial systems using the DICOM protocol, and Chapter 13 for Agfa, CeMax/Icon, Brit and other commercial systems using autorouting with the DICOM MAG_C-Store protocol.

4.10 Send PACS Request Image Transfer Messages

This menu-option is only available when the VistA Imaging DICOM Gateway is configured to receive Exam Complete messages from a commercial PACS. The Exam Complete message signals the gateway to retrieve images from the commercial PACS.

This menu-option will start a process that will send a C-MOVE request to the PACS to retrieve the images referenced in an "Exam Complete" message (see Section 4.9). These images will be retrieved and transferred to the VistA Storage Server.

Prerequisites:

- Commercial PACS
- VistA Hospital Information System
- Storage Server

Request
Images

When the user double-clicks on the above icon, a telnet window will open. The title bar of this window will contain the following text:

Follow the convention to select:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #2 (Send PACS Request Image Transfer Messages).

```
Ready to issue PACS image transfer requests?  y// yes


**********************************************************
***  Exam Complete Request Handler (Job #20) Started  ***
**********************************************************
FILE D:\DICOM\Data1\LOGDCM.020\OUTGOING.DCM -- STUDY ROOT Q/R MOVE REQUEST --


**********************************************************
***  User Process Started on MAR 07, 2000 at 13:05:49  ***
**********************************************************


Connecting to 11.22.33.41 on port 104

*******************************************************
***  Sending A-ASSOCIATE-REQUEST to EMED_SCP_LAND  ***
*******************************************************

PDU Type: 01H (A-ASSOCIATE-RQ)                          Length=258
Version=1   Called AE: "EMED_SCP_LAND"       Calling AE: "VA VISTA"
ITEM Type: 10H (Application Context Item)               Length=21
Application Context: 1.2.840.10008.3.1.1.1  (DICOM Application Context Name)
ITEM Type: 20H (Presentation Context Item)              Length=46
Presentation Context ID: 1          Result=0
                -- Transfer Syntax(es) --
SUBITEM Type: 30H (Abstract Syntax Sub-Item)            Length=17
Presentation Context: 1.2.840.10008.1.1  (Verification SOP Class)
SUBITEM Type: 40H (Transfer Syntax Sub-Item)            Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                -- End of Transfer Syntax(es) --
ITEM Type: 20H (Presentation Context Item)              Length=56
Presentation Context ID: 3          Result=0
                -- Transfer Syntax(es) --
SUBITEM Type: 30H (Abstract Syntax Sub-Item)            Length=27
```

```
Presentation   Context:   1.2.840.10008.5.1.4.1.2.2.2     (Study   Root   Query/Retrieve
Information Model - MOVE)
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                      Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                     -- End of Transfer Syntax(es) --
ITEM Type: 50H (User Information Item)                            Length=51
SUBITEM Type: 51H (Maximum Length Sub-Item)                      Length=4
Maximum PDU length: 16384
ITEM Type: 52H (Implementation Class UID Sub-Item)               Length=22
Implementation Class: 1.2.840.113754.2.1.1.0  (VA DICOM V2.5)
ITEM Type: 55H (Implementation Version Name)                     Length=13
Implementation Version Name: VA DICOM V2.5

Sending PDU Type: 01H (A-ASSOCIATE-RQ)  Length: 258
D:\DICOM\Data1\LOGDCM.020\OUTGOING.PDU
Recving PDU Type: 02H (A-ASSOCIATE-AC) PDU len=205
D:\DICOM\Data1\LOGDCM.020\INCOMING.PDU

**********************************************************************
***   Receiving A-ASSOCIATE-RESPONSE on MAR 07, 2000 at 13:05:49  ***
**********************************************************************


PDU Type: 02H (A-ASSOCIATE-AC)                                   Length=205
Version=1   Called AE: "EMED_SCP_LAND"        Calling AE: "VA VISTA"
ITEM Type: 10H (Application Context Item)                        Length=21
Application Context: 1.2.840.10008.3.1.1.1  (DICOM Application Context Name)
ITEM Type: 21H (Presentation Context Item)                       Length=25
Presentation Context ID: 1         Result=0 (acceptance)
                 -- Transfer Syntax(es) --
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                     Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                 -- End of Transfer Syntax(es) --
ITEM Type: 21H (Presentation Context Item)                       Length=25
Presentation Context ID: 3         Result=0 (acceptance)
                 -- Transfer Syntax(es) --
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                     Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                 -- End of Transfer Syntax(es) --
ITEM Type: 50H (User Information Item)                           Length=50
SUBITEM Type: 51H (Maximum Length Sub-Item)                      Length=4
Maximum PDU length: 16384
ITEM Type: 52H (Implementation Class UID Sub-Item)              Length=20
Implementation Class: 1.2.840.113705.1.100  (*** Unknown UID: <<1.2.840.113705.1.100>>
***)
ITEM Type: 55H (Implementation Version Name)                     Length=14
Implementation Version Name: EMEDDICOM3V100

Sending PDU Type: 04H (P-DATA-TF)  Length: 342 (342)
D:\DICOM\Data1\LOGDCM.020\OUTGOING.DCM PDU len=128   PDV hdr=3, pc=3, len=122
                                     PDU len=226   PDV hdr=2, pc=3, len=220

Recving PDU Type: 04H (P-DATA-TF)      PDU len=134   PDV hdr=3, pc=3, len=128
D:\DICOM\Data1\LOGDCM.020\INCOMING.DCM
Reading D:\DICOM\Data1\LOGDCM.020\INCOMING.DCM
*****************************************************************
***   C-MOVE Response Received   Status=0 R:0  C:26  F:0  W:0  ***
*****************************************************************

Sending PDU Type: 05H (A-RELEASE-RQ)  Length: 4
D:\DICOM\Data1\LOGDCM.020\OUTGOING.PDU
Recving PDU Type: 06H (A-RELEASE-RP)   PDU len=4
D:\DICOM\Data1\LOGDCM.020\INCOMING.PDU
```

4.11 Process DICOM Images

Images that have been acquired must be associated with the corresponding patient and study in the VistA medical record. The "Process DICOM Images" task makes this association and inserts information about each image into the database. A different process will copy the image files to permanent storage on a jukebox.

For DICOM image files to be properly associated with the correct patient and study on the VistA patient database, the header of each image file must contain the correct values for the patient name, patient identification, and accession number.

Process
DICOM
Images

When you double-click the icon, a telnet window will open. The title bar of this window will contain the following text:
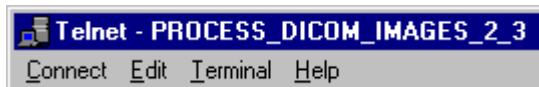
Follow the convention to select:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #3 (Process DICOM Images).

Note: This option should always be running on the DICOM Image Gateway.

4.11.1 Software Steps in Processing a DICOM Image

This task processes the images that were obtained from the acquisition instruments (see Section 4.3) and are referenced in DICOM RAW IMAGE File (#2006.571) (stored in `^MAGDINPT(2006.571,…)`). The program loops through the following steps:

1. Obtain the pointer to the next entry to process from `^MAGDINPT(2006.571,"ACOUNT")`.

2. If that image file is not "complete" wait for a maximum of five minutes. If, after five minutes, the file is still not completed, then add an entry to DICOM INCOMPLETE IMAGE File (#2006.593)(stored in `^MAGD(2006.593,…)`) for later processing, update the counter in `^MAGDINPT(2006.571,"ACOUNT")`, and start another iteration of the processing loop (go back to step 1). The name of the file is changed by appending "INCOMPLETE" to the name-extension.

3. When the image file is complete, read the information in the header of the DICOM file and extract the information that identifies the modality (manufacturer, model and model name), patient (demographics), study, and image.

    When the VistA DICOM Image Gateway attempts to process an image, it tries to extract these values from the image header. Since not all image acquisition modalities place the accession number value in the proper DICOM element (0008,0050), processing an image first involves trying to figure out what kind of a modality created the image and determining where it put the accession number. This mapping for the image acquisition device is defined in the file **Modality.DIC**. (If this mapping does not exist, the process is terminated and a pointer to the image is placed in the FileMan table "DICOM Undefined Modalities" (stored in `^MAGD(2006.5712,…)`).)

4. If the VistA database already contains the image (that is, the Image Instance UID is already present), display an error message, delete the image file from the input directory, update the `^MAGDINPT(2006.571,"ACOUNT")` counter, and start another iteration of the processing loop (go back to step 1).

5. If the modality cannot be found in the RADIOLOGY MODALITY INSTRUMENT File (#2006.582) (stored in `^MAGDICOM(2006.582,…)`), add an entry to the DICOM UNDEFINED MODALITIES File (#2006.5712) (stored in `^MAGD(2006.5712,…)`) for later processing, update the counter in the DICOM RAW IMAGE File (#2006.571) (stored in `^MAGDINPT(2006.571,"ACOUNT")`), and start another iteration of the processing loop (go back to step 1). Undefined modalities will be listed in the storage server statistics (see Section 4.13).

6. Each image acquisition instrument is mapped to a specific medical service (like radiology or consults). The patient and study are looked up on that service using the name, identification, and accession number. If the proper study is found, an association is created between the image and the corresponding study.
    Check whether the accession number that is provided by the modality is stored in the VistA database.

7. If the accession number is not found in the VistA database, then add the image file reference to the DICOM FAILED IMAGES File (#2006.575) (stored in `^MAGD(2006.575,…)`), for manual correction (see Menu Options on VistA), update the counter in the DICOM RAW IMAGE File (#2006.571) (stored in `^MAGDINPT(2006.571,"ACOUNT")`), and start another iteration of the processing loop (go back to step 1). Image files that fail to be matched to the corresponding patient and study are reported in the storage server statistics (see Section 4.13).

8. Check whether the name of the patient that is provided by the commercial PACS or the modality corresponds to the name stored in the VistA database for the accession number in question. This check is based on the full name of the patient. The check allows for the possibility that characters are transposed. The last name and the first six characters of the first name must match. The middle initial, if provided, must match.

9. Check whether the social security number corresponds to the number stored in the VistA database. This check allows for the possibility that digits are transposed.

10. If a matching entry in the VistA database cannot be found, then add the image file reference to the DICOM FAILED IMAGES File (#2006.575) (stored in `^MAGD(2006.575,…)`), for manual correction (see Menu Options on VistA), update the counter in the DICOM RAW IMAGE File (#2006.571) (stored in `^MAGDINPT(2006.571,"ACOUNT")`), and start another iteration of the processing loop (go back to step 1). Image files that fail to be matched to the corresponding patient and study are reported in the storage server statistics (see Section 4.13).

11. Otherwise, create an entry in the IMAGE File (#2005) (stored in `^MAG(2005,…)`).

12. Update the image pointer in the corresponding "parent report file" (one of Radiology or Medicine).

13. Create derived files (**.BIG**, **.TGA**, and **.ABS**). TGA, ABS, BIG, and TXT are created on the DICOM Gateway, each with an image size. The images are transmitted to the RAID image server with a request placed for the return of the size of each of the transmitted images, which is compared with the calculated image sizes. If the numbers agree, the transmission is considered successful and steps 14 and 15 will be executed.

14. Add entries to the "copy file to jukebox" background processor queue.

15. Delete the image file in D:\DICOM\Image_In.

16. Update the counter in `^MAGDINPT(2006.571,"ACOUNT")`.

17. Process completed entries in the DICOM INCOMPLETE IMAGE File (#2006.5713) (stored in `^MAGD(2006.5713,…)`). If entries in this file are more than one hour old, delete the image file from the directory D:\DICOM\Image_In.

18. Process completed entries in the DICOM UNDEFINED MODALITIES File (#2006.5712) (stored in `^MAGD(2006.5712,…)`).

19. Process completed entries in the DICOM FAILED IMAGES File (#2006.575) (stored in `^MAGD(2006.575,…)`).

20. Go back to step 1.

4.11.2 Operational Details of DICOM Image Processing

When the DICOM Gateway creates an association between the image and the corresponding study, it assigns the VistA image file name to the image file, processes the file and stores the resulting images.

Note: The patient name and patient ID (social security number) may either be displayed or hidden, depending on the setting of the `Display Patient Name/ID in Image Processing?` switch in the gateway configuration.

```
Ready to process DICOM Images and send them to VistA?  y//  <Enter> Yes


M0000114.DCM -- IMAGPATIENT,ONE M. -- 000-01-9676 -- G MRC-154      (with name and id displayed)
M0000114.DCM -- ****,* -- ***-**-**** -- GMRC-154    (with name and id suppressed)
 DEL d:\DICOM\IMAGE_IN\TMP_IMAGE.TGA
 MAG_DCMTOTGA d:\DICOM\IMAGE_IN\M0000114.DCM d:\DICOM\IMAGE_IN\TMP_IMAGE.TGA X576 Y456 O1598 B8
F0 C255
 COPY d:\DICOM\IMAGE_IN\TMP_IMAGE.TGA \isw-imgqadb\image1$\DE\00\38\DE003841.TGA
  1)        1 file(s) copied.
 DEL d:\DICOM\IMAGE_IN\TMP_IMAGE.ABS
 MAG_ABSTRTGA d:\DICOM\IMAGE_IN\TMP_IMAGE.TGA d:\DICOM\IMAGE_IN\TMP_IMAGE.ABS /8
 COPY d:\DICOM\IMAGE_IN\TMP_IMAGE.ABS \isw-imgqadb\image1$\DE\00\38\DE003841.ABS
  1)        1 file(s) copied.
 DEL d:\DICOM\IMAGE_IN\TMP_TEXT.TXT
 COPY d:\DICOM\IMAGE_IN\TMP_TEXT.TXT \isw-imgqadb\image1$\DE\00\38\DE003841.TXT
  1)        1 file(s) copied.
 DEL d:\DICOM\IMAGE_IN\M0000114.DCM
```

4.11.3 Interaction Between Image Processing and Radiology Exam Editing

When a radiology technologist opens a study for editing in the Radiology package before the DICOM Gateway has processed all images associated with the study, the DICOM Gateway stops processing the images associated with the study. It generates a message in the Image Processing session indicating that the study is locked and that processing is temporarily blocked.

The following is an example of such a message.

```
VistA DICOM Image Gateway -- Pete's Cache 5.0 Development

    1   (Receive PACS Exam Complete Messages)
    2   (Send PACS Request Image Transfer Messages)
    3   Process DICOM Images
    4   Increment DICOM Image Input Pointer
    5   Display Real-Time Storage Server Statistics
    6   Display Cumulative Storage Server Statistics
    7   Display Daily Image Processing Statistics
    8   Send DICOM Images to Another Storage Server
    9   Display a DICOM Image Header
   10   Re-Transmit Images from PACS
   11   Purge Incomplete Image Information
   12   Import DICOM Objects
   13   Validate Failed Image Table
   14   TELEREADER


   OPTION:  3


Fetching UID Table from VistA ... 6272 nodes

Ready to process DICOM Images and send them to VistA?  y// Yes
Connecting to M-to-M RPC Broker Server "LOCALHOST" on Port 4800 - SUCCESS!
<UserLogin>_0000022.DCM -- PATIENT^FOURZEROONE^^^ -- 000-00-0401 -- 040111-362
Waiting (radiology exam locked)... 0:00:54
```

Once the record is locked, if the editing continues for more than five (5) minutes, the DICOM Gateway sends an email message to the mailgroup defined in its configuration.

The following is an example of such an email message:

```
NON-FATAL WARNING: IMAGE PROCESSING IS BLOCKED Someone in the Radiology Department is
editing study 040111-362 whose images are being processed by the DICOM gateway.
Image processing is temporarily stopped and will resume upon completion of the editing.

Message generated at 1-Apr-2011, 07:58:54

Routine: MAGDIR6
DICOM Gateway "Pete's Cache 5.0 Development (<UserLogin>)".
```

Important: Do not open a study in the Radiology package before the DICOM Gateway has processed all images related to the study. If you do so, image processing will stop while the study is edited. We highly recommend that images be viewed in VistA Imaging Display for quality, quantity, and accuracy before performing a case edit or updating the exam status in the radiology package.

4.12 Increment DICOM Image Input Pointer

On rare occasions, a garbled image may be transmitted to the Image Gateway, which would cause image processing to stop. In order to continue operations, the corrupted image file can be manually bypassed by incrementing the image pointer.

Use the Caché Terminal icon to start a session for this menu option.

After login, select the following menu options:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #4 (Increment DICOM Image Input Pointer).

```
The last image in the "D:\DICOM\Image_In" directory is number 3.

There are no images waiting to be processed.

The current image processing pointer value is 1.

Do you wish to increment the image processing pointer?  n// y - INCREMENTED
```

4.13   Display Storage Server Statistics in Real Time

The option Display Real-Time Storage Server Statistics is used to monitor the results of the DICOM image processing task and to detect problems in the workflow. The option should be run continuously.

Caché
Terminal

When you double-click the Caché Terminal icon, a telnet window opens. The title bar of this window contains the following text:

Follow the convention to select:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #5 (Display Real-Time Storage Server Statistics).

The Image Status application displays the number of…

*   Image files that have been completely processed and stored in VistA
*   Images that failed because of patient/study information mismatch
*   Images that failed because the image acquisition modality was not defined in **Modality.DIC**

The list of "Instruments" that is presented is defined in the master file named **Instrument.DIC**. After starting this process, the screen display will look like this:

```
Ready to output instrument statistics?  y// yes


                VISTA DICOM Image Storage Server


Instrument      Description                                 Port      Service
----------      -----------                                 ----      -------
  CR1           Fuji AC3 CR, Radiology                      60050     RAD
  CT1           Picker PQ 5000, Room 2142                   60060     RAD
LUMISYS         Lumisys Scanner, Radiology                  60110     RAD
LUMISYS_TOP     Lumisys Scanner, Topeka Radiology           60111     RAD
   US           Acuson Sequoia, Rm 2136                     60090     RAD


              VISTA DICOM Image Storage Server Status


Instrument      Interface Status         Associations      Images  (Time)
----------      ----------------         ------------      ---------------
  CR1           Up (since 06/03)
  CT1           Up (since 06/03)            (active)          273 (11:51)
LUMISYS         Down 12:50 02/11
```

```
LUMISYS_TOP     Down 12:50 02/11
   US           Down 12:50 02/11

  984.5 megabytes (66.9%) of free space on drive d:    (Total=1472.5 megabytes)

Exit?  no //
```

In the preceding example, the VistA DICOM Storage Provider has been operational for the CR1 and CT1 modalities since 06/03, but has not been used for the other three modalities since 02/11. There is currently an active DICOM association between the CT1 modality and its VistA DICOM Storage Provider, and it is probably sending images. A total of 273 images have been acquired from the CT1 modality today, the last at 11:51.

Every 30 seconds an updated set of statistics will be displayed. After each set of statistics, the program will ask whether or not to exit. If this question is not answered with **Yes**, the program will continue indefinitely.

Some images may be waiting to be processed, because the patient or study information was entered incorrectly on the instrument (see Chapter 10) or because the instrument was not yet defined.

The VistA Imaging DICOM Gateway system may not be able to process certain images because the image parameters are not defined in the **Modality.DIC** master file. An error message like the following may be displayed:

```
        *** The following images have undefined modalities ***
Manufacturer               Model                         Modality  #Images
------------               -----                         --------  -------
VAMC Image Acquisition     VA Image Camera                  OT        1
```

When this happens, the modality needs to be added to the dictionary (see Chapter 10.)

4.14   Display Cumulative Storage Server Statistics

This option provides the daily totals of images acquired from the various instruments. It can be run at any time.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #6 (Display Cumulative Storage Server Statistics).

The numbers in the report represent the daily totals of images acquired from the various instruments.

```
                  IMAGE CAPTURE STATISTICS BY MODALITY


                     L
                     U
                     M
                     I
           C    C    S
           R    T    Y
           1    1    S
  DATE    =================
02/13/98                2
04/20/98                3
04/21/98               14
07/16/98   21
07/17/98   40
07/18/98    4
. . .
05/31/99   40
06/01/99  134  250
06/02/99  125  296
06/03/99  109   56

Push <Enter> to continue...
```

4.15   Display Daily Image Processing Statistics

This option allows the user to quickly assess any delay or problems in processing images. The numbers shown represent the numbers of individual images, not exams.

Use the Caché Terminal icon to start a session for this menu option.

Caché Terminal

After login, select the following menu options:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #7 (Display Daily Image Processing Statistics).

The numbers in this report represent images acquired and processed from the various instruments, and the time stamp for the most recent image.

```
          VISTA DICOM Image Storage Server Statistics
```

```
Please enter beginning date: T // <Enter>

          VISTA DICOM Image Storage Server Statistics for 06/10/99

Modality            Images Acquired              Images Processed
--------            ---------------              ----------------
  CR1                 44  (12:42)                  44  (12:43)
 PB_CT                99  (10:06)                 156  (10:25)

Exit?  no //
```

Note: The number of images processed may be different than the number of images acquired, because of delays introduced by studies that have inaccurate patient information and need to be manually corrected (see Chapter 7).

4.16   Send DICOM Images to Another Storage Server

Images can be sent from VistA to another DICOM storage provider, like a commercial PACS, workstation, radiation therapy planning device, etc.

Sending images to another storage server is a two-step process involving separate image/study selection and transmission steps. There are two different selection methodologies. The first (menu option 1 below) allows you to select individual images/studies for transmission. The second (menu option 5 below) allows groups of studies to be exported as a batch.

DICOM Export Menu Options
1. Select DICOM Images for Transmission
2. Transmit DICOM Images to a Storage SCP
3. Stop Image Transmission Queue Processor
4. (Re)Initialize Image Transmission Queue
5. Batch Export VistA Radiology Images
6. Display Batch Export Statistics

The selection step can be initiated from any PC that has the VistA Imaging DICOM Gateway software available; the transmission step (menu option 2 above) can be run only on PCs that are set up to transmit files to the designated DICOM storage server.

Before performing the DICOM Export, the destination DICOM storage providers must be setup as described in the VistA Imaging DICOM Installation Guide. Their AE Titles, IP addresses, and port numbers must be in the **SCU_List.DIC** master file and in the USER APPLICATION File (#2006.585, stored in the ^MAGDICOM(2006.585) global). After modifications have been made to the master file, this file needs to be re-imported into the active database using the menu option #6 - Update SCU_List.DIC (see section 6.3.7).

4.16.1   Select DICOM Images for Transmission

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #8 (Send DICOM Images to Another Storage Server).
3. In the third menu, select #1 (Select DICOM Images for Transmission).

This program will enter image files into a transmission queue in the DICOM IMAGE OUTPUT File (#2006.574) (stored in ^MAGDOUTP(2006.574,…)).
In order to select an image for transmission, either the case number or the internal image number may be entered. If an image number is entered, it must be preceded by a "tick mark" (accent grave).

```
Select images to send via DICOM

All uses pose potential violations of patient privacy.

It is absolutely required that all users with transmission capability
personally inspect each downloaded image.

For technical reasons, related to the image capture process,
some of the images contain patient identification data which
must be removed manually.

Each image transmitted is tracked and audited by the Imaging System.

The images are not to be distributed outside of the VA, or used for
any other purposes than listed below.

The transmitting user is specifically responsible for the protection
of these images.

Press <Enter> to continue: <Enter>

Indicate the reason for transmission:

   [a]  Clinical care for the patient whose images are being transmitted

   [b]  Clinical care for other VA patients

   [c]  Use in approved research by VA staff

   [d]  Approved teaching purposes by VA staff

   [e]  Use in approved VA publications

   [f]  Clinical care (Export to HIPAA Compliant Archive)

Enter letter for reason: A <Enter>
```

Enter electronic signature: xxx **<Enter>**

Specify RADIOLOGY or CONSULT examination (R or C): R// **<Enter> R**

Enter Case Number (or `ien): **26 <Enter>** ??? report does not exist

Press <Enter> to try another case number... **<Enter>**

Select images to send via DICOM

Enter Case Number (or `ien): **102197-57 <Enter>**

Image File Information

Acquisition Site: 589, KANSAS CITY, MO
Number: 50215   Accession Number: 102197-57
Name: "IMAGPATIENT,SIX R. 000086293 CHEST 2 VIEWS PA&LAT"
Object: XRAY GROUP   Image Type: RAD CT
Image Name: "CHEST 2 VIEWS PA&LAT"
Study UID: 2.16.840.1.113662.2.1.483644493333.429.33.9159
There are 3 images in this group:
   50216   50217   50218

Is this the correct image? n// **y <Enter>**

DICOM Service Class Providers
----
  1 -- LOCAL IMAGE STORAGE
  2 -- LOCAL MODALITY WORKLIST
  3 -- VISTA PACS TEXT GATEWAY EXERCISER

Select the provider application (1-3): **1 <Enter>**

Send the images to LOCAL IMAGE STORAGE? n// **y <Enter>** -- images will be sent

Press <Enter> to continue... **<Enter>**

Ready to select studies to send via DICOM? y// **<Enter>** Yes

Select images to send via DICOM

Enter Case Number (or `ien): `**50216 <Enter>**

Image File Information

Acquisition Site: 589, KANSAS CITY, MO
Number: 50216
Name: "IMAGPATIENT,SIX R. 000086293 CHEST 2 VIEWS PA&LAT"
Object: DICOM IMAGE   Image Type: CT
Image Name: "CHEST 2 VIEWS PA&LAT (#1)"
GROUP #: 50215
Image UID: 2.16.840.1.113662.2.1.429.19961105.203459.9300

Is this the correct image? n// **y <Enter>**

DICOM Service Class Providers

```
  1 -- LOCAL IMAGE STORAGE
  2 -- LOCAL MODALITY WORKLIST
  3 -- VISTA PACS TEXT GATEWAY EXERCISER

Select the provider application (1-3): 1 <Enter>

Send the images to LOCAL IMAGE STORAGE?  n// y <Enter> -- images will be sent

Push <Enter> to continue... <Enter>

Select images to send via DICOM

Enter Case Number (or `ien): `50217 <Enter>

Image File Information
----------------------
Acquisition Site: 589, KANSAS CITY, MO
Number: 50217
Name: "IMAGPATIENT,SIX R.  000086293  CHEST 2 VIEWS PA&LAT"
Object: XRAY                    Image Type: CT
Image Name: "CHEST 2 VIEWS PA&LAT (#2)"
GROUP #: 50215
Image UID: 2.16.840.1.113662.2.1.429.19961105.203459.9300

Is this the correct image?  n// y <Enter>

DICOM Service Class Providers
-----------------------------
  1 -- LOCAL IMAGE STORAGE
  2 -- LOCAL MODALITY WORKLIST
  3 -- VISTA PACS TEXT GATEWAY EXERCISER

Select the provider application (1-3): 1 <Enter>

Send the images to LOCAL IMAGE STORAGE?  n// y <Enter> -- images will be sent

Push <Enter> to continue... <Enter>

Select images to send via DICOM

Enter Case Number (or `ien): `50218 <Enter>

Image File Information
----------------------
Acquisition Site: 589, KANSAS CITY, MO
Number: 50218
Name: "IMAGPATIENT,SIX R.  000086293  CHEST 2 VIEWS PA&LAT"
Object: XRAY                    Image Type: CT
Image Name: "CHEST 2 VIEWS PA&LAT (#3)"
GROUP #: 50215
Image UID: 2.16.840.1.113662.2.1.429.19961105.203459.9300

Is this the correct image?  n// y <Enter>

DICOM Service Class Providers
-----------------------------
  1 -- LOCAL IMAGE STORAGE
```

```
  2 -- LOCAL MODALITY WORKLIST
  3 -- VISTA PACS TEXT GATEWAY EXERCISER

Select the provider application (1-3): 1 <Enter>

Send the images to LOCAL IMAGE STORAGE?  n// y <Enter> -- images will be sent

Push <Enter> to continue... <Enter>

Select images to send via DICOM

Enter Case Number (or `ien): <Enter>
```

4.16.2   Transmit DICOM Images to a Storage SCP

Use the Caché Terminal icon to start a session for this menu option.

After login, select the following menu options:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #8 (Send DICOM Images to Another Storage Server).
3. In the third menu, select #2 (Transmit DICOM Images to a Storage SCP).

Files that have been entered into the transmission queue in the DICOM IMAGE OTPUT File (#2006.574)(stored in ^MAGDOUTP(2006.574,…)) are transmitted to their destinations using this menu option. Once this program is started, it runs continuously.

VistA DICOM image transmission is a two-step process. First the DICOM image has to be reconstituted from the TARGA image and the corresponding text file. (This is performed by MUMPS and the MAG_DCMTOTGA.EXE program.) The regenerated DICOM image is stored in the D:\DICOM\Image_Out directory. Then a MAG_VISTA_SEND_IMAGE.EXE process is started to create an association to the destination storage server and transmit the images. When images are stored internally in DICOM format, the reconstitution step is skipped, but the images will still be copied to the D:\DICOM\Image_Out directory. Patient demographics are updated before the image is sent out.

The dialog below shows the transmission of the images selected in the example in Section 4.16.1.

```
Ready to send DICOM Images from VistA?  y// yes <Enter>

Display the MAG_VISTA_SEND_IMAGE window?  y//yes

COPY \\VHAISWIMM1\IMAGE1$\CT_TEST.DCM D:\DICOM\Image_Out\CT_TEST.DCM
  1)        1 file(s) copied.
```

```
********************************************************************
***   Send Image (Job #5) Started on JUL 22, 1999 at 10:36:26   ***
********************************************************************
 MAG_VISTA_SEND_IMAGE LOCALHOST 65535

Socket Available on Port 65535
Recving <<Connection established to MUMPS>>
Sending <<CONNECT LOCALHOST 60100>>
Recving <<CONNECTION SUCCESSFUL>>
********************************************************
***   Sending A-ASSOCIATE-REQUEST to VistA_Storage   ***
********************************************************


PDU Type: 01H (A-ASSOCIATE-RQ)                              Length=208
Version=1   Called AE: "VistA_Storage"       Calling AE: " VistA Testing"
ITEM Type: 10H (Application Context Item)                   Length=21
Application Context: 1.2.840.10008.3.1.1.1  (DICOM Application Context Name)
ITEM Type: 20H (Presentation Context Item)                  Length=56
Presentation Context ID: 1          Result=0
                  -- Transfer Syntax(es) --
SUBITEM Type: 30H (Abstract Syntax Sub-Item)               Length=25
Presentation Context: 1.2.840.10008.5.1.4.1.1.2  (CT Image Storage)
SUBITEM Type: 40H (Transfer Syntax Sub-Item)               Length=19
Transfer Syntax: 1.2.840.10008.1.2.1  (Explicit VR Little Endian)
                  -- End of Transfer Syntax(es) --
ITEM Type: 50H (User Information Item)                      Length=51
SUBITEM Type: 51H (Maximum Length Sub-Item)                Length=4
Maximum PDU length: 32768
ITEM Type: 52H (Implementation Class UID Sub-Item)         Length=22
Implementation Class: 1.2.840.113754.2.1.1.0  (VA DICOM V2.5)
ITEM Type: 55H (Implementation Version Name)               Length=13
Implementation Version Name: VA DICOM V2.5
Sending <<NEW_ASSOCIATION D:\DICOM\Image_Out\ASSOCIAT.OUT D:\DICOM\Image_Out\ASSOCIAT.IN>>
Recving <<ASSOCIATION ACKNOWLEDGE>>

********************************************************************
***   Receiving A-ASSOCIATE-RESPONSE on JUL 22, 1999 at 10:36:27   ***
********************************************************************

PDU Type: 02H (A-ASSOCIATE-AC)                              Length=179
Version=1   Called AE: "VistA_Storage"       Calling AE: "VistA Testing"
ITEM Type: 10H (Application Context Item)                   Length=21
Application Context: 1.2.840.10008.3.1.1.1  (DICOM Application Context Name)
ITEM Type: 21H (Presentation Context Item)                 Length=27
Presentation Context ID: 1          Result=0 (acceptance)
                  -- Transfer Syntax(es) --
SUBITEM Type: 40H (Transfer Syntax Sub-Item)               Length=19
Transfer Syntax: 1.2.840.10008.1.2.1  (Explicit VR Little Endian)
                  -- End of Transfer Syntax(es) --
ITEM Type: 50H (User Information Item)                      Length=51
SUBITEM Type: 51H (Maximum Length Sub-Item)                Length=4
Maximum PDU length: 32768
ITEM Type: 52H (Implementation Class UID Sub-Item)         Length=22
Implementation Class: 1.2.840.113754.2.1.1.0  (VA DICOM V2.5)
ITEM Type: 55H (Implementation Version Name)               Length=13
Implementation Version Name: VA DICOM V2.5

Image 1/1: D:\DICOM\Image_Out\CT_TEST.DCM on JUL 22, 1999 at 10:36:27
Sending <<SEND_IMAGE D:\DICOM\Image_Out\COMMAND.DCM D:\DICOM\Image_Out\CT_TEST.D
CM 32768 338 D:\DICOM\Image_Out\RESPONSE.DCM>>
Recving <<IMAGE SENT>>  (not on file)
Sending <<END_ASSOCIATION D:\DICOM\Image_Out\RELEASE.OUT D:\DICOM\Image_Out\RELE
ASE.IN>>
```

```
Recving <<ASSOCIATION ENDED>>
Sending <<END_SESSION>>
 MAG_TGATODCM \\VHAISWIMM1\IMAGE1$\LA050217.TGA D:\DICOM\Image_Out\LA050217.DCM 524288
************************************************************
***   Send Image (Job #5) Started on JUL 22, 1999 at 10:36:29  ***
************************************************************
 MAG_VISTA_SEND_IMAGE LOCALHOST 65535

Socket Available on Port 65535
Recving <<Connection established to MUMPS>>
Sending <<CONNECT LOCALHOST 60100>>
Recving <<CONNECTION SUCCESSFUL>>
********************************************************
***   Sending A-ASSOCIATE-REQUEST to VistA_Storage  ***
********************************************************


PDU Type: 01H (A-ASSOCIATE-RQ)                                 Length=206
Version=1   Called AE: "VistA_Storage"       Calling AE: "VistA Testing"
ITEM Type: 10H (Application Context Item)                      Length=21
Application Context: 1.2.840.10008.3.1.1.1  (DICOM Application Context Name)
ITEM Type: 20H (Presentation Context Item)                     Length=54
Presentation Context ID: 1          Result=0
                 -- Transfer Syntax(es) --
SUBITEM Type: 30H (Abstract Syntax Sub-Item)                  Length=25
Presentation Context: 1.2.840.10008.5.1.4.1.1.2  (CT Image Storage)
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                 Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                 -- End of Transfer Syntax(es) --
ITEM Type: 50H (User Information Item)                        Length=51
SUBITEM Type: 51H (Maximum Length Sub-Item)                 Length=4
Maximum PDU length: 32768
ITEM Type: 52H (Implementation Class UID Sub-Item)           Length=22
Implementation Class: 1.2.840.113754.2.1.1.0  (VA DICOM V2.5)
ITEM Type: 55H (Implementation Version Name)                 Length=13
Implementation Version Name: VA DICOM V2.5
Sending <<NEW_ASSOCIATION D:\DICOM\Image_Out\ASSOCIAT.OUT D:\DICOM\Image_Out\ASS
OCIAT.IN>>
Recving <<ASSOCIATION ACKNOWLEDGE>>

********************************************************************
***   Receiving A-ASSOCIATE-RESPONSE on JUL 22, 1999 at 10:36:30  ***
********************************************************************


PDU Type: 02H (A-ASSOCIATE-AC)                                 Length=177
Version=1   Called AE: "VistA_Storage"       Calling AE: "VistA Testing"
ITEM Type: 10H (Application Context Item)                      Length=21
Application Context: 1.2.840.10008.3.1.1.1  (DICOM Application Context Name)
ITEM Type: 21H (Presentation Context Item)                     Length=25
Presentation Context ID: 1          Result=0 (acceptance)
                 -- Transfer Syntax(es) --
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                 Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                 -- End of Transfer Syntax(es) --
ITEM Type: 50H (User Information Item)                        Length=51
SUBITEM Type: 51H (Maximum Length Sub-Item)                 Length=4
Maximum PDU length: 32768
ITEM Type: 52H (Implementation Class UID Sub-Item)           Length=22
Implementation Class: 1.2.840.113754.2.1.1.0  (VA DICOM V2.5)
ITEM Type: 55H (Implementation Version Name)                 Length=13
Implementation Version Name: VA DICOM V2.5

Image 1/1: D:\DICOM\Image_Out\LA050217.DCM on JUL 22, 1999 at 10:36:30
Sending <<SEND_IMAGE D:\DICOM\Image_Out\COMMAND.DCM D:\DICOM\Image_Out\LA050217.
```

```
DCM 32768 0 D:\DICOM\Image_Out\RESPONSE.DCM>>
Recving <<IMAGE SENT>>  (not on file)
Sending <<END_ASSOCIATION D:\DICOM\Image_Out\RELEASE.OUT D:\DICOM\Image_Out\RELE
ASE.IN>>
Recving <<ASSOCIATION ENDED>>
Sending <<END_SESSION>>
 MAG_TGATODCM \\VHAISWIMM1\IMAGE1$\LA050218.TGA D:\DICOM\Image_Out\LA050218.DCM 524288
*************************************************************************
***   Send Image (Job #5) Started on JUL 22, 1999 at 10:36:32  ***
*************************************************************************
 MAG_VISTA_SEND_IMAGE LOCALHOST 65535

Socket Available on Port 65535
Recving <<Connection established to MUMPS>>
Sending <<CONNECT LOCALHOST 60100>>
Recving <<CONNECTION SUCCESSFUL>>
********************************************************
***   Sending A-ASSOCIATE-REQUEST to VistA_Storage  ***
********************************************************


PDU Type: 01H (A-ASSOCIATE-RQ)                            Length=206
Version=1   Called AE: "VistA_Storage"       Calling AE: "VistA Testing"
ITEM Type: 10H (Application Context Item)                 Length=21
Application Context: 1.2.840.10008.3.1.1.1  (DICOM Application Context Name)
ITEM Type: 20H (Presentation Context Item)                Length=54
Presentation Context ID: 1          Result=0
                  -- Transfer Syntax(es) --
SUBITEM Type: 30H (Abstract Syntax Sub-Item)             Length=25
Presentation Context: 1.2.840.10008.5.1.4.1.1.2  (CT Image Storage)
SUBITEM Type: 40H (Transfer Syntax Sub-Item)             Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                  -- End of Transfer Syntax(es) --
ITEM Type: 50H (User Information Item)                    Length=51
SUBITEM Type: 51H (Maximum Length Sub-Item)              Length=4
Maximum PDU length: 32768
ITEM Type: 52H (Implementation Class UID Sub-Item)       Length=22
Implementation Class: 1.2.840.113754.2.1.1.0  (VA DICOM V2.5)
ITEM Type: 55H (Implementation Version Name)             Length=13
Implementation Version Name: VA DICOM V2.5
Sending <<NEW_ASSOCIATION D:\DICOM\Image_Out\ASSOCIAT.OUT D:\DICOM\Image_Out\ASSOCIAT.IN>>
Recving <<ASSOCIATION ACKNOWLEDGE>>

*********************************************************************
***   Receiving A-ASSOCIATE-RESPONSE on JUL 22, 1999 at 10:36:32  ***
*********************************************************************


PDU Type: 02H (A-ASSOCIATE-AC)                            Length=177
Version=1   Called AE: "VistA_Storage"       Calling AE: "VistA Testing"
ITEM Type: 10H (Application Context Item)                 Length=21
Application Context: 1.2.840.10008.3.1.1.1  (DICOM Application Context Name)
ITEM Type: 21H (Presentation Context Item)                Length=25
Presentation Context ID: 1           Result=0 (acceptance)
                  -- Transfer Syntax(es) --
SUBITEM Type: 40H (Transfer Syntax Sub-Item)             Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                  -- End of Transfer Syntax(es) --
ITEM Type: 50H (User Information Item)                    Length=51
SUBITEM Type: 51H (Maximum Length Sub-Item)              Length=4
Maximum PDU length: 32768
ITEM Type: 52H (Implementation Class UID Sub-Item)       Length=22
Implementation Class: 1.2.840.113754.2.1.1.0  (VA DICOM V2.5)
ITEM Type: 55H (Implementation Version Name)             Length=13
Implementation Version Name: VA DICOM V2.5
```

```
Image 1/1: D:\DICOM\Image_Out\LA050218.DCM on JUL 22, 1999 at 10:36:32
Sending <<SEND_IMAGE D:\DICOM\Image_Out\COMMAND.DCM D:\DICOM\Image_Out\LA050218.
DCM 32768 0 D:\DICOM\Image_Out\RESPONSE.DCM>>
Recving <<IMAGE SENT>>  (not on file)
Sending <<END_ASSOCIATION D:\DICOM\Image_Out\RELEASE.OUT D:\DICOM\Image_Out\RELE
ASE.IN>>
Recving <<ASSOCIATION ENDED>>
Sending <<END_SESSION>>/
^C
*** Error: ,Z<INRPT>XXX^MAGDXXX:::6:0:, ***
```

When all files are transmitted, this menu option may be terminated by pressing **Control+C**, as shown above.

The details of the above log require a working knowledge of the DICOM Standard (PS 3.7-1999), as well as familiarization with the VistA Imaging DICOM Gateway implementation. It is more useful for support personnel.

4.16.3 Stop Image Transmission Queue Processor

When a transmission queue processor has been started using the menu option from 4.16.2, this processor will continue until instructed to stop using this menu option.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #8 (Send DICOM Images to Another Storage Server).
3. In the third menu, select #3 (Stop Image Transmission Queue Processor).

When this menu option is selected, the Image Transmission Queue processor that was started (in a different Telnet window) will stop; the program will acknowledge the request by displaying:

```
The transmitter will stop soon.
```

4.16.4 Initialize Image Transmission Queue

If a communication error occurs, the transmission queue will have to be reinitialized.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #8 (Send DICOM Images to Another Storage Server).
3. In the third menu, select #4 (Initialize Image Transmission Queue).

```
Initialize Image Transmission Queue?  n// y <Enter>

Image Transmission Queue has been initialized

Push <Enter> to continue...
```

4.16.5   Batch Export VistA Radiology Images

Batch Export allows a multiple Radiology studies to be exported at one time. This may be by a date range, radiology report number range, or by a selected patient. The first two capabilities can be used to transfer images from VistA to a commercial PACS, while the third can be used to transfer multiple studies to a DICOM CD burner. The examples below show all three scenarios.

4.16.5.1   Batch Export of Radiology Images by Date Range

This capability is used to export a set of Radiology images for a given Radiology Report date range. You establish the date range and indicate whether the studies should be exported in ascending (chronological) or descending (reverse chronological) order. It also allows you to determine when to run the Batch Export process, perhaps only during the off-hours. This capability is useful for exporting a set of studies to a commercial PACS.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #8 (Send DICOM Images to Another Storage Server).
3. In the third menu, select #5 (Batch Export VistA Radiology Images).

This program will enter image files into a transmission queue in the DICOM IMAGE OUTPUT File (#2006.574) (stored in `^MAGDOUTP(2006.574,…)`).

```
****************************************************************************
***                                                                    ***
```

```
*** V i s t A   D I C O M   I m a g e   E x p o r t e r            ***
*** ------------------------------------------------              ***
***                                                               ***
*** This program may be used to copy radiology images from VistA to a   ***
*** another DICOM image archive.                                  ***
***                                                               ***
*** The regular "Transmit DICOM Images to a Storage SCP" menu option    ***
*** is used to copy the images to the other DICOM image archive.  ***
*** You may use Ctrl-C (^C) to stop this process, if you need to abort it.   ***
***                                                               ***
*****************************************************************************
```

Scan by Date, Report Number, or Patient (D, N, or P): **DATE <Enter>**

All uses pose potential violations of patient privacy.

It is absolutely required that all users with transmission capability
personally inspect each downloaded image.

For technical reasons, related to the image capture process,
some of the images contain patient identification data which
must be removed manually.

Each image transmitted is tracked and audited by the Imaging System.

The images are not to be distributed outside of the VA, or used for
any other purposes than listed below.

The transmitting user is specifically responsible for the protection
of these images.

Press <Enter> to continue: **<Enter>**

Indicate the reason for transmission:

   [a] Clinical care for the patient whose images are being transmitted

   [b] Clinical care for other VA patients

   [c] Use in approved research by VA staff

   [d] Approved teaching purposes by VA staff

   [e] Use in approved VA publications

   [f] Clinical care (Export to HIPAA Compliant Archive)

Enter letter for reason: **A <Enter>**
Enter electronic signature: xxx **<Enter>**

The DICOM storage provider is "LOCAL PACS SIMULATOR".

Do you wish to change it? n // **<Enter>** n

The radiology reports will be scanned in the "ASCENDING" order.

Do you wish to change it? n // **<Enter>** n

Enter the earliest date for the report.

Earliest Report Date: NOV 24, 1998// **<Enter>** (NOV 24, 1998)

```
Enter the latest date for the report.

Latest Report Date: FEB 23, 2006@23:59// <Enter> (FEB 23, 2006@23:59)

The active hours of operation are indicated below with a "Y"
                M12345678901N12345678901 (M=midnight, N=noon)
Active hours are: YYYYYYYYYYYYYYYYYYYYYYYY

Do you wish to change these hours? n // <Enter>   n


        F i n a l   P a r a m e t e r   C h e c k l i s t
        -------------------------------------------------
      DICOM storage provider: LOCAL PACS SIMULATOR
       Report scanning order: ASCENDING
    Earliest date for report: NOV 24, 1998
      Latest date for report: FEB 23, 2006@23:59
   Active hours of operation: M12345678901N12345678901 (M=midnight, N=noon)
                              YYYYYYYYYYYYYYYYYYYYYYYY

Ready to begin exporting DICOM images? Y

Report #   Accession      Group #      #Images                   Date
--------   ---------      -------      -------                   ----
     28 : 112498-19        318         27 images              NOV 24, 1998-
```

4.16.5.2   Batch Export of Radiology Images by Report Number

This capability is used to export a set of Radiology images by the Radiology Report number. The user establishes the initial report number and how many to export. You indicate whether the studies should be exported in ascending (chronological) or descending (reverse chronological) order. It also allows you to determine when to run the Batch Export process; e.g., only during the off-hours. This capability is useful for exporting a set of studies to a commercial PACS.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #8 (Send DICOM Images to Another Storage Server).
3. In the third menu, select #5 (Batch Export VistA Radiology Images).

This program will enter image files into a transmission queue in the DICOM IMAGE OUTPUT File (#2006.574) (stored in ^MAGDOUTP(2006.574,…)).

```
********************************************************************************
***                                                                        ***
*** V i s t A   D I C O M   I m a g e   E x p o r t e r                     ***
```

```
*** ----------------------------------------------------    ***
***                                                          ***
*** This program may be used to copy radiology images from VistA to a   ***
*** another DICOM image archive.                             ***
***                                                          ***
*** The regular "Transmit DICOM Images to a Storage SCP" menu option   ***
*** is used to copy the images to the other DICOM image archive.   ***
*** You may use Ctrl-C (^C) to stop this process, if you need to abort it.   ***
***                                                          ***
****************************************************************************
```

Scan by Date, Report Number, or Patient (D, N, or P): **NUMBER <Enter>**

All uses pose potential violations of patient privacy.

It is absolutely required that all users with transmission capability
personally inspect each downloaded image.

For technical reasons, related to the image capture process,
some of the images contain patient identification data which
must be removed manually.

Each image transmitted is tracked and audited by the Imaging System.

The images are not to be distributed outside of the VA, or used for
any other purposes than listed below.

The transmitting user is specifically responsible for the protection
of these images.

Press <Enter> to continue: **<Enter>**

Indicate the reason for transmission:

   [a] Clinical care for the patient whose images are being transmitted

   [b] Clinical care for other VA patients

   [c] Use in approved research by VA staff

   [d] Approved teaching purposes by VA staff

   [e] Use in approved VA publications

   [f] Clinical care (Export to HIPAA Compliant Archive)

Enter letter for reason: **a <Enter>**
Enter electronic signature: xxx **<Enter>**

The DICOM storage provider is "LOCAL PACS SIMULATOR".

Do you wish to change it? n // **<Enter>** n

The radiology reports will be scanned in the "ASCENDING" order.

Do you wish to change it? n // **<Enter>** n

Scanning will start with radiology report # "100".

Do you wish to change it? n // **y <Enter>**

The first radiology report is #1 (061390-3) entered on JUN 13, 1990.
The last radiology report is #201 (110403-267) entered on NOV 04, 2003.

```
Enter the new value of the radiology report #: 100 // 1 <Enter>

Radiology report #1 (061390-3) entered on JUN 13, 1990.

Is this where to begin scanning? n // y <Enter> -- changed

This run will try to export images for 10 studies.
(Studies without images will not be included in this count.)

Do you wish to change this count? n // y <Enter> n

Enter the new value of the batch size: 10 // 20 <Enter>

The active hours of operation are indicated below with a "Y"
                M12345678901N12345678901 (M=midnight, N=noon)
Active hours are: YYYYYYYYYYYYYYYYYYYYYYYY

Do you wish to change these hours? n // <Enter>  n

        F i n a l   P a r a m e t e r   C h e c k l i s t
        -----------------------------------------------
     DICOM storage provider: LOCAL PACS SIMULATOR
      Report scanning order: ASCENDING
        Starting with report: 1 (JUN 13, 1990)
Number of studies to export: 20
  Active hours of operation: M12345678901N12345678901 (M=midnight, N=noon)
                             YYYYYYYYYYYYYYYYYYYYYYYY

Ready to begin exporting DICOM images? Y <Enter>

Report #   Accession       Group #       #Images                        Date
--------   ---------       -------       -------                        ----
     1 : 061390-3
     2 : 061390-6
     3 : 061390-1
     4 : 082492-9
     5 : 082492-13
     6 : 061390-8            81          60 images              JUN 13, 1990\
```

4.16.5.3   Batch Export of Radiology Images by Selected Patient

This capability is used to export a set of Radiology images for a given Patient. The user identifies the patient and indicates whether the studies should be exported in ascending (chronological) or descending (reverse chronological) order. It is also allow the user to determine when to run the Batch Export process, perhaps only during the off-hours. This capability is most useful for exporting a set of studies to a DICOM CD Burner.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #8 (Send DICOM Images to Another Storage Server).
3. In the third menu, select #5 (Batch Export VistA Radiology Images).

This program will enter image files into a transmission queue in the DICOM IMAGE OUTPUT File (#2006.574) (stored in ^MAGDOUTP(2006.574,…)).

```
*****************************************************************************
***                                                                   ***
*** V i s t A   D I C O M   I m a g e   E x p o r t e r               ***
*** -------------------------------------------------                  ***
***                                                                   ***
*** This program may be used to copy radiology images from VistA to a  ***
*** another DICOM image archive.                                       ***
***                                                                   ***
*** The regular "Transmit DICOM Images to a Storage SCP" menu option   ***
*** is used to copy the images to the other DICOM image archive.       ***
*** You may use Ctrl-C (^C) to stop this process, if you need to abort it. ***
***                                                                   ***
*****************************************************************************



Scan by Date, Report Number, or Patient (D, N, or P): PATIENT <Enter>

All uses pose potential violations of patient privacy.

It is absolutely required that all users with transmission capability
personally inspect each downloaded image.

For technical reasons, related to the image capture process,
some of the images contain patient identification data which
must be removed manually.

Each image transmitted is tracked and audited by the Imaging System.

The images are not to be distributed outside of the VA, or used for
any other purposes than listed below.

The transmitting user is specifically responsible for the protection
of these images.

Press <Enter> to continue: <Enter>

Indicate the reason for transmission:

  [a]  Clinical care for the patient whose images are being transmitted

  [b]  Clinical care for other VA patients

  [c]  Use in approved research by VA staff

  [d]  Approved teaching purposes by VA staff

  [e]  Use in approved VA publications

  [f]  Clinical care (Export to HIPAA Compliant Archive)
```

Enter letter for reason: **A <Enter>**
Enter electronic signature: xxx **<Enter>**

The DICOM storage provider is "LOCAL PACS SIMULATOR".

Do you wish to change it? n // **<Enter>**   n

The patient is currently defined as follows:

```
    Social Sec#  Patient's Name              Birth Date
    ----------   --------------              ----------
    000-84-4831  PATIENT, B                     1929
```

Do you wish to change it? n // **Y <Enter>**

Enter Patient: MADT -- 1 MATCHES

```
    Social Sec#  Patient's Name              Birth Date
    ----------   --------------              ----------
 1) 000-50-5000  PATIENT, F                     1924
```

Patient has 7 radiology reports on file, from DEC 24, 1992 to NOV 01, 1999

Is this the correct patient? No // **Y <Enter>**

The radiology reports will be scanned in the "ASCENDING" order.

Do you wish to change it? n // **<Enter>**   n

Enter the earliest date for the report.

Earliest Report Date: DEC 24, 1992// **<Enter>**   (DEC 24, 1992)

Enter the latest date for the report.

Latest Report Date: NOV 01, 1999@23:59// **<Enter>**   (NOV 01, 1999@23:59)

The active hours of operation are indicated below with a "Y"
                M12345678901N12345678901 (M=midnight, N=noon)
Active hours are: YYYYYYYYYYYYYYYYYYYYYYYYY

Do you wish to change these hours? n // **<Enter>**   n

         F i n a l   P a r a m e t e r   C h e c k l i s t

      DICOM storage provider: LOCAL PACS SIMULATOR
       Report scanning order: ASCENDING
                Patient Name: PATIENT, F
      Social Security Number: 000-50-5000
               Date of Birth: 1924
    Earliest date for report: DEC 24, 1992
      Latest date for report: NOV 01, 1999@23:59
   Active hours of operation: M12345678901N12345678901 (M=midnight, N=noon)
                             YYYYYYYYYYYYYYYYYYYYYYYYY

Ready to begin exporting DICOM images? **Y <Enter>**

```
Report #   Accession       Group #      #Images                      Date
--------   ---------       -------      -------                      ----
    45 : 122492-31           53         1 image               DEC 24, 1992\
```

4.16.6 Display Batch Export Statistics

The history and progress of batch export transmission can be displayed.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #2 (Image Gateway).
2. In the second menu, select #8 (Send DICOM Images to Another Storage Server).
3. In the third menu, select #6 (Display Batch Export Statistics).

```
VistA DICOM Export Utility Statistics
-------------------------------------

Current Status: Export Utility has ABORTED

Active hours of operation: M12345678901N12345678901 (M=midnight, N=noon)
                           YYYYYYYYYYYYYYYYYYYYYYYYY

DICOM storage provider: EYE STORAGE SCP

*** REPORT NUMBER SCAN ORDER ***
Run    Started    A/D    First   Batch/Studies  Finished      Last       #Images
---    -------    ---    ------  ------------    --------     ------      -------
  1  10/07 08:18  D       201     10/2           10/07 08:19    200          4

*** PATIENT: PATIENT,C       000-10-3663    JUN 10,1945 ***
Run    Started    A/D  Begin Date   Stop Date    Finished    #Images
---    -------    ---  ----------   ---------    --------    -------
  2  12/14 07:42  D     11/24/98     04/01/05   12/14 08:08      987

DICOM storage provider: RADIOLOGY STORAGE SCP

*** DATE/TIME SCAN ORDER ***
Run    Started    A/D  Begin Date   Stop Date  Last Date    Finished    #Images
---    -------    ---  ----------   ---------  ---------    --------    -------
  3  02/23 14:33  A     11/24/98     02/23/06   11/24/98   (incomplete)     27

DICOM storage provider: LOCAL PACS SIMULATOR

*** DATE/TIME SCAN ORDER ***
Run    Started    A/D  Begin Date   Stop Date  Last Date    Finished    #Images
---    -------    ---  ----------   ---------  ---------    --------    -------
  4  02/23 14:35  A     11/24/98     02/23/06   11/24/98   (incomplete)     27

*** REPORT NUMBER SCAN ORDER ***
Run    Started    A/D    First   Batch/Studies  Finished      Last       #Images
---    -------    ---    ------  ------------    --------     ------      -------
  5  02/23 14:42  A        1      20/            02/23 14:42     5          60
```

```
*** PATIENT: PATIENT,B                  000-84-4831    1929 ***
Run    Started   A/D  Begin Date   Stop Date    Finished    #Images
---    -------   ---  ----------   ---------    --------    -------
  6  02/23 14:52  A    06/13/90     08/24/92   02/23 14:52
```

4.17   Display a DICOM Image Header

Occasionally, for operational reasons, you may have to display the contents of a DICOM image header.

This program displays DICOM encoded image headers in human-readable form (it is the same program as described for the DICOM Text Gateway above in Section 3.11, but with different defaults).

Use the Caché Terminal icon to start a session for this menu option.

Caché Terminal

After login, select the following menu options:

- In the first menu, select #2 (Image Gateway).
- In the second menu, select #9 (Display a DICOM Image Header).

You will be asked to enter the number of the file to display. All unprocessed image files are in the **D:\DICOM\Image_In** directory. The example below shows the formatted output of the information in the file D:\DICOM\Image_In\A000000**1**.DCM. As a shortcut, the name of this file can be entered by selecting **I** (for image) and file number **1** (to indicate the first image).

Note: An object that has been stored in VistA in DICOM format can be displayed by entering the grave accent (`) followed by the internal entry number in the Image File (#2005) (stored in ^MAG(2005)).

```
Ready to read a DICOM file?  y// y <Enter>

Enter output device ("S" for screen or "F" for file): S// <Enter> Screen

Enter the queue letter (a-h or s-z), or I for image (or '^' to exit):  I// I <Enter>

Enter file number (or path): 1 <Enter>

DUMP of DICOM file D:\DICOM\Image_In\A0000001.DCM

  O   G   E    L                    Created at 14:17 PM on 26-MAY-1999
  f   r   l    e
  f   o   e    n
  s   u   m    g
  e   p   e    t
```

```
   t        n       h     A t t r i b u t e         V a l u e
            t                 ---------------------------------
000084:0002,0000 UL 0004 Group Length              "204 (0x000000CC)"
000090:0002,0001 OB 0002 File Meta Information Ver "0 (0x00)"
                                                   "1 (0x01)"
00009E:0002,0002 UI 001A Media Storage SOP Class U "1.2.840.10008.5.1.4.1.1.1"
                                                   Computed Radiography Image Storage
0000C0:0002,0003 UI 0034 Media Storage SOP Instanc "1.3.46.670589.8.922140021400
                     ... 3.96.8.12.11.12.53.26711"
0000FC:0002,0010 UI 0012 Transfer Syntax UID       "1.2.840.10008.1.2"
                                                   Implicit VR Little Endian
000116:0002,0012 UI 0016 Implementation Class UID  "1.2.840.113754.2.1.1.0"
000134:0002,0013 SH 000E Implementation Version Na "VA DICOM V2.5"
00014A:0002,0016 AE 000A Source Application Entity "DICOM_TEST"
00015C:0008,0005 CS 000A Specific Character Set     "ISO_IR 100"
00016E:0008,0008 CS 0010 Image Type                "DERIVED"
                                                   "PRIMARY"
000186:0008,0016 UI 001A SOP Class UID             "1.2.840.10008.5.1.4.1.1.1"
                                                   Computed Radiography Image Storage
0001A8:0008,0018 UI 0034 SOP Instance UID          "1.3.46.670589.8.922140021400
                     ... 3.96.8.12.11.12.53.26711"
0001E4:0008,0020 DA 0008 Study Date                "19950928"
0001F4:0008,0021 DA 0008 Series Date               "19950928"
000204:0008,0023 DA 0008 Image Date                "19950928"
000214:0008,0030 TM 0006 Study Time                "110223"
000222:0008,0031 TM 0006 Series Time               "110223"
000230:0008,0033 TM 0006 Image Time                "110223"
00023E:0008,0050 SH 000C Accession Number          "exam number"
000252:0008,0060 CS 0002 Modality                  "CR"
00025C:0008,0070 LO 0018 Manufacturer              "Philips Medical Systems"
00027C:0008,0080 LO 0020 Institution Name          "Philips Medical Systems Hamb
                     ... urg"
0002A4:0008,0090 PN 0004 Referring Physician's Nam "ward"
0002B0:0008,1010 SH 000C Station Name              "THORAVISION"
0002C4:0008,1030 LO 0006 Study Description         "THORAX"
0002D2:0008,1040 LO 000E Institutional Department  "Our Department"
0002E8:0008,1090 LO 0024 Manufacturer's Model Name "Cassette Holder Type 9840 50
                     ... 0 70201"
000314:0010,0010 PN 0016 Patient's Name            "Pacemaker THORAVISION"
000332:0010,0020 LO 000C Patient ID                "IMAGPatient1,One"
000346:0010,0030 DA 0008 Patient's Birth Date      "19071230"
000356:0010,0040 CS 0002 Patient's Sex             "F"
000360:0010,1000 LO 0006 Other Patient IDs         "26279"
00036E:0018,0015 CS 0006 Body Part Examined        "CHEST"
00037C:0018,0060 DS 0004 KVP                       "150"
000388:0018,1000 LO 000A Device Serial Number      "92.00.003"
00039A:0018,1020 LO 000E Software Version(s)       "Version 3.3.1"
0003B0:0018,1110 DS 0004 Distance Source to Detect "1995"
0003BC:0018,1150 IS 0002 Exposure Time             "6"
0003C6:0018,1152 IS 0002 Exposure                  "1"
0003D0:0018,115E DS 0006 Image Area Dose Product   "0.800"
0003DE:0018,1160 SH 000A Filter Type               "0.1Cu 1Al"
0003F0:0018,1170 IS 0002 Generator Power           "50"
0003FA:0018,1180 SH 000A Collimator/grid Name      "Upper,1250"
00040C:0018,1190 DS 0002 Focal Spot(s)             "2"
000416:0018,1200 DA 0000 Date of Last Calibration  "<unknown>"
00041E:0018,1201 TM 0000 Time of Last Calibration  "<unknown>"
000426:0018,1260 SH 0010 Plate Type                "Sel Drum 500x500"
00043E:0018,1700 CS 000C Collimator Shape          "RECTANGULAR"
000452:0018,1702 IS 0004 Collimator Left Vertical  "-171"
00045E:0018,1704 IS 0004 Collimator Right Vertical "171"
00046A:0018,1706 IS 0004 Collimator Upper Horizont "814"
000476:0018,1708 IS 0004 Collimator Lower Horizont "1196"
```

```
000482:0018,5020 LO 002E Processing Function       "6000,17074,9962,10877,11098,
                ... 14765,18206,20536"
0004B8:0018,5021 LO 000E Postprocessing Function   "UKE_pa_020395"
0004CE:0018,5101 CS 0002 View Position             "PA"
0004D8:0018,6000 DS 0002 Sensitivity               "0"
0004E2:0020,000D UI 0024 Study Instance UID         "1.3.46.670589.8.922140021400
                ... 3.25269"
00050E:0020,000E UI 0026 Series Instance UID        "1.3.46.670589.8.922140021400
                ... 3.25269.1"
00053C:0020,0010 SH 0006 Study ID                  "25269"
00054A:0020,0011 IS 0002 Series Number             "1"
000554:0020,0013 IS 0006 Image Number              "50136"
000562:0020,0020 CS 0004 Patient Orientation       "L"
                                                   "F"
00056E:0020,4000 LT 000E Image Comments            "\\pa\Portrait"
000584:0028,0002 US 0002 Samples per Pixel         "1 (0x0001)"
00058E:0028,0004 CS 000C Photometric Interpretatio "MONOCHROME1"
0005A2:0028,0010 US 0002 Rows                       "1910 (0x0776)"
0005AC:0028,0011 US 0002 Columns                    "1716 (0x06B4)"
0005B6:0028,0030 DS 000C Pixel Spacing             "0.185"
                                                   "0.185"
0005CA:0028,0100 US 0002 Bits Allocated            "16 (0x0010)"
0005D4:0028,0101 US 0002 Bits Stored                "15 (0x000F)"
0005DE:0028,0102 US 0002 High Bit                  "14 (0x000E)"
0005E8:0028,0103 US 0002 Pixel Representation       "0 (0x0000)"
0005F2:0028,1050 DS 0006 Window Center             "15000"
000600:0028,1051 DS 0006 Window Width              "30000"
00060E:7FE0,0010 OW 05F0 Pixel Data                "<image>"
"length=6555120 (0x006405F0)"
"offset=1558 (0x0616)"

End of File D:\DICOM\Image_In\A0000001.DCM  (printed 10:53 AM  17-JUN-99)


Enter file number (or path): <Enter>

Enter the queue letter (a-h or s-z), or I for image (or '^' to exit):  I// ^ <Enter>

Push <Enter> to continue...
```

When more than a screenful of information is to be displayed, the program will pause with the prompt "more..." To terminate the display, answer this question with **^**, **No**, **Quit** or **Exit** (this response is not case-sensitive).

The following elements (highlighted in the above example) contain data that the VistA Imaging DICOM Gateway uses to properly identify and process the image:

- The Patient Name (0010,0010)
- The Patient ID (0010,0020)
- The Accession Number (0008,0050)
- The Manufacturer (0008,0070)
- The Modality (0008,0060)
- The Manufacturer's Model Name (0008,1090)
- Further image processing information (number of bits stored, numbers of rows and columns, offset value, etc.)

Many years ago, some modalities stored the Accession Number in a DICOM element other than the standard one (0008,0050). For these instruments, it was usually necessary to train the technologists to manually enter the Accession Number into this element. The VistA Imaging DICOM Gateway then uses information regarding manufacturer, model, and modality to invoke specialized MUMPS code to extract the Accession Number from the surrogate element. Generally, the Accession Number is now stored in DICOM element (0008,0050) and no additional effort like this is needed.

4.18   Re-Transmit Images from PACS

Images can be retrieved from a PACS. Normally, the system will automatically retrieve images from a PACS when an operator signals a "study complete" event. In the case that old images need to be re-transmitted from a PACS, the system can be set up to re-query the PACS for all images from a given date-range. The following menu options are available to support this process:

1   Start Querying the PACS
2   Stop Querying the PACS
3   Maintain Set-Up Parameters

4.18.1   Start Querying the PACS

To correctly query the PACS, a number of parameters need to be set up. See section 4.18.3 for the complete set of parameters. Many sites prefer to adjust two parameters for each query-session, so an opportunity is offered to change these two parameters when starting a new query session. When no parameters need to be changed, both questions can be answered by just pressing the Enter key.

```
Current conversion window is from report #39 to #47.

Scanning order is ASCENDING // <Enter> ASCENDING
Issue queries:
 1. for all studies
 2. only for studies that don't currently have images
 3. only for studies that already have images
Make selection: 1 // <Enter> 1
                 M12345678901N12345678901 (M=midnight, N=noon)
Active hours are: YYYYYYYYYYYYYYYYYYYYYYYY
              // YYYYYYYYYYYYYYYYYYYYYYYY <Enter>
```

The first question indicates the sequence in which the database is traversed. For some queries it is better to go in chronological order; for others, it is better to query in reverse-chronological order. Answer as appropriate.

The second question indicates when queries are to be issued. Depending on the nature of the query, you might want a query to be issued for all studies, or only for those studies that already have images, or just for those studies that don't have any images in the VistA system yet. Answer this question as appropriate for the query at hand.

The third question relates to the times of day when the query process is allowed to be active. For each hour where a **Y** is selected, the query process will be allowed to be active; for each hour where an **N** is selected, the query process will be de-activated. Once the process is started, it will check the time-of-day regularly, and the process will activate and de-activate itself as directed.

4.18.2   Stop Querying the PACS

Use this menu option to signal the querying process to stop.

When this menu option is used, the querying process will complete its current transaction and then exit gracefully. When "Control+C" is pressed in the window where the querying process is running, the process will stop immediately, possibly in the middle of a transaction. Pressing "Control+C" can have undesired side effects, and hence should be discouraged.

4.18.3   Maintain Set-Up Parameters

This menu option can be used to set up all parameters for a PACS query session:

```
Current conversion window is from report #39 to #47.

Scanning order is ASCENDING // <Enter> ASCENDING
Issue queries:
 1. for all studies
 2. only for studies that don't currently have images
 3. only for studies that already have images
Make selection: 1 // 1 <Enter>
                   M12345678901N12345678901 (M=midnight, N=noon)
Active hours are: YYYYYYYYYYYYYYYYYYYYYYYY
               // YYYYYYYYYYYYYYYYYYYYYYYY <Enter>

Include dashes in SSN? Yes // <Enter> Yes

Enter the start-date for the ACR-NEMA era.
                 1 January 1900// <Enter> 1 January 1900
Enter the end-date for the ACR-NEMA era.
                 25 April 1973// <Enter> 25 April 1973
Enter the start-date for the Pre-12.1 era.
                 26 April 1973// <Enter> 26 April 1973
Enter the end-date for the Pre-12.1 era.
                 31 October 1985// <Enter> 31 October 1985
Enter the start-date for the Post-12.1 era.
                 1 November 1985// <Enter> 1 November 1985
Enter the end-date for the Post-12.1 era.
                 10 February 2003// <Enter> 10 February 2003
Enter the start-date for the Fuji era.
                 1 January 1900// <Enter> 1 January 1900
Enter the end-date for the Fuji era.
                 1 January 2200// <Enter> 1 January 2200

Press <Enter> to continue...
```

Note that different PACSs may have different requirements about dashes in SSNs. Be sure to use the setting that is appropriate for the PACS to be queried.

The first two questions are the same as presented with the menu option from section 4.18.1.

The other six questions have to do with the software that may have been installed on the PACS at different periods of time. When a DICOM Gateway issues a query to the PACS, the information in the query-request must be formatted in such a way that it corresponds to the information that was stored by the PACS. The software on the PACSs might have been from one of three possible generations:

- Software from the ACR/NEMA era (at most sites, that era either never happened or ended around 1998)

- Software from the "pre level 12.1" era (as far as the Development Group knows, no VistA site ever ran that software in production, but the possibility is included as an option nevertheless)

- Software from the "post level 12.1" era (this is most likely the format for all data on most current PACS models)

- Software for the Fuji Synapse PACS models

The dates that are entered indicate the start and end of the various eras. It does not hurt to be generous with these limit-dates, and it is permissible to have overlapping date ranges. In order to prevent the DICOM Gateway from issuing any request formatted according to one era, the limit-dates for that era could be set to 1-January-1900 through 1-January-1901 (since there were no computers in those days, the software wouldn't find any data-records for such an era). Enter dates as appropriate for the site and query.

Chapter 5 Routing

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. Routing takes two forms: autorouting, and on-demand routing.

In *autorouting*, automatically selected images are transmitted to one or more destinations. Images are selected based on a predefined set of routing rules. Autorouting functions are managed using the Routing Gateway.

In *on-demand routing*, manually selected exams are transmitted to one or more destinations. Exams are selected using the VistARad diagnostic workstation and are transmitted by the Routing Gateway.

A properly implemented routing system can streamline a site's Imaging workflow. Scenarios where routing can be used include:

- Workload sharing between institutions or service providers
- Rapid access of 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

5.1 Routing Menu Options

The menu options for the Routing software are:

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 the Transmission Queue
8. Re-Queue all Failed Entries in the Transmission Queue
9. Remove Obsolete Entries from Transmission Queue
10. Display Routing Rules

The functionality of these menu options is further explained in the VistA Imaging Routing User Guide.

Chapter 6 System Maintenance

Various utility programs are available to help in the maintenance of the software on the VistA Imaging DICOM Gateway PCs. This chapter describes the various utility programs and tools.

6.1   System Maintenance Menu Options

The menu options for the System Maintenance software are:

1.   System Operation
    1.   Display MUMPS-to-MUMPS Broker Status
    2.   Display DICOM Message Log
    3.   Issue a DICOM Echo Request
    4.   Display the Version of the Software
    5.   Display Gateway Application Usage Statistics
    6.   Support Telephone Numbers
    7.   Test E-Mail Transmission
2.   Gateway Configuration and DICOM Master Files
    1.   Display Gateway Configuration Parameters
    2.   Update Gateway Configuration Parameters
    3.   Update AETITLE.DIC
    4.   Update INSTRUMENT.DIC
    5.   Update MODALITY.DIC
    6.   Update PORTLIST.DIC
    7.   Update SCU_LIST.DIC
    8.   Update WORKLIST.DIC
    9.   Reinitialize All the DICOM Master Files
    10.   Create Shortcuts for Instruments
    11.   Validate Access/Verify Codes for Modality Worklist
    12.   Display Versions and/or Time Stamps Components
3.   MUMPS Utilities
    1.   Access MUMPS Error Log
    2.   Global Variable Lister
    3.   Display MUMPS System Status
    4.   Check Available Space in MUMPS Database
    5.   Check Available Disk Space
    6.   Display License Expiration Date
4.   Enter Programmer Mode

6.2 System Operation Tools

6.2.1 Display MUMPS-to-MUMPS Broker Status

The PCs that run the VistA Imaging DICOM Gateway are connected to the main VistA Hospital Information System using a VA-proprietary protocol for calling remote procedures, commonly known as VA Kernel Broker.

One characteristic of networking in general is that connections occasionally get broken and need to be remade. All current-day protocols are resilient enough to recover automatically from these temporary lapses in connectivity. However, sometimes the lapses in connectivity may last long enough that you might notice a disruption in communication.

The VA Kernel Broker also depends on the validity of your credentials that determine which menu options are accessible to you.

This menu option may be used to determine that.

- The VistA Hospital Information System can still be reached using the configured parameters
- Your credentials are still valid on the VistA system

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #1 (System Operation).
3. In the third menu, select #1 (Display MUMPS-to-MUMPS Broker Status).

When this menu option is executed, any issues with the connectivity will be reported. A normal, successful, status will be displayed as:

```
Configured to connect using M-to-M Broker to address
"10.11.12.13", port 4300
```

6.2.2   Display DICOM Message Log

The operation of the VistA Imaging DICOM Gateway is performed by a number of separate tasks, some which run in the foreground while others run in the background. Many of these tasks produce log files that can be reviewed to observe their progress and to check for any error conditions that may have occurred.

This tool includes a real-time message display. This tool can also select which activity is displayed.

Use the Caché Terminal icon to start a session for this menu option.

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #1 (System Operation).
3. In the third menu, select #2 (Display DICOM Message Log).

You will receive a "`Historical Log or New Activity?  N//`" prompt.

6.2.2.1   New Activity

If you select the option to monitor new activity, you will be asked if you want to display all new activity or the activity for only a specific session. The following example illustrates this:

```
Show new activity in All logs or just the One log?  A// O
Display which log? (enter matching string or <null> for all) 127.0.0.1
Receiving "Echo DICOM_ECHO 127.0.0.1"
************************************************************************
***   Provider Process (Job #292) Started on AUG 06, 2002 at 08:01:13  ***
************************************************************************
*****************************************************************
***   Connection with 127.0.0.1 on AUG 06, 2002 at 08:01:13  ***
*****************************************************************

Recving PDU Type: 01H (A-ASSOCIATE-RQ) PDU len=206
d:\DICOM\DATA1\LOGDCM.292\INCOMING.PDU

*****************************************************************
***   Receiving A-ASSOCIATE-REQUEST on AUG 06, 2002 at 08:01:13  ***
*****************************************************************
PDU Type: 01H (A-ASSOCIATE-RQ)                            Length=206
Version=1   Called AE: "DICOM_STORAGE"       Calling AE: "DICOM_ECHO"
ITEM Type: 10H (Application Context Item)                 Length=21
Application Context: 1.2.840.10008.3.1.1.1  (DICOM Application Context Name)
ITEM Type: 20H (Presentation Context Item)                Length=46
Presentation Context ID: 1          Result=0
                -- Transfer Syntax(es) --
SUBITEM Type: 30H (Abstract Syntax Sub-Item)             Length=17
Presentation Context: 1.2.840.10008.1.1  (Verification SOP Class)
SUBITEM Type: 40H (Transfer Syntax Sub-Item)            Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                -- End of Transfer Syntax(es) --
```

```
ITEM Type: 50H (User Information Item)                          Length=59
SUBITEM Type: 51H (Maximum Length Sub-Item)                    Length=4
Maximum PDU length: 16384
ITEM Type: 52H (Implementation Class UID Sub-Item)             Length=30
Implementation Class: 1.2.840.113654.2.3.1995.2.10.0  (*** Unknown UID: <<1.2.84
0.113654.2.3.1995.2.10.0>> ***)
ITEM Type: 55H (Implementation Version Name)                   Length=13
Implementation Version Name: MIRCTN03AUG98
****************************************************
***   Calling: DICOM_ECHO   Called: DICOM_STORAGE   ***
****************************************************


****************************************************
***   Sending A-ASSOCIATE-ACCEPT to DICOM_ECHO   ***
****************************************************

PDU Type: 02H (A-ASSOCIATE-AC)                                Length=177
Version=1   Called AE: "DICOM_STORAGE"      Calling AE: "DICOM_ECHO"
ITEM Type: 10H (Application Context Item)                     Length=21
Application Context: 1.2.840.10008.3.1.1.1  (DICOM Application Context Name)
ITEM Type: 21H (Presentation Context Item)                    Length=25
Presentation Context ID: 1          Result=0 (acceptance)
                    -- Transfer Syntax(es) --
SUBITEM Type: 40H (Transfer Syntax Sub-Item)                  Length=17
Transfer Syntax: 1.2.840.10008.1.2  (Implicit VR Little Endian)
                    -- End of Transfer Syntax(es) --
ITEM Type: 50H (User Information Item)                         Length=51
SUBITEM Type: 51H (Maximum Length Sub-Item)                   Length=4
Maximum PDU length: 32768
ITEM Type: 52H (Implementation Class UID Sub-Item)            Length=22
Implementation Class: 1.2.840.113754.2.1.3.0  (VA DICOM V3.0)
ITEM Type: 55H (Implementation Version Name)                  Length=13
Implementation Version Name: VA DICOM V3.0

Sending PDU Type: 02H (A-ASSOCIATE-AC)  Length: 177
d:\DICOM\DATA1\LOGDCM.292\OUTGOING.PDU
Recving PDU Type: 04H (P-DATA-TF)      PDU len=74    PDV hdr=3, pc=1, len=68
d:\DICOM\DATA1\LOGDCM.292\INCOMING.DCM
Reading d:\DICOM\DATA1\LOGDCM.292\INCOMING.DCM
******************************
***  Echo Request Received  ***
******************************
FILE d:\DICOM\DATA1\LOGDCM.292\OUTGOING.DCM -- VERIFICATION ECHO RESPONSE -- NO
MESSAGE HANDLE YET

Sending PDU Type: 04H (P-DATA-TF)  Length: 90 (90)
d:\DICOM\DATA1\LOGDCM.292\OUTGOING.DCM PDU len=96     PDV hdr=3, pc=1, len=90

Recving PDU Type: 05H (A-RELEASE-RQ)   PDU len=4
d:\DICOM\DATA1\LOGDCM.292\INCOMING.PDU

Sending PDU Type: 06H (A-RELEASE-RP)  Length: 4
d:\DICOM\DATA1\LOGDCM.292\OUTGOING.PDU
```

The real-time display of the log is terminated by entering Control+C (^C) on the keyboard.

6.2.2.2 Historical Log

The historical log files may be viewed as follows:
```
Log #    Process Start & End   Description
-----    -------------------   -----------
    1    25-FEB 11:22  11:22   PACS Gateway
    2    25-FEB 11:22  11:22   User Requested DICOM Echo
    3    25-FEB 11:22  11:22   User with LOCAL MODALITY WORKLIST
    4    25-FEB 11:22  11:22   Echo VistA Testing 127.0.0.1,localhost

Enter Log Number: 4// <Enter> 4
```

```
Print the log to a File or display it on the Screen?   S// <Enter> S


*************************************************************************
***   Provider Process (Job #19) Started on FEB 25, 2000 at 11:22:10   ***
*************************************************************************
*************************************************************************
***   Connection with 127.0.0.1,localhost on FEB 25, 2000 at 11:22:10   ***
*************************************************************************

Recving PDU Type: 01H (A-ASSOCIATE-RQ) PDU len=253
D:\DICOM\Data1\LOGDCE.019\INCOMING.PDU

*********************************************************************
***   Receiving A-ASSOCIATE-REQUEST on FEB 25, 2000 at 11:22:11   ***
*********************************************************************

PDU Type: 01H (A-ASSOCIATE-RQ)                           Length=253
Version=1        Called AE: "VistA_Worklist"   Calling AE: "VistA Testing"
ITEM Type: 10H (Application Context Item)                Length=21
Application Context: 1.2.840.10008.3.1.1.1  (DICOM Application Context Name)

Press <Enter> to continue, ^ to exit...
```

The TCP/IP connection is shown above, followed by the beginning of the association session. The details of the log require a working knowledge of the DICOM Standard (PS 3.7-1999), as well as familiarization with the VistA Imaging DICOM Gateway implementation. It is more useful for support personnel.

6.2.3 Issue a DICOM Echo Request

This menu option may be used to check whether DICOM communication is possible with a known Application Entity (instrument, PACS, etc.) that is registered in the master file **SCU_List.DIC**.

Prerequisite:

- Target DICOM Validation Service Class Provider (configured to respond to VistA)

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #1 (System Operation).
3. In the third menu, select #3 (Issue a DICOM Echo Request).

The following example shows the results of a successful DIOCM Echo test:

```
Generate a DICOM ECHO request
Service Class Providers
-----------------------
 1 -- LOCAL MODALITY WORKLIST
 2 -- LOCAL IMAGE STORAGE

Select the provider application (1-2): 1// 1
Sending the PDU to the SCP
|
DICOM ECHO Completed Successfully
```

When either the TCP/IP address or the port number is incorrect, the following response and error message might be obtained:

```
Generate a DICOM ECHO request
Service Class Providers
-----------------------
 1 -- LOCAL MODALITY WORKLIST
 2 -- LOCAL IMAGE STORAGE

Select the provider application (1-2): 1// 2
*****************************************************************************
*** TCP not setup correctly                                            ***
*** Connecting to IP Address "ERRORHOST", port "60100".               ***
*** Cannot open Socket                                                 ***
*** Routine: ^MAGDTCP1                     Please Call Support Personnel ***
*****************************************************************************
```

When the target Application Entity is not set up to respond to DICOM Echo requests, the following response and error message may be encountered:

```
Generate a DICOM ECHO request
Service Class Providers
-----------------------
 1 -- LOCAL MODALITY WORKLIST
 2 -- LOCAL IMAGE STORAGE

Select the provider application (1-2): 2// 2
Sending the PDU to the SCP
|
*****************************************************************************
*** DICOM GATEWAY ERROR                                                ***
*** Unknown Presentation Context ID for 1.2.840.10008.1.1             ***
*** Routine: ^MAGDTCP2                     Please Call Support Personnel ***
*****************************************************************************
```

6.2.4   Display the Version of the Software

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #1 (System Operation).
3. In the third menu, select #4 (Display the Version of the Software).

This menu option may be used to identify the version and build numbers of the current VistA Imaging DICOM Gateway software.

```
This is "IMAGING 3.0" created on 12-February-2004.

Installed patches:
Patch 9: 31-March-2003
Patch 10: 20-November-2003
Patch 11: 12-February-2004
Patch 21: 30-October-2003

Press <Enter> to continue...
```

6.2.5   Display Gateway Application Usage Statistics

This menu option starts a program that displays the numbers of invocations of menu options at the site. It is useful for troubleshooting problems.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #1 (System Operation).
3.   In the third menu, select #5 (Display Gateway Application Usage Statistics).

```
Display Gateway Configuration Parameters
  25 Feb 2000:    1 invocation
  Total:          1
Install INSTRUMENT.DIC
  29 Feb 2000:    3 invocations
  Total:          3
```

```
Support Telephone Numbers
  25 Feb 2000:    1 invocation
  Total:          1
Display Imaging Usage Statistics
  25 Feb 2000:    2 invocations
  Total:          2
Issue DICOM Echo Request
  25 Feb 2000:    4 invocations
  Total:          4
Start Processing Text Messages from HIS
  25 Feb 2000:    3 invocations
  Total:          3
Display DICOM Message Log
  25 Feb 2000:    6 invocations
  29 Feb 2000:    5 invocations
  Total:         11

Press <Enter> to continue:
```

6.2.6   Support Telephone Numbers

If you encounter problems with the VistA Imaging DICOM Gateway Software, the National VistA Support Help Desk can be called for assistance. This option may be used to list the telephone numbers. Please tell the Help Desk personnel that this is a problem with a VistA Imaging DICOM Gateway.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #1 (System Operation).
3. In the third menu, select #6 (Support Telephone Numbers).

The following information will be output:

```
National VISTA Support Help Desk
(888) 596-HELP

DVA Washington CIO Field Office -- Imaging Project
(301) 734-0100 voice  (301) 734-0111 fax

Push <Enter> to continue...
```

6.2.7 Test E-mail Transmission

In order to verify that the Test E-mail Transmission capability is operational, it is necessary to generate a test email message. The email message will be sent to the emergency email address specified in the DICOM Gateway Configuration Parameters (menu option 4-2-2).

This menu option may be used to create a test message:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #1 (System Operation).
3. In the third menu, select #7 (Test E-mail Transmission).

The following information will be output:

```
Enter text to be included in message
>This is a test <Enter>
> <Enter>

Test message should contain the content to be generated.

OK to send: YES// <Enter>

Message will be transmitted within minutes.

Press <Enter> to continue...
```

6.3 Gateway Configuration and DICOM Master Files

This set of menu options reference the various parameters that control the VistA Imaging DICOM Gateway.

The format and content of the master files is described in a separate document (VistA Imaging DICOM Gateway Installation Guide).

Note: It is strongly recommended that rather than support separate copies of the dictionary files on each gateway system, the site maintain a single copy of the DICOM dictionary files in the **F:\DICOM\Dict** directory on a network drive, from which it can be accessed by all the systems.

Warning: Using any of the menu options in this section while VistA Imaging DICOM Gateway software is active may have unpredictable results. Before making any changes to the configuration parameters or master files, always stop all active DICOM processes by waiting until they reach an idle state, and then terminating them.

6.3.1 Display Gateway Configuration Parameters

This menu option can be used to obtain a quick overview of the parameters that define the processor-specific settings for the current computer. These parameters (stored locally in the DICOM Gateway Parameter File (#2006.563) ^MAGDICOM(2006.563)) may be changed and updated using the **Update Gateway Configuration Parameters** menu option. (see Section 6.3.2).

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #2 (Gateway Configuration and DICOM Master Files).
3. In the third menu, select #1 (Display Gateway Configuration Parameters).

The Gateway Configuration Parameters file will display. A sample file is shown below; values will vary from site to site.

```
        Gateway Configuration Parameters
        --------------------------------


             ASCII DICOM TEXT = YES
              COMMERCIAL PACS = N/A
             CONFIG DATE/TIME = 3030620.09084
                 CONSOLIDATED = NO
          CSTORE CONTROL PORT = 60000
    CURRENT IMAGE DESTINATION = <varies>
     CURRENT IMAGE FILE NAME = <varies>
       CURRENT IMAGE POINTER = <varies>
        CURRENT IMAGE SOURCE = <varies>
                 DAILY REPORT = <varies>
               DATA PATH / 1 = d:\DICOM\DATA1
               DATA PATH / 2 = d:\DICOM\DATA2
                   DICT PATH = d:\DICOM\DICT
                       DOMAIN = TESTSITE.MED.VA.GOV
           EMED_C_MOVE_DELAY = N/A
              FREE DISK SPACE = 2
                IMAGE GATEWAY = YES
            IMAGE INPUT PATH = d:\DICOM\IMAGE_IN
           IMAGE OUTPUT PATH = C:\DICOM\IMAGE_OUT
             INSTRUMENT PATH = d:\DICOM\INSTRUMENT
          LAST IMAGE POINTER = <varies>
      LAST RAD REPORT POINTER = <varies>
                    LOCATION = 660 - SALT LAKE CITY
      LOGIN PROGRAMMER ACCESS = ******
          M-to-M BROKER ADDR = 111.222.33.44
          M-to-M BROKER MSGS = NO
  M-to-M BROKER BGND ACCESS = ******
  M-to-M BROKER BGND VERIFY = ******
          M-to-M BROKER PORT = 4800
                   MACHINE ID = M
                    MAILGROUP = john.doe@med.va.gov
                  MESSAGE LOG = YES
            MODALITY WORKLIST = YES
```

```
MOVE DESTINATION AE TITLE = VISTA_STORAGE
        MULTIFRAME COUNTER = 0
        PACS EXAM COMPLETE = NO
               POST OFFICE = xxx.xxx.xxx.xxx
         ROUTING PROCESSOR = NO
             ROUTING RULES = NO
        SEND CPT MODIFIERS = YES
                   SCRATCH = C:\DOCUME~1\ADMINI~1\LOCALS~1\temp
            SEND PACS TEXT = YES
   SHOW PATIENT NAME & ID = YES
       SSN DASHES FOR PACS = NO
              SYSTEM TITLE = Silver Spring Test Gateway
              TEXT GATEWAY = YES
      TEXT GATEWAY SERVICE = RAD,CON
                  UID ROOT = 1.2.840.113754
                   VERSION = VA DICOM V3.0

Push <Enter> to continue...
```

6.3.2   Update Gateway Configuration Parameters

This section describes parameters that will be different for every Imaging DICOM Gateway. System-specific parameters deal with names of workstations, names of disks where certain groups of data are stored, whether or not certain transactions are to be processed, and so forth.

Please refer to the VistA Imaging DICOM Gateway Installation Guide for a description of these configuration parameters.

Use the Caché Terminal icon to start a session for this menu option.

Caché Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #2 (Gateway Configuration and DICOM Master Files).
3. In the third menu, select #2 (Update Gateway Configuration Parameters).

6.3.2.1   System Title

```
Please enter the system title: system title
                              xxxxxxxxx <Enter>
```

- The system title is a short character string that appears on the top of the main DICOM application menu.

- The system title may not contain caret (^) or vertical bar (|).

Examples:
> "DICOM Image Server System #3"
> "DICOM Text Gateway and Background Processor"

6.3.2.2   Location (Institution)

```
This computer is currently located at location name (location number)
Are you sure you wish to change it? NO//
```

Each VistA Imaging DICOM Gateway belongs to a location. A location is defined in the Institution File (#4). When a site does not run the consolidated version of the Imaging Software, the locations of all VistA Imaging DICOM Gateways at that site are the same as the location of the site that is defined in the Imaging Site Parameters File (#2006.1).
When a site does run the consolidated version of the Imaging Software, each VistA Imaging DICOM Gateway may have its own location. However, a VistA Imaging DICOM Gateway can only have a location that is defined as an entry in the Imaging Site Parameters.

Note: If a VistA Imaging DICOM Gateway is configured to use the MUMPS-to-MUMPS Broker, a user will be able to login only on that VistA Imaging DICOM Gateway if, in the main VistA system, that user is granted access to the "Division" that corresponds to the location of the VistA Imaging DICOM Gateway.

6.3.2.3   Drive Letter for Text Gateway Data

```
Please enter the device letter for
the DICOM text directory: x://
```

The DICOM text directory is usually on the local system, and is used to hold the DICOM text files. C:\DICOM (or D:\DICOM) is typically the DICOM text directory.
You may select another device letter (C:-Z:), however.

6.3.2.4   Drive Letter for Image Gateway Data

```
Please enter the device letter for
the DICOM image directories: x://
```

The DICOM image directories are usually on the local system and are used to hold both the input and output image files. C:\DICOM (or D:\DICOM) is typically the DICOM image directory.
You may select another device letter (C:-Z:), however.

6.3.2.5   Free Disk Space Threshold

```
Please enter the percentage of free disk space
required to allow storage of image files: free space%//
```

Storage of image files should not be allowed when there is not enough free disk space left to allow for proper processing of these files.
A typical percentage of free space to require is 15%.

6.3.2.6   Drive Letter for Master File Data

```
Enter the device letter for
the DICOM dictionary directory: x://
```

The DICOM dictionary directory is usually on a networked system, and is used to hold both the DICOM text and image files. `C:\DICOM` (or `D:\DICOM`) is typically the DICOM data directory.

Note: You may select another device letter (C:-Z:), however.

6.3.2.7   Number of Channels

```
Please enter the number of communication channels number//
```

Communication channels are used to broadcast VistA event data. A separate channel is needed for each different destination. For instance, event data may be sent to both a commercial PACS and to one or more Modality Worklist service class providers. Each destination must have its own event channel number and a dedicated subdirectory on the Text Gateway drive (`x:\DICOM\Datan\...`).

The number of communication channels must be between 1 and 9.

6.3.2.8   Machine ID

```
Please enter the machine ID: ID//
```

Each DICOM machine needs a single unique identification letter. Use "A" for the first, "B" for the second, "C" for the third, and so forth.

The names of the DICOM image files acquired by this system will begin with this letter.

6.3.2.9   Image Gateway

```
Will this computer be a DICOM Image Gateway? Yes or No//
```

- Answering "Yes" to this question will enable settings that allow this system to be used as an image gateway.
- Answering "No" means that it will not be possible to use this system as an image gateway.
- A system can be configured to be a text gateway as well as an image gateway, as well as a Routing Gateway.

6.3.2.10   Text Gateway

```
Will this computer be a DICOM Text Gateway? Yes or No//
```

- Answering "Yes" this question will enable settings that allow this system to be used as a text gateway.
- Answering "No" means that it will not be possible to use this system as a text gateway.
- A system can be configured to be a text gateway as well as an image gateway, as well as a Routing Gateway.

6.3.2.11   Routing gateway

```
Will this computer be a Routing Processor? Yes or No//
```

- Answering "Yes" to this question will enable settings that allow this system to be used as a Routing Processor.
- Answering "No" means that it will not be possible to use this system as a Routing Processor.
- Only answer "Yes" when "auto-routing" is active.
- A system can be configured to be a text gateway as well as an image gateway, as well as a Routing Gateway.

6.3.2.12   Auto Routing

```
Will this computer be part of a system
where 'autorouting' is active? Yes or No//
```

- Answering "Yes" to this question will generate queue entries for the evaluation of routing rules when images are acquired.
- Answering "No" means that no such entries will be generated.
- Only answer "Yes" when "auto-routing" is active.

Note: if a site has experimented with Routing and has completed the experiment, or when a site decides to not perform Routing activities for a while, it is important that this switch be set to "No." Failure to do so will cause a significant accumulation of entries in the Rule Evaluation Queue, while there will be no process that takes any of these entries out of this queue.

6.3.2.13   Radiology and/or Consults

```
Will this Text Gateway be used for RADIOLOGY? Yes or No//
Will this Text Gateway be used for CONSULTS? Yes or No//
```

- It is possible to configure two Text Gateways, one for RADIOLOGY and the other for CONSULTS.
- If the Gateway being configured is to be the only Text Gateway and it is going to be used for both RADIOLOGY and CONSULTS (the default configuration), answer "Yes" to both questions.
- Otherwise, answer "Yes" or "No" as appropriate for the computer at hand.

6.3.2.14   Text messages to Commercial PACS

```
Send text to a commercial PACS, Mitra Broker, et cetera? Yes or No//
```

This question will only be asked on a system that is slated to be used as a Text Gateway.

- Answering "Yes" to this question will enable settings to use this system to send text messages to external systems.
- Answering "No" means that it will not be possible to send such messages.

6.3.2.15   Exam Complete Messages

```
Is a PACS going to send Exam Complete messages to VistA? Yes or No//
```

- Answering "Yes" to this question will enable settings that allow this system to receive Exam Complete messages from a PACS to trigger image transfer.
- Answering "No" means that this system will not be prepared to receive such messages.

6.3.2.16   Commercial PACS

```
Select the kind of commercial PACS at this site
-----------------------------------------------

 1. GE Medical Systems PACS with Mitra PACS Broker
 2. GE Medical Systems PACS with ACR-NEMA Text Gateway
 3. EMED;eMed Technology Corporation PACS
 4. Other commercial PACS

What kind of a PACS? type//
```

This question will only be asked on a system that is slated to either be sending text messages to a PACS, or to be receiving Exam Complete messages from a PACS.

Select the kind of commercial PACS that is installed at the site. If the PACS is from GE Medical Systems, make sure to specify whether it uses the (new) Mitra Broker, or the (old) ACR-NEMA protocol version of the Text Gateway.

6.3.2.17 AE Title for C-MOVE

```
Enter the PACS-to-VistA C-Move destination AE Title: VISTA_STORAGE//
```

Usually, the AE Title of the VistA system for this purpose is "VISTA_STORAGE." When a PACS is sending images to multiple systems, the PACS needs to be able to distinguish among the various systems, and each system will need to use a unique name.
Enter the name that is appropriate for your site.

6.3.2.18 Modality Worklist

```
Will this system be a Modality Worklist Provider? Yes or No//
```

This question will only be asked on a system that is slated to be used as a Text Gateway.

- Answering "Yes" to this question will enable settings that allow this system to operate as a Modality Worklist Provider.
- Answering "No" means that this system will not be able to respond to Modality Worklist requests.

6.3.2.19 CPT Modifiers

```
Send CPT Modifiers? Yes or No//
```

- Answering "Yes" to this question will have the effect that when CPT codes are transmitted, modifiers will be included.
- Answering "No" means that such modifiers will be omitted.

6.3.2.20 Delay after Exam Complete

```
Delay for C-Move request after Exam Complete [min]: time//
```

This question will be asked only on a system that is slated to either be sending text messages to a PACS, or to be receiving Exam Complete messages from a PACS.

Enter a time-delay value (like 5m 30s for 5 minutes, 30 seconds) for the period that should elapse between the moment an "Exam Complete" message arrives, and the moment a C-MOVE request can be initiated.

6.3.2.21   Dashes in Social Security Numbers

```
Include DASHES in Social Security Numbers sent to PACS? Yes or No//
```

This question will be asked only on a system that is slated to send text messages to a PACS.

- Answering "Yes" to this question will have the effect that when Social Security Numbers are transmitted to PACS, dashes will be included. (This is the default: nnn-nn-nnnn.)
- Answering "No" means that this pair of dashes will be omitted.

6.3.2.22   VistA System IP Address

```
Enter the network address for the main VistA HIS: address//
```

This question will be asked only on a system that is slated to use the MUMPS-to-MUMPS Broker.

Please enter the network address for the main VistA Hospital Information System where the MUMPS-to-MUMPS Broker Listener is running. Enter it either in "*nnn.nnn.nnn.nnn*" format, or as an entry in the HOSTS file.

6.3.2.23   MUMPS-to-MUMPS Broker Listener Port Number

```
Enter the network port number for the main VistA HIS: number//
```

This question will be asked only on a system that is slated to use the MUMPS-to-MUMPS Broker.

- Please enter the port number of the MUMPS-to-MUMPS Broker Listener on the main VistA Hospital Information System.
- A TCP/IP port number is an integer between 0 and 65,535 (typically higher than 2048).
- Please note that the MUMPS-to-MUMPS Broker Listener must be running on the main VistA Hospital Information System in addition to the regular RPC Broker. Be sure to enter the port number of the MUMPS-to-MUMPS Broker Listener and not that of the traditional RPC Broker.

6.3.2.24   Email Address for Emergency Messages

```
Send emergency e-mail notices to: address//
```

The answer to this question must be the name of a mailgroup.

- Note that names of mailgroups may contain letters and digits and dashes, but no spaces.
- The name of the mailgroup and the name of the server where this group resides are separated by one at-sign (@).
  (These messages are sent by SMTP-mail, not by FORUM-mail!)
- A valid name of a mailgroup would be:
  G.MAGDBB@LAVC.ISC-WASH.VA.GOV

6.3.2.25   Display Names of Patients

```
Display Patient Name/ID in Image Processing? Yes or No//
```

- Answering "Yes" to this question will enable the normal image processing application to display the patient name and id ssn.
- Answering "No" will disable the display of the patient identification. This may be necessary to comply with HIPAA.

6.3.2.26   Access Code for Modality Worklist

When an external entity sends a Modality Worklist request to a DICOM Gateway, the DICOM Gateway is usually able to respond to the request using information that is stored on the Gateway itself. In some cases, the DICOM Gateway will need to query the VistA system for details to report back to the requester. When the DICOM Gateway makes such a request to the VistA system, it will use the access code that is specified as the answer to this question.

Note: the response to this question is treated as a password; i.e., it is not displayed on your monitor.

```
Access Code for Modality Worklist //
```

6.3.2.27   Verify Code for Modality Worklist

When an external entity sends a Modality Worklist request to a DICOM Gateway, the DICOM Gateway is usually able to respond to the request using information that is stored on the Gateway itself. In some cases, the DICOM Gateway will need to query the VistA system for details to report back to the requester. When the DICOM Gateway makes such a request to the VistA system, it will use the access code that is specified as the answer to this question.

Note: The response to this question is treated as a password; i.e., it is not displayed on your monitor.

```
Verify Code for Modality Worklist //
```

6.3.2.28   Modality Worklist Port Numbers

Modality worklist requests are usually processed through TCP/IP port number 60010. Some sites have equipment that uses a different port number, and that cannot be configured to use any other port number. In order to support such equipment, it is possible to define additional port numbers for modality worklist processors.

```
Currently, there is a Modality WorkList processor for
the following port:
        60010

Change? [A/D/N] N// ? <Enter>
Enter one of the following:
  No               if no (additional) change is to be made
  Add <number>     to add a listener for a port
  Delete <number>  to remove a listener for a port
Note that valid port numbers are integers between 1 and 65535.
Note that the listener for port 60010 may not be removed.

Currently, there is a Modality WorkList processor for
the following port:
        60010

Change? [A/D/N] N// a 104 <Enter>

Currently, there are Modality WorkList processors for
the following ports:
        104
        60010

Change? [A/D/N] N// d 104 <Enter>

Currently, there is a Modality WorkList processor for
the following port:
        60010

Change? [A/D/N] N//
```

6.3.2.29   Email Post Office

The Department of Veterans Affairs has three virus-checking post offices set up for nationwide email. The post office to select for this setting should be the one to which the site has the best network connection. Possible responses are listed below:

0: use the local VistA system (default)
1: use the Virus-Checking Office in Silver Spring, MD at 10.2.27.92
2: use the Virus-Checking Office in Hines, IL at 10.3.27.92
3: use the Virus-Checking Office in San Francisco, CA at 10.6.27.92
4: use VA-Forum at 10.2.29.131

...or enter the TCP/IP address of the system to be used.

```
Which post-office will this computer use? // smtp.va.gov <Enter>
```

Note: VA policy on the use of email post offices has changed several times while this documentation was being prepared. At the time this document was published, the only value allowed for this setting was "**smtp.va.gov**." Consult with your ISO to obtain information about current policy regarding this.

6.3.3   AE_TITLE

The AE_TITLE.SAMPLE file will be copied to the AE_TITLE.DIC file in the network dictionary file folder. The installation process does this automatically. AE_TITLE.DIC may be edited by the site.

6.3.4   Update INSTRUMENT.DIC

The list of individual instruments that are being used at a site is maintained in master file **Instrument.DIC**. This menu option loads the contents of this file into the VistA Imaging DICOM Gateway MUMPS database.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #2 (Gateway Configuration and DICOM Master Files).
3. In the third menu, select #4 (Update INSTRUMENT.DIC).

The following will be displayed to confirm the progress of the dictionary update:

```
Building the Instrument Dictionary -- ^MAGDICOM(2006.581)
Ready to read dictionary file "F:\DICOM\Dict\INSTRUMENT.DIC"?  y// y <Enter>

Comment: <<List of Image Acquisition Instruments>>
Comment: <<>>
Comment: <<Mnemonic|Description|Institution ID|Imaging Service|Port|MachineID>>
Comment: <<  Instituion ID can be the number (688), name (Washington, DC), our null.>>
Comment: <<  Leave Institution ID to null to default to the local site>>
Comment: <<  Note: the Machine ID is optional>>
Comment: <<>>
Comment: << Imaging services are defined as follows>>
Comment: <<   RAD --------- Radology>>
Comment: <<   CON --------- Consult/Procedure Request Tracking (CPRS)>>
Comment: <<>>
```

```
Comment: <<>>
Comment: << Examples:>>
Comment: <<>>
Comment: << Computed Radiography>>
CR1 -- Fuji AC3 CR, Room 2156 -- 460 -- RAD -- 60100
CR2 -- Fuji AC3 CR, Room 2160 (Chest) -- 460 -- RAD -- 60101
CR3 -- Fuji AC3 CR, Cubby, 2145 Hallway -- 460 -- RAD -- 60102
Comment: <<>>
Comment: << Computed Tomography>>
CT1 -- GE High Speed Advantage, Room 2142 -- 460 -- RAD -- 60120
Comment: <<>>
Comment: << Digital Radio Fluoro>>
DRS1 -- GE Digital Radio Fluoro, Rm 2163 -- 460 -- RAD -- 60140
DRS2 -- GE Digital Radio Fluoro, Rm 2150 -- 460 -- RAD -- 60141
Comment: <<>>
Comment: << Special Procedures>>
LCA -- GE LCA Advantex DLX, Rm 2143 -- 460 -- RAD -- 60150
Comment: <<>>
LUMISYS -- Lumisys Scanner, Rm 2122 -- 460 -- RAD -- 60190
Comment: <<>>
Comment: << Ultrasound>>
US -- ATL Ultramark9, Rm 2136 -- 460 -- RAD -- 60160
Comment: <<>>
Comment: << Nuclear Medicine>>
NM -- Siemens, Rm 2093 -- 460 -- RAD -- 60170
Comment: <<>>
Comment: << GE Windows Workstation>>
GI-FLUORO -- ASPECT -- 512 -- CON -- 60210
Comment: <<>>
ADW -- GE Advantage Workstation -- 460 -- RAD -- 60200
Comment: <<>>
Comment: << Default DICOM Port>>
DEFAULT -- Default DICOM Port -- 512 -- RAD -- 104
Comment: <<>>
Comment: <<>>
Comment: << Place your entries below>>
```

Note: In the .dic files, leading and trailing spaces are ignored when the data is imported into the database. This makes it possible to align information for easier reading.

6.3.5 Update MODALITY.DIC

Image processing is controlled by fields in the **Modality.DIC** master file. This menu option loads the contents of this file into the VistA Imaging DICOM Gateway MUMPS database.

Use the Caché Terminal icon to start a session for this menu option.

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #2 (Gateway Configuration and DICOM Master Files).

3. In the third menu, select #5 (Update MODALITY.DIC).

The following will be displayed to confirm the progress of the dictionary update:

```
Building the Modality Type Dictionary -- ^MAGDICOM(2006.582)
Ready to read dictionary file "F:\DICOM\Dict\MODALITY.DIC"?  y// y <Enter>

Comment: << List of different typs of modality image acquisition instruments>>
Comment: <<>>
Comment: << mfgr | model | modality | mag_dcmtotga.exe parameters | case# lookup code
Comment: << | data extraction code|data extraction file|imaging service>>
Comment: <<>>
Comment: << Note: for Healthcare Providers, use the following two values: >>
Comment: <<   demtotga.exe parameters should be "<DICOM>">>
Comment: <<   Case# lookup code should be "CORRECT^MAGDIR3">>
Comment: <<>>
Comment: << Imaging services are defined as follows>>
Comment: <<    RAD --------- Radology>>
Comment: <<    CON -------- Consult/Procedure Request Tracking (CPRS)>>
Comment: <<
Comment: << Examples:>>
Comment: <<>>
ACMECTCOMPANY -- BETA -- CT -- b12 f0
                      GECT^MAGDIR3 -- GECT^MAGDIR4A -- datagect.dic
GEMEDICALSYSTEMS -- GENESIS_JUPITER -- CT -- b12 f0
                      GECT^MAGDIR3 -- GECT^MAGDIR4A -- datagect.dic
GEMEDICALSYSTEMS -- GENESIS_HISPEED_RP -- CT -- b12 f0
                      GECTHISA^MAGDIR3 -- GECT^MAGDIR4A -- datagect.dic
GEMEDICALSYSTEMS -- HISPEEDRP -- CT -- b12 f0
                      GECTHISA^MAGDIR3 -- GECT^MAGDIR4A -- datagect.dic
GEMEDICALSYSTEMS -- GENESIS_SIGNA -- MR -- b12 f0
                      LONGCASE^MAGDIR3 -- GECT^MAGDIR4A -- datagect.dic
GEMEDICALSYSTEMS -- DRS -- RF -- b8
                      GEDRS^MAGDIR3 -- GELCA^MAGDIR4A -- datamisc.dic
GEMEDICALSYSTEMS -- DLX -- XA -- b10
                      STUDYID^MAGDIR3 -- GELCA^MAGDIR4A -- datamisc.dic
PICKERINTERNATIONAL,INC. -- PQ2000 -- CT -- b12 a1000 f0 c4095
                      PQ2000^MAGDIR3 -- PICKERCT^MAGDIR4A -- datagect.dic
PICKERINTERNATIONAL,INC. -- PQ2000 -- SC -- b12 a1000 f0 c4095
                      PQ2000^MAGDIR3 -- PICKERCT^MAGDIR4A -- datagect.dic
DEJARNETTERESEARCHSYSTEMS -- IMAGESHAREFUJICRACQUISITIONSTATION -- CR -- b10 f0
c1023 R8/b10 f0 c1023
                      LONGCASE^MAGDIR3 --  -- datamisc.dic
LUMISYS -- * -- CR -- b12 f0 c4095 R8
                      LONGCASE^MAGDIR3 --  -- datamisc.dic
LUMISYS -- * -- SC -- b12 f0 c4095 R8
                      LONGCASE^MAGDIR3 --  -- datamisc.dic
LUMISYS -- * -- RAD -- b12 f0 c4095 R8
                      LONGCASE^MAGDIR3 --  -- datamisc.dic
ASPECTELECTRONICS,INC. -- ACCESSACQUISITIONMODULE -- US -- b8
                      PIDCASE^MAGDIR3 --  -- datamisc.dic
TOPCON -- NW6S -- XC -- <DICOM>
                      CORRECT^MAGDIR3 -- datamisc.dic -- CON
#
Comment: <<>>
Comment: << Place your entries below>>
Comment: << end of file>>

Ready to build the "Data Transfer" Dictionaries?  y// y <Enter>
F:\DICOM\Dict\DataGECT.DIC
F:\DICOM\Dict\DataMISC.DIC
```

Note: In the .dic files, leading and trailing spaces are ignored when the data is imported into the database. This makes it possible to align information for easier reading.

6.3.6   Update PORTLIST.DIC

Note: This dictionary is needed only if your site is interfacing to a commercial PACS or a commercial Modality Worklist Broker (i.e., a Mitra Broker or a DeJarnette MediShare).

The list of VistA Server TCP/IP port numbers is maintained in master file **PortList.DIC**. This menu option loads the contents of this file into the VistA Imaging DICOM Gateway MUMPS database.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #2 (Gateway Configuration and DICOM Master Files).
3. In the third menu, select #6 (Update PORTLIST.DIC).

The following will be displayed to confirm the progress of the dictionary update:

```
Building the TCP/IP Provider Port Dictionary -- ^MAGDICOM(2006.584)
Ready to read dictionary file "F:\DICOM\Dict\PORTLIST.DIC"?  y// y <Enter>

Comment: <<Menu Option|AE Title|Port|File Mode (FIFO QUEUE or DIRECT)|CHANNEL>>
PACS INTERFACE -- VISTA PACS I/F -- 60040 -- FIFO QUEUE -- 1
Comment: <<MITRA Broker Interface|VistA PACS I/F|60041|FIFO QUEUE|2>>
Comment: <<DeJarnette Medishare Interface|VistA PACS I/F|60042|FIFO QUEUE|2>>
Comment: <<Perry Point CR (a)|PP_CR_A|60043|DIRECT|1>>
Comment: <<Perry Point CR (b)|PP_CR_B|60044|DIRECT|1>>
```

Note: In the .dic files, leading and trailing spaces are ignored when the data is imported into the database. This makes it possible to align information for easier reading.

6.3.7   Update SCU_LIST.DIC

This menu option loads the contents of the **SCU_List.DIC** .file into the VistA Imaging DICOM Gateway MUMPS database (#2006.585), and into the DICOM TRANSMIT DESTINATION File (#2006.587) in the VistA System.

Chapter 6 – System Maintenance

Use the Caché Terminal icon to start a session for this menu option.

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #2 (Gateway Configuration and DICOM Master Files).
3. In the third menu, select #7 (Update SCU_LIST.DIC).

The following will be displayed to confirm the progress of the dictionary update:

```
Building the User Application Dictionary -- ^MAGDICOM(2006.585)
Ready to read dictionary file "F:\DICOM\Dict\SCU_LIST.DIC"?  y// y <Enter>

Comment: << User Application List>>
Comment: << Format:>>
Comment: << line 1:Application Name|Called AE Title|Calling AE Title|Destination
 IP Address|Socket>>
Comment: << line 2:|Presentation Context Name|Transfer Syntax Name>>
Comment: << line 3:||Transfer Syntax Name (if there are more than one)>>
Comment: <<>>
Comment: << Examples:>>
Comment: <<>>
Comment: << EMED Query/Retrieve|EMED_SCP_LAND|VISTA_QR_SCU|111.222.333.172|104>>
Comment: << |Verification SOP Class|Implicit VR Little Endian>>
Comment: << |Study Root Query/Retrieve Information Model - MOVE|Implicit VR Litt
le Endian>>
Comment: <<>>
Comment: << GEMS PACS Query/Retrieve|QueryRetrieve|VISTA_QR_SCU|111.222.333.73|1
04>>
Comment: << |Verification SOP Class|Implicit VR Little Endian>>
Comment: << |Study Root Query/Retrieve Information Model - FIND|Implicit VR Litt
le Endian>>
Comment: << |Study Root Query/Retrieve Information Model - MOVE|Implicit VR Litt
le Endian>>
Comment: <<>>
Comment: << MITRA Modality Worklist|Testing|SCANNER1|TEST_NT1|60010>>
Comment: << |Verification SOP Class|Implicit VR Little Endian>>
Comment: << |Modality Worklist Information Model - FIND|Implicit VR Little Endia
n>>
Comment: <<>>
Comment: << DeJarnette Lasershare|Lasershare|VistA Send Image|127.0.0.1|60100>>
Comment: << |CT Image Storage|Implicit VR Little Endian>>
Comment: <<>>
Comment: <<>>
LOCAL MODALITY WORKLIST^VistA_Worklist^VistA Testing^LOCALHOST^60010
     Verification SOP Class
          Implicit VR Little Endian
     Modality Worklist Information Model - FIND
          Implicit VR Little Endian
Comment: <<>>
LOCAL IMAGE STORAGE^VistA_Storage^VistA Testing^LOCALHOST^60100
     CT Image Storage
          Implicit VR Little Endian
Comment: <<>>
```

```
Comment: << Place your entries below>>
Comment: << end of file>>
```

For detailed information about adding entries to this file, refer to the *DICOM Imaging Installation Guide*.

6.3.8   Update WORKLIST.DIC

Note: This dictionary must contain an entry for every device that is going to use the DICOM Modality Worklist service.

The list of descriptions of instruments that use DICOM Modality Worklist at each site is maintained in master file **WorkList.DIC**. This menu option loads the contents of this file into the VistA Imaging DICOM Gateway MUMPS database.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #2 (Gateway Configuration and DICOM Master Files).
3. In the third menu, select #8 (Update WORKLIST.DIC).

The following will be displayed to confirm the progress of the dictionary update:

```
Building the Modality Worklist Dictionary -- ^MAGDICOM(2006.583)
Ready to read dictionary file "F:\DICOM\Dict\WORKLIST.DIC"?  y// y <Enter>

Comment: << List of Modality Worklist service users>>
Comment: <<>>
Comment: <<  Station AE Title|Institution ID|Imaging Service|Imaging Type>>
Comment:<<           |Short or Long Accession Number|Description>>
Comment: <<  Instituion ID can be the number (688), name (Washington, DC), or null.>>
Comment: <<  Leave Institution ID to null to default to the local site >>
Comment: <<  Imaging Types are from IMAGE INDEX FOR SPECIALTY / SUBSPECIALTY>>
Comment: <<>>
Comment: <<  Imaging services are defined as follows>>
Comment: <<    RAD --------- Radology>>
Comment: <<    CON --------- Consult/Procedure Request Tracking (CPRS)>>
Comment: <<>>
Comment: <<>>
Comment: << Examples:>>
Comment: <<>>
Comment: << IM_CR|BALTIMORE, MD|RAD|RAD|SHORT>>
Comment: << MS_FCRIDGW|BALTIMORE, MD|RAD|RAD|SHORT>>
Comment: << SCANNER1|BALTIMORE, MD|RAD|RAD|LONG>>
Comment: << LUMISYS|BALTIMORE, MD|RAD|RAD|LONG>>
Comment: << ALI_SCU|BALTIMORE, MD|RAD|RAD|LONG>>
```

```
Comment: << PICKER_KRUSTY|BALTIMORE, MD|RAD|RAD|LONG>>
Comment: << PCU_QWL_SCU|BALTIMORE, MD|RAD|RAD|LONG>>
Comment: << PICKER_NM_MW|BALTIMORE, MD|RAD|RAD|LONG>>
Comment: << ALIPC_QWL_SCU|BALTIMORE, MD|RAD|RAD|LONG>>
Comment: << IMCR_1|BALTIMORE, MD|RAD|RAD|LONG>>
Comment: <<>>
Comment: << Healthcre Providers>>
Comment: << IRIS-1||CON|OPHTH|LONG|Canon Retinal Camera, Eye Clinic, Rm, E-170>>
Comment: << DENIX-2||CON|DENTAL|LONG|Intra-Oral Xray Unit, Rm, D-153>>
Comment: << GI_LAB_SCU|<Your Institution goes here>|CON|GI|LONG|North Clinic>>
Comment: << IRIS-1||CON|OPHTH|LONG|Canon Retinal Camera, Eye Clinic, Rm, E-170>>
Comment: << DENIX-2||CON|DENTAL|LONG|Intra-Oral Xray Unit, Rm, D-153>>
Comment: << GI_LAB_SCU|<Your Institution goes here>|CON|GI|LONG|North Clinic>>
Comment: <<>>
Comment: << Test AE title is for exercising the local VISTA MWL provider>>
TEST -- 523 -- RAD -- RAD -- LOG
Comment: <<>>
Comment: << Place your entries below>>
```

Note: In the .dic files, leading and trailing spaces are ignored when the data is imported into the database. This makes it possible to align information for easier reading.

6.3.9 Reinitialize All the DICOM Master Files

In addition to the site-specific master files, there are a number of master files that contain static information that is needed by the VistA Imaging DICOM Gateways. Examples of such files are the list of DICOM elements, the list of supported SOP classes, and the list of recognized HL7 messages.

When this menu option is started, the contents of all master files, the static ones as well as the site-specific ones, will be re-loaded into the VistA Imaging DICOM Gateway.
This menu option should be run whenever you need to apply an update to the static master file dictionaries.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #2 (Gateway Configuration and DICOM Master Files).
3. In the third menu, select #9 (Reinitialize All the DICOM Master Files).

```
Ready to build all of the DICOM Master Files?  y// <Enter> yes


This system's title is "Timbuktu DICOM Gateway"
Do you wish to change it?  n// <Enter> no -- not changed

Please enter the device letter for the DICOM text directory: d:// <Enter> d
```

```
Please enter the device letter for the DICOM image directories: d:// <Enter> d
Enter the device letter for the DICOM dictionary directory: d:// <Enter> d

Please enter the number of communication channels  2// <Enter> 2

Please enter the machine id:  A// <Enter> A

Output ASCII *.TXT files for all DICOM messages?  YES// <Enter> YES

Will this system be a DICOM Image Gateway?  YES// <Enter> YES

Will this system be a DICOM Text Gateway?  YES// <Enter> YES

Will this computer be a Routing Processor? NO// <Enter> NO

Will this computer be part of a system
where 'autorouting' is active? NO// <Enter> NO

Will this Text Gateway be used for RADIOLOGY? YES// <Enter> YES

Will this Text Gateway be used for CONSULTS? YES// <Enter> YES

Send text to a commercial PACS, Mitra Broker, etc.?  YES// <Enter> YES

Is a PACS going to send Exam Complete messages to VistA?  NO// <Enter> NO

Will this system be a Modality Worklist Provider?  YES// <Enter> YES

Keep a detailed log of every message?  YES// <Enter> YES

Send CPT Modifiers? NO// <Enter> NO

Include DASHES in Social Security Numbers sent to PACS? NO// <Enter> NO

Use M-to-M Broker? NO// <Enter> NO

Send emergency e-mail notices to: john.doe@va.gov// <Enter> john.doe@va.gov

Display Patient Name/ID in Image Processing? YES// <Enter> YES


Building the DICOM Element Dictionary -- ^MAGDICOM(2006.51)
Ready to read dictionary file "F:\DICOM\Dict\ELEMENT.DIC"?  y// <Enter> y


Building the DICOM Message Template Dictionary -- ^MAGDICOM(2006.52)
Ready to read dictionary file "F:\DICOM\Dict\TEMPLATE.DIC"?  y// <Enter> y

*** PASS 1 STARTED ***
*** PASS 2 STARTED ***
- DONE -


Building the DICOM UID Dictionary -- ^MAGDICOM(2006.53)
Ready to read dictionary file "F:\DICOM\Dict\UID.DIC"?  y// <Enter> y


Updating the extended SOP negotiation table... done!

Updating the PDU TYPE table... done!
```

```
Updating the Imaging Service table...
done!

Building the ^DICOM(HL7) dictionary
Ready to read dictionary file "F:\DICOM\Dict\HL7.dic"?  y// <Enter> y

done!


Building the Instrument Dictionary -- ^MAGDICOM(2006.581)
Ready to read dictionary file "F:\DICOM\Dict\INSTRUMENT.DIC"?  y// <Enter> y


Building the Modality Type Dictionary -- ^MAGDICOM(2006.582)
Ready to read dictionary file "F:\DICOM\Dict\MODALITY.DIC"?  y// <Enter> y


Building the Modality Worklist Dictionary -- ^MAGDICOM(2006.583)
Ready to read dictionary file "F:\DICOM\Dict\WORKLIST.DIC"?  y// <Enter> y


Building the TCP/IP Provider Port Dictionary -- ^MAGDICOM(2006.584)
Ready to read dictionary file "F:\DICOM\Dict\PORTLIST.DIC"?  y// <Enter> y


Building the User Application Dictionary -- ^MAGDICOM(2006.585)
Ready to read dictionary file "F:\DICOM\Dict\SCU_LIST.DIC"?  y// <Enter> y


Building the Provider Application Dictionary -- ^MAGDICOM(2006.586)
Ready to read dictionary file "F:\DICOM\Dict\SCP_LIST.DIC"?  y// <Enter> y


Ready to build the "Data Transfer" Dictionaries?  y// <Enter> y



-- DICOM Master File Build completed successfully --
```

6.3.10   Create Shortcuts for Instruments

Whenever the INSTRUMENT.DIC is modified, you can automatically create the shortcuts for the instruments in the Instrument folder on the desktop. This will create shortcuts with the mnemonic names that are used to internally identify the instruments. Alternatively, you can manually copy an existing shortcut to create new ones, and then edit them.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).

2. In the second menu, select #2 (Gateway Configuration and DICOM Master Files).
3. In the third menu, select #10 (Create Shortcuts for Instruments).

The creation of the instrument shortcuts is performed silently, and there is no output. After it is completed, you are given the opportunity to edit the `hosts` file that maps symbolic names onto physical IP addresses, usually stored in the directory:

```
c:\winnt\system32\drivers\etc
```

See the *VistA Imaging Installation Guide* for more details.

6.3.11   Validate Access/Verify Codes for Modality Worklist

When an external entity sends a Modality Worklist request to a DICOM Gateway, the DICOM Gateway is usually able to respond to the request using information that is stored on the Gateway itself. In some cases, the DICOM Gateway will need to query the VistA system for details to report back to the requester. When the DICOM Gateway makes such a request to the VistA system, it will use the access and verify codes that were set up using menu option 4-2-2, Update Gateway Configuration Parameters. Since credentials may be changed on the VistA system, there is a need to check temporarily whether the stored credentials are still valid. This menu option is provided to perform such checks.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1.   In the first menu, select #4 (System Maintenance).
2.   In the second menu, select #2 (Gateway Configuration and DICOM Master Files).
3.   In the third menu, select #11 (Validate Access/Verify Codes for Modality Worklist).

When this menu option is executed, it will report either:

```
Access and Verify codes are valid for background task usage.
```

or

```
Access and Verify codes are NOT valid for background task usage.
```

6.3.12   Display Versions and/or Time Stamps of Components

This menu option is used to display path and date information about dictionary and executable files used by the local gateway. This option also uploads the path and date information for these files into the VistA system.

The database on the VistA system can then be queried through Remote Procedure Calls by non-M[UMPS] applications to obtain information about these components.
Use the Caché Terminal icon to start a session for this menu option.

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #2 (Gateway Configuration and DICOM Master Files).
3. In the third menu, select #12 (Display Versions and/or Time Stamps of Components).

When this menu option is executed, it will display a report like:

```
            Host Name = isw-test
             Location = 660
    Instrument (path) = C:\DICOM\DICT\INSTRUMENT.dic
   Instrument (stamp) = 23-JUN-2003 17:20:00
      Modality (path) = C:\DICOM\DICT\MODALITY.dic
     Modality (stamp) = 23-JUN-2003 17:19:00
     Port List (path) = C:\DICOM\DICT\PORTLIST.dic
    Port List (stamp) = 22-JUN-1999 13:56:00
      SCU List (path) = C:\DICOM\DICT\SCU_LIST.dic
     SCU List (stamp) = 9-MAR-2001 11:22:00
      WorkList (path) = C:\DICOM\DICT\WORKLIST.dic
     WorkList (stamp) = 23-JUN-2003 17:46:00
 CT Parameters (path) = C:\DICOM\DICT\CT_PARAM.dic
CT Parameters (stamp) = 28-MAY-2008 20:44:00
              Version =
;;3.0;IMAGING;**1,7,9,26,21,10,36,3,11,30,5,51,50,52,69,75,66**;28-May-2008;;Build
1252
   DICOM Viewer (path) = C:\Program Files\VistA\Imaging\DCMView\MAG_DCMVIEW.exe
  DICOM Viewer (stamp) = 13-APR-2004 01:37:00
        C-Store (path) = C:\Program Files\VistA\Imaging\DICOM\MAG_CSTORE.exe
       C-Store (stamp) = 28-MAY-2008 20:44:00
  Reconstructor (path) = C:\Program Files\VistA\Imaging\DICOM\MAG_RECON.exe
 Reconstructor (stamp) = 28-MAY-2008 20:44:00
 DICOM to Targa (path) = C:\Program Files\VistA\Imaging\DICOM\MAG_DCMTOTGA.exe
DICOM to Targa (stamp) = 28-MAY-2008 20:44:00
```

6.3.13   Site-Specific Parameters

In addition to the parameters that are different for each gateway processor, there are also parameters that are site-specific. These parameters are in the Imaging Site Parameters File

(#2006.1) (stored in `^MAG(2006.1,…)`). The site-specific parameters that apply to the VistA Imaging DICOM Gateways are described below. Please refer to the VistA Imaging Installation Guide for additional information.

6.3.13.1   Purge Retention Days PACS File

This field is used by the Background Processor purge to determine the number of days to retain DICOM image files. All DICOM images that have not been accessed in this many days will be removed from magnetic storage by automatic file migration procedures.
A typical value for this parameter is **120** days (roughly 4 months).

6.3.13.2   Percentage Free Space DICOM Messages

The value of this field is the minimum percentage of free space for a DICOM Text Gateway.
A typical value for this parameter is **25** percent.

The menu option "Start Processing Text Messages from HIS" automatically checks the value of this site parameter at every iteration, before it attempts to store any additional data is stored. If the amount of free space is less than this threshold, a purge will be executed automatically (There will be a momentary delay in processing while the purge runs).

6.3.13.3   Retention Days DICOM Messages

The value of this parameter is the number of days that old processed DICOM messages are to be retained. The subroutine that purges old DICOM messages will only remove messages that are older than this number of days.

A typical value for this parameter is **25** days.

6.3.13.4   Purge Retention Days PACS Big File

This field is used by the Background Processor purge function to determine the number of days to retain "Big" DICOM files. All "Big" DICOM images that have not been accessed in this many days will be removed from magnetic storage by the Background Processor purge function.
A typical value for this parameter is **90** days (roughly 3 months).

6.3.13.5   PACS Interface Switch

The value of this field is set to **1** if there is a VistA DICOM Image Gateway. Otherwise, this value is either empty or **0**.

When this switch is turned off, the site parameters PURGE-RETENTION DAYS PACS FILE, PCT FREE SPACE DICOM MSGS and PURGE-RETEN DAYS PACS BIG FILE will be ignored by the VistA Imaging DICOM Gateway software.

6.3.13.6   PACS Image Write Location

The value of this parameter is a pointer to the Network Location File (#2005.2) (stored in `^MAGD(2005.2,…)`). This value indicates the drive to which images are currently being written. DICOM images are copied to the network location specified by this field.

6.4   MUMPS Utilities

6.4.1   Access MUMPS Error Log

To help diagnose problems with the VistA Imaging DICOM Gateway software, it is necessary to determine if there was a MUMPS error in the application.

When a MUMPS error occurs in the VistA Imaging DICOM Gateway software, an entry is made in an error log file. Information is recorded about the nature of the error, the date and time the error occurred, and the internal status of the application when the error occurred.

This error log may be accessed and maintained using this menu option. (This utility can also be invoked by typing **D ^%ER** at the command line in programmer mode.) Please report all significant errors to the National Help Desk.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #3 (MUMPS Utilities).
3. In the third menu, select #1 (Access MUMPS Error Log).

The output typically will look like the following:

```
For Date: T <Enter> 30 Dec 2005   1 Error

Error: 1 <Enter>

 1. <SUBSCRIPT>SHIELD+19^MAGDMFB  at  8:23 am.   $I=|TRM|:|2540   ($X=0  $Y=242)
     $J=2540  $ZA=2   $ZB=   $ZS=16384 ($S=16634272)
             E   S D1=0 F  S D1=$O(^MAGDMLOG(D0,1,D1)) Q:'D0  W
$G(^MAGDMLOG(D0,1,D1,0)),!

Variable: D0 <Enter> (copying data ... done)
(base stack level = 3)
         D0        =      16

Variable: <Enter>

Error: <Enter>

For Date: <Enter>
```

6.4.2   Global Variable Lister

This menu option can be used to view the values of entries in databases through the general-purpose "Global Variable Lister" program. (This utility can also be invoked by typing **D ^%G** at the command line in programmer mode.)

This utility program is mainly intended to support diagnostic activities.

DO NOT CHANGE ENTRIES IN ANY GLOBAL FILE.

The Food and Drug Administration classifies the VistA Imaging DICOM Gateway as a medical device. As such, it may not be changed in any way. Modifications to the software or database may result in an adulterated medical device under 21CFR820, the use of which is considered to be a violation of US Federal Statutes.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #3 (MUMPS Utilities).
3. In the third menu, select #2 (Global Variable Lister).

The output typically will look like the following:

```
Local or Remote? LOCAL// ? <Enter>

Enter 'Local' for global variables that reside on the
DICOM Gateway or 'Remote' for global variables that reside
on the VistA system.

Note: you can only view global variables on a VistA system
if you have the security key MAG SYSTEM on that system.

Local or Remote? LOCAL// LOCAL  <Enter>

Global ^MAGDICOM(2006.563 <Enter>
^MAGDICOM(2006.563,0)=DICOM GATEWAY PARAMETER^2006.563^1^1
^MAGDICOM(2006.563,1,"ASCII DICOM TEXT")=YES
                   "COMMERCIAL PACS")=N/A
                   "CONFIG DATE/TIME")=3051229.092311
                        "CONSOLIDATED")=NO
                "CSTORE CONTROL PORT")=60000
           "CURRENT IMAGE DESTINATION")=c:\mag1h\DM00\00\00\00\88\
^MAGDICOM(2006.563,1,"DATA PATH",0)=^2006.5631^2^2
^MAGDICOM(2006.563,1,"DATA PATH",1,0)=C:\DICOM\DATA1
^MAGDICOM(2006.563,1,"DATA PATH",2,0)=C:\DICOM\DATA2
^MAGDICOM(2006.563,1,"DICT PATH")=C:\DICOM\DICT
                      "DOMAIN")=IMGDEM01.MED.VA.GOV
```

```
                 "EMED_C_MOVE_DELAY")=0
                  "FREE DISK SPACE")=15
                    "IMAGE GATEWAY")=YES
                "IMAGE INPUT PATH")=C:\DICOM\IMAGE_IN
              "IMAGE OUTPUT PATH")=C:\DICOM\IMAGE_OUT
                "INSTRUMENT PATH")=C:\DICOM\INSTRUMENT
                        "LOCATION")=660
                   "LOCATION NAME")=SALT LAKE CITY
         "LOGIN PROGRAMMER ACCESS")=5007061268
              "M-to-M BROKER ADDR")=127.0.0.1
        "M-to-M BROKER BGND ACCESS")=***********
        "M-to-M BROKER BGND VERIFY")=***********
              "M-to-M BROKER PORT")=4300
                      "MACHINE ID")=C
                       "MAILGROUP")=user.one@med.va.gov
                     "MESSAGE LOG")=YES
                "MODALITY WORKLIST")=YES
^MAGDICOM(2006.563,1,"MOVE DESTINATION AE TITLE")=VISTA_STORAGE
              "PACS EXAM COMPLETE")=NO
                     "POST OFFICE")=10.2.27.92
^MAGDICOM(2006.563,1,"ROUTING PROCESSOR")=YES
                   "ROUTING RULES")=YES
^MAGDICOM(2006.563,1,"SCRATCH")=C:\DOCUME~1\ADMINI~1\LOCALS~1\temp
                "SEND CPT MODIFIERS")=NO
                    "SEND PACS TEXT")=NO
              "SHOW PATIENT NAME & ID")=NO
                "SSN DASHES FOR PACS")=NO
                      "SYSTEM TITLE")=Ed's Cache Test Gateway
                      "TEXT GATEWAY")=YES
              "TEXT GATEWAY SERVICE")=RAD,CON
                        "UID ROOT")=1.2.840.113754
                         "VERSION")=VA DICOM V3.0
                    "WORKLIST PORT")=60010
^MAGDICOM(2006.563,1,"WORKLIST PORT",0)=^2006.5632^1^1

Global ^ <Enter>
```

6.4.3   Display MUMPS System Status

This menu option displays the status of all active MUMPS processes (user tasks as well as system tasks).

Normally, a system status can be obtained by right-clicking the Caché Cube and then selecting **Control Panel**. In the Control Panel, select the option labeled **Processes**. When accessing a Caché system remotely, a system status can also be invoked from the DICOM Gateway menu.

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #3 (MUMPS Utilities).

3. In the third menu, select #3 (Display MUMPS System Status).

This menu option displays the status of all active MUMPS processes (user tasks as well as system tasks). (This utility can also be invoked by typing **D ^%SS** at the command line in programmer mode.)

The output typically will look like the following:

```
                    Cache System Status: 10:00 am 03 Jan 2006

Process  Devices       KB Namespace       Routine      CPU,Glob   Pri  UIC   Location
  1480                    %SYS                             0,0       7   0,0   CONTROL
  1760                    %SYS                            41,310     8   0,0   WRTDMN
  1776                    %SYS                             0,0       7   0,0   GARCOL
  1784                    %SYS                           511,8       7   0,0   JRNDMN
  1792                    %SYS                             0,0       7   0,0   EXPDMN
   356   //./nul       64 %SYS            TASKMGR       4438,853     7   0,0
  2032   //./nul       43 %SYS            CLNDMN          33,10      7   0,0
  2044   //./nul       60 ^^c:\cachesys\mgr\
                                          MONITOR        1041,33     7   0,0
         c:\cachesys\mgr\cconsole.log
   164   //./nul       49 %SYS            LMFMON        4564,23      7   0,0   LMFMON
   216   |TCP|60000    57 DICOM           MAGDCST2      1505,228     7   0,0
  2484   |TCP|60000    57 DICOM           MAGDCST2      1517,227     7   0,0
  2596   |TCP|60000    57 DICOM           MAGDCST2      1526,232     7   0,0
  2300*  |TRM|:|2300  101 DICOM           MAGDBB     4742155,256187  7   0,0
         |TCP|4300
   212   |TCP|1972     45 %SYS            %cmtP           52,14      7   0,0
   340   |TCP|60000    48 DICOM           ZSTU            70,12      7   0,0
         c:\dicom\cache\cstore.out
  3008   |TCP|1972     68 %SYS            %CDSrv0       6228,266     7   0,0
  3228*  -            120 DICOM           MAGDDR2A   1154656,50656   7   0,0
         t:\dicom\data1\w00000\w0000001.xxx
         t:\dicom\data1\w00000\w0000001.dcm
         |TCP|4300
         |TRM|:|3228
  2452*  -             84 DICOM           MAGDCST4    148046,1563    7   0,0
         |TNT|localhost:1086|2452
         |TCP|4300
  3308*  |TRM|:|3308   68 DICOM           %SS           1920,30      7   0,0
  3444   |TCP|60010    48 DICOM           ZSTU            49,12      7   0,0
         c:\dicom\cache\worklist_60010.out
  3092*  |TCP|60040    96 DICOM           MAGDTCP3    161015,1997    7   0,0
         |TNT|localhost:1104|3092

12 user, 10 system, 16 mb global/8 mb routine cache
```

The information displayed by this option is as follows:

Column Heading	Description
Process	The job number of the task.
Devices	The devices that are being used by the process, typically an internal number that identifies a terminal, and the TCP/IP address and port-number when the terminal in question represents a telnet session.
KB	The current amount of memory being used.

Column Heading	Description
Namespace	The name of the environment in which the jobs are being processed (%SYS indicates a system-related task, DICOM indicates an application-related task.
Routine	The name of the program that is currently running.
CPU	The amount of MUMPS instructions that have been executed by the process.
Glob	The number of accesses to global variables that have been executed by the process.
PRI	The current priority of the process.
UIC	The User Identification Code of the process (for a DICOM Gateway, this will always be 0,0).
Location	The current status of the process.

Normally, the following tasks can be expected to be present:

There are always some processes that are active in the namespace called %SYS. These processes are part of the Caché system and should not be manipulated by end-users.

```
 1480                      %SYS                         0,0     7   0,0   CONTROL
 1760                      %SYS                        41,310   8   0,0   WRTDMN
 1776                      %SYS                         0,0     7   0,0   GARCOL
 1784                      %SYS                        511,8    7   0,0   JRNDMN
 1792                      %SYS                         0,0     7   0,0   EXPDMN
  356   //./nul    64 %SYS           TASKMGR          4438,853  7   0,0
 2032   //./nul    43 %SYS           CLNDMN             33,10   7   0,0
 2044   //./nul    60 ^^c:\cachesys\mgr\
                                     MONITOR          1041,33   7   0,0
        c:\cachesys\mgr\cconsole.log
  164   //./nul    49 %SYS           LMFMON           4564,23   7   0,0   LMFMON
  212   |TCP|1972  45 %SYS           %cmtP              52,14   7   0,0
 3008   |TCP|1972  68 %SYS           %CDSrv0          6228,266  7   0,0
```

Then, of course, there is the process that runs the system status program:

```
 3308*  |TRM|:|3308  68 DICOM       %SS              1920,30   7   0,0
```

The next sets of processes are the TCP/IP socket listener tasks, which should always be present. These tasks listen on specific network ports and start new programs when connections are made to them. The VistA Imaging DICOM Gateway uses two of these tasks, one listening on 60000 for the Storage service, and the other listening on 60010 for the Modality Worklist service.

```
  340   |TCP|60000   48 DICOM       ZSTU              70,12    7   0,0
        c:\dicom\cache\cstore.out
 3444   |TCP|60010   48 DICOM       ZSTU              49,12    7   0,0
        c:\dicom\cache\worklist_60010.out
```

Then there are the background MUMPS DICOM Storage Controller tasks for the foreground MAG_C-Store server processes. On a VistA DICOM Image Gateway, one or more MAG_C-

Store process should always be active, each with its own MUMPS DICOM Storage Controller. (These processes should not be present on a VistA DICOM Text Gateway.)

```
  216   |TCP|60000   57 DICOM          MAGDCST2   1505,228   7   0,0
 2484   |TCP|60000   57 DICOM          MAGDCST2   1517,227   7   0,0
 2596   |TCP|60000   57 DICOM          MAGDCST2   1526,232   7   0,0
```

An Image Gateway usually also has the task that displays the VistA DICOM Image Gateway statistics. It will typically be waiting for input from the terminal:

```
 2452*  -            84 DICOM          MAGDCST4 148046,1563   7   0,0
        |TNT|localhost:1086|2452
        |TCP|4300
```

Next is the task that processes DICOM images. It should always be active on an image gateway. When it is idling, the routine name will show as MAGDBB; when it is processing images, the routine is usually one of the MAGDIR* ones.

```
 2300*  |TRM|:|2300 101 DICOM          MAGDBB  4742155,256187  7   0,0
        |TCP|4300
```

Then there is the task that processes text messages. This process should always be active on a VistA DICOM Text Gateway. When it is idling, the routine will show as MAGDBB; when it is processing messages, any other routine may be reported.

```
 3228*  -           120 DICOM          MAGDDR2A 1154656,50656  7   0,0
        t:\dicom\data1\w00000\w0000001.xxx
        t:\dicom\data1\w00000\w0000001.dcm
        |TCP|4300
        |TRM|:|3228
```

Finally, there is the task that sends DICOM text messages to a commercial PACS. This task should be active on a VistA DICOM Text Gateway, if it is configured to support this activity. When it is idling, the routine will show as MAGDBB; when it is transmitting messages, any other routine may be reported.

```
 3092*  |TCP|60040   96 DICOM          MAGDTCP3 161015,1997   7   0,0
        |TNT|localhost:1104|3092
```

6.4.4   Check Available Disk Space

This menu-option may be used to obtain a report on the amount of available disk space on the drive that holds the data that is being created by the VistA Imaging DICOM Gateway. The report will include the total amount of space on the drive, as well as the remaining amount of available space.

Use the Cache Terminal icon to start a session for this menu option.

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #3 (MUMPS Utilities).
3. In the third menu, select #4 (Check Available DISK Space).

The display typically will look like:

```
Free  space on drive d:    472.3 Megabytes
Total space on drive d:   1460.5 Megabytes

Push <Enter> to continue...
```

You should get approximately the same figures looking at the disk properties screen (i.e., click on My Computer, right-click on the disk, and click **Properties**).

You should keep track of disk utilization to ensure there is always enough free disk space to run the gateway for an extended period of time.

6.4.5   Display License Expiration Date

The VistA Imaging DICOM Gateway operates on top of a MUMPS system that is separately licensed. Licenses for MUMPS systems have a pre-determined expiration date. Since it important to be able to extend a license before it expires, this menu option is provided to check the actual expiration date of the current license.

Use the Caché Terminal icon to start a session for this menu option.

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #3 (MUMPS Utilities).
3. In the third menu, select #6 (Display License Expiration Date).

When this menu option is executed, it will report the expiration date of the license that is currently being used:

```
Cache Key display:
Based on the file 'c:\cachesys\mgr\cache.key'
```

```
    LicenseCapacity =    Cache 5.0 Enterprise - Concurrent Users for Intel
(Windows):800,
                        Multi-Server
    CustomerName =       VA CIOFO Silver Spring
    OrderNumber =        200385564
    ExpirationDate =     4/14/2033
    AuthorizationKey = *********************
    MachineID =
    currently available =    798
    minimum   available =    798
    maximum   available =    800
```

6.5   Enter Programmer's Mode

Access to Programmer's Mode is protected by an additional password. For information on how to re-define this password (see Chapter 8).

Use the Caché Terminal icon to start a session for this menu option.

Caché
Terminal

After login, select the following menu options:

1. In the first menu, select #4 (System Maintenance).
2. In the second menu, select #4 (Enter Programmer's Mode).

This menu option is included for use by VistA support personnel.

Note: in the sample text below, the text "**password**" appears. Use a site-specific password that is appropriate.

The user will be prompted to enter the Programmer Access Code:
```
PROGRAMMER ACCESS CODE:  password <Enter> (Programmer Mode)
[DCM,DCE]>
```

DO NOT EDIT ANY ROUTINES OR CHANGE ENTRIES IN ANY GLOBAL FILE.

Chapter 7 Menu Options on VistA

The DICOM Gateway operates together with a VistA system. A number of features are controlled directly from the DICOM Gateway computer; a couple of other features are controlled from a menu on the VistA system.

The menu for DICOM Gateway related features on VistA is called MAGD DICOM MENU. This menu contains the following options:

- Correct Clinical Specialties DICOM File Entries [MAGD FIX CLINSPEC DICOM FILE]
- Correct RAD-DICOM File Entries [MAGD FIX DICOM FILE]
- List Unread Studies [MAGD LIST UNREAD STUDIES]
- Print DICOM Failed Image File Entries [MAGD PRINT DICOM FILE]
- Clean Up DICOM Gateway (DICOM Destinations) [MAGD REMOVE GATEWAY XMIT]
- Clean Up DICOM Gateway (Failed Images) [MAGD REMOVE GATEWAY FAILED]
- Rename DICOM Gateway (DICOM Destinations) [MAGD RENAME GATEWAY XMIT]
- Rename DICOM Gateway (Failed Images) [MAGD RENAME GATEWAY FAILED]
- Validate DICOM Correct Information [MAG DICOM CORRECT VALIDATE]

These menu options are described in this chapter.

The menu for DICOM Gateway Importer features on VistA is called MAG IMPORTER MENU.

This menu contains the following options:
- Build Outside Imaging Location file [MAG BUILD OUT IMG LOC]
- Check Outside Imaging Location file [MAG CHECK OUT IMG LOC]
- Display Studies to be Imported [MAG DISPLAY IMPORTER]

These menu options are described in the *Imaging DICOM Gateway Importer User Manual*.

Note: The "MAG DICOM GATEWAY VIEW" VistA key provides access to all the Importer menus on the DICOM Gateway. Importer Users (typically Radiology personnel) who do not need full privileges should be assigned this key.

7.1   Correct Clinical Specialties DICOM File Entries

This menu option will allow corrections to be made on DICOM files, which failed during the acquisition process on DICOM Image gateways. This option is used by Radiology Technologists. The routine used on the DICOM Image gateway will sometimes fail to match exactly on the patient's name, SSN or accession number and thus a reference to the failed file will be written to the MAGD(2006.575 global. This menu option will read from this global and allow manual corrections so the entries can be reprocessed on the DICOM Image gateways.

The corrections could be made through looping by either patient or study unique ID. The user could also specify a date range.

The following example uses the patient selection utility:

```
Select OPTION NAME: MAGD FIX CLINSPEC DICOM FILE <Enter>
Correct Clinical Specialties DICOM File Entries

     Select one of the following:

        P         Patient
        L         Loop thru file
        D         Specify a Date Range

Update entries by: Patient

Select DICOM FAILED IMAGES PID: IMAGPATIENT,EIGHT

**************Processing entry**********

  PATIENT: IMAGPATIENT,EIGHT                        SSN: 000001018
Request/Consultation #: UNKNOWN
  Equipment: CR                                    Model: CR
  Date Processed: AUG 6,2009                        Problem with: NO CASE #
  Comment:
  Correcting file on server ID: ISW-hostname
     C:\DICOM\Image_In\ISW-hostname00070.DCM
Do you want to Correct this entry? (Y/N/D/Q)// Y
 Lookup by case number or patient name
*** Select a request/consult with whose ***
***  TIU note to associate this image   ***
Enter patient or request/consultation: IMAGPATIENT,EIGHT
IMAGPATIENT,EIGHT        8-15-48    000001018     YES    SC VETERAN
     1   IMAGPATIENT,EIGHT  3-11-1993@14:03:00  REQ/CON #5  CARDIOLOGY  IMAGPA
TIENT,EIGHT
     2   IMAGPATIENT,EIGHT  12-29-1993@10:42:00  REQ/CON #8  CARDIOLOGY  IMAGP
ATIENT,EIGHT
     3   IMAGPATIENT,EIGHT  12-29-1993@10:43:00  REQ/CON #9  GASTROENTEROL
OGY  IMAGPATIENT,EIGHT
     4   IMAGPATIENT,EIGHT  7-25-2008@17:44:00  REQ/CON #124  OPHTHALMOLOG
Y  IMAGPATIENT,EIGHT
CHOOSE 1-4: 1  3-11-1993@14:03:00  REQ/CON #5  CARDIOLOGY  IMAGPATIENT,EIGHT
PATIENT: PATIENT,ONEZEROONEEIGHT                    SSN: 000001018
Req/Con No.  Procedure                To Service         Req Date
-----------  ---------                ----------------   --------
5                                     CARDIOLOGY         MAR 11, 1993@14:03
Exam status:   PENDING
  ****Please review the following: *****
  Previous name: IMAGPATIENT,EIGHT
      New name: IMAGPATIENT,EIGHT
  Previous ssn: 000001018
      New ssn: 000001018
  Previous request/consultation #: UNK'
      New request/consultation #: GMRC-5
Social Security numbers do not match. Update? (Y/N/D/Q)// Y
Will change the following:
  ****Please review the following: *****
  Previous name: IMAGPATIENT,EIGHT
      New name: IMAGPATIENT,EIGHT
  Previous ssn: 000001018
      New ssn: 000001018
```

```
   Previous request/consultation #: UNK'
        New request/consultation #: GMRC-5
Are you sure you want to correct this entry? ? No// Y  (Yes)
Updating the file....
```

Note that you cannot select a Consult order that has been discontinued or cancelled. If you try to do so, a warning message is displayed identifying the status of the Consult order:

```
Select OPTION NAME: MAGD FIX CLINSPEC DICOM FILE         Correct Clinical Specialties
DICOM File Entries
Correct Clinical Specialties DICOM File Entries

     Select one of the following:

        P          Patient
        L          Loop thru file
        D          Specify a Date Range

Update entries by: Loop thru file
**************Processing entry**********

  PATIENT: IMAGPATIENT,FIVE                              SSN: 00045689
Request/Consultation #:
  Equipment: CR                                Model: CR
  Date Processed: JUN 25,2009                  Problem with: NO CASE #
  Comment:
  Correcting file on server ID: ISW-hostname-LT
     Isw-hostname00123.DCM
Do you want to Correct this entry? (Y/N/D/Q)// Y
 Lookup by case number or patient name
*** Select a request/consult with whose ***
***  TIU note to associate this image   ***
Enter patient or request/consultation: 112  5-18-2004@01:04:00  REQ/CON #112
PULMONARY  IMAGPATIENT,FIVE
        ...OK? Yes//   (Yes)

This consult has been cancelled and cannot be selected.
```

7.2   Correct Radiology DICOM File Entries

This menu option is used to process radiology images in situations were the patient name, SSN or accession number in an acquired DICOM image does not match an associated Radiology Order in VistA HIS. This option is used by Radiology Technologists. This menu option will read from the ^MAGD(2006.575) global and allow manual corrections so the entries can be processed on the DICOM Image gateways.

The corrections could be made through looping by either patient or study unique ID. The user could also specify a date range.

7.2.1   Selection by Patient

```
Select OPTION NAME: MAGD FIX DICOM FILE <Enter>
Correct RAD-DICOM File Entries

     Select one of the following:

        P          Patient
```

```
            L         Loop thru file
            D         Specify a Date Range

Update entries by: P <Enter> atient
Select DICOM Failed Images: ? <Enter>
 Answer with DICOM Failed Images PATIENT
 Do you want the entire DICOM Failed Images List? Y <Enter> (Yes)
Choose from:
   IMAGPATIENT,SIX         D:\DICOM\Image_In\A0002791.DCM
     CASE#: 031298-<unknown>  DATE: Feb 24, 1999  MODALITY: CR1

   IMAGPATIENT,ONE M.       D:\DICOM\Image_In\A0014799.DCM
     CASE#: 062398-<unknown>  DATE: Feb 24, 1999  MODALITY: CR1

   IMAGPATIENT,TWO N.       D:\DICOM\Image_In\F0000001.DCM
     CASE#: 021097-4666      DATE: Apr 28, 1999  MODALITY: WALSH

   IMAGPATIENT,SIX R.       D:\DICOM\Image_In\A0000034.DCM
     CASE#: 091798-<unknown>  DATE: Sep 23, 1999  MODALITY: CR1

   IMAGPATIENT,THREE O.      D:\DICOM\Image_In\A0014810.DCM
     CASE#: 062498-<unknown>  DATE: Feb 24, 1999  MODALITY: CR1

   IMAGPATIENT,FOUR P.       D:\DICOM\Image_In\A0014816.DCM
     CASE#: 062498-<unknown>  DATE: Feb 24, 1999  MODALITY: CR1

   IMAGPATIENT,FIVE Q.       D:\DICOM\Image_In\A0014803.DCM
     CASE#: 061898-<unknown>  DATE: Feb 24, 1999  MODALITY: CR1

                ^
Select DICOM Failed Images: IMAGPATIENT,FIVE Q. <Enter>
D:\DICOM\Image_In\A0014803.DCM
     CASE#: 061898-<unknown>  DATE: Feb 24, 1999  MODALITY: CR1

**************Processing entry**********

  PATIENT: IMAGPATIENT,FIVE Q.                    SSN: 666302197
RADIOLOGY CASE #: 061898-<unknown>
  Equipment: CR1                                  Model: NM
  Date Processed: FEB 24,1999                     Problem with: PATIENT
  Comment: 061898-<unknown>
  Correcting file on server ID: A
     D:\DICOM\Image_In\A0014803.DCM
Do you want to Correct this entry? (Y/N/D/Q)// ? <Enter>
Please respond with one of the following codes.
Legend: Y=yes, N=no, D=delete, P=Previous entry, and Q=quit

Do you want to Correct this entry? (Y/N/D/Q)// Y <Enter>
 Lookup by case number or patient name

Enter Case Number or Patient Name: ? <Enter>
Enter an active case number in the following form '999'...
         ...or enter a completed case number as 'MMDDYY-999'
         ...or enter a patient's name
         ...or enter a patient's 9-digit SSN
         ...or enter the first character of the patient's
            last name and the last four digits of their SSN.

Do you wish to see the entire list of active cases? NO// <Enter>

Enter Case Number or Patient Name: IMGPATIENT,SIX R. <Enter>
Select RAD/NUC MED PATIENT: IMGPATIENT,SIX R. //   IMGPATIENT,SIX R.   01-06-44
000086293
```

```
     NO      NON-VETERAN (OTHER)

                          *** WARNING ***
                     Case Lookup by Patient

Patient's Name: IMGPATIENT,SIX R.   000086293              Run Date: OCT 26,1999

    Case No.   Procedure                    Exam Date  Status of Exam   Imaging Loc
    --------   -------------                ---------  ---------------- -----------
1    106       RENAL ULTRASOUND             09/23/99   WAITING FOR EXAM NUCLEAR MED
2    93        RENAL ULTRASOUND             03/30/99   CANCELLED        ONCOLOGY CL
3    90        SPINE LUMBOSACRAL MIN 2 VI   02/19/99   WAITING FOR EXAM ONCOLOGY CL
4    72        (i)CT ABDOMEN W/CONT         09/23/98   WAITING FOR EXAM RADIOLOGY C
5    71        CT ABDOMEN W&W/O CONT        09/21/98   CANCELLED        RADIOLOGY C
6    88        RENAL ULTRASOUND             08/26/98   WAITING FOR EXAM RADIOLOGY C
7    75        CHEST 2 VIEWS PA&LAT         08/26/98   WAITING FOR EXAM RADIOLOGY C
8    70        CT ABDOMEN W&W/O CONT        08/04/98   COMPLETE         CAT SCAN
9    71        CT ABDOMEN W/O CONT          08/04/98   COMPLETE         CAT SCAN
10   72        CT ABDOMEN W&W/O CONT        08/04/98   COMPLETE         CAT SCAN
11   14        CHEST 2 VIEWS PA&LAT         08/03/98   CANCELLED        RADIOLOGY C
12   70        ABDOMEN 1 VIEW               06/27/98   COMPLETE         RADIOLOGY C
13   42        UPPER GI AIR CONT W/O KUB    05/12/98   CANCELLED        RADIOLOGY C
14   42        CT ABDOMEN W/CONT            03/25/97   COMPLETE         RADIOLOGY C

***DICOM Image information to correct:
  Patient                    Date Acquired      Case No.        Modality
  IMAGPATIENT,FIVE Q.        FEB 24,1999        061898-<unknown>NM

  ****Please review the following: *****
  Previous name: IMAGPATIENT,FIVE Q.
       New name: IMAGPATIENT,SIX R.
  Previous ssn: 000074067
       New ssn: 000086293
  Previous case #: 061898-<unknown>
       New case #: 106
Social Security numbers do not match. Update? (Y/N/D/Q)// Y <Enter>
Will change the following:
  ****Please review the following: *****
  Previous name: IMAGPATIENT,FIVE Q.
       New name: IMAGPATIENT,SIX R.
  Previous ssn: 000074067
       New ssn: 000086293
  Previous case #: 061898-<unknown>
       New case #: 106
Are you sure you want to correct this entry? ? No// **<Enter>** (No)
```

7.2.2   Looping through the List of Failed Images

The following example uses the loop utility:

```
Correct Clinical Specialties DICOM File Entries

     Select one of the following:

         P          Patient
         L          Loop thru file
         D          Specify a Date Range

Update entries by: Loop thru file
**************Processing entry**********

  PATIENT: IMAGPATIENT,FIVE                                  SSN: 0000112
Request/Consultation #:
```

```
  Equipment: CT                                    Model: CT
  Date Processed: AUG 10,2009                      Problem with: NO CASE #
  Comment:
  Correcting file on server ID: ISW-hostname

Do you want to Correct this entry? (Y/N/D/Q)//
**************Processing entry**********

  PATIENT: IMAGPATIENT,FOUR                                SSN: 000000460
Request/Consultation #:
  Equipment: CR                                    Model: CR
  Date Processed: AUG 6,2009                        Problem with: NO CASE #
  Comment:
  Correcting file on server ID: ISW-hostname
      C:\DICOM\Image_In\ISW-hostname00070.DCM
Do you want to Correct this entry? (Y/N/D/Q/P)// Y
 Lookup by case number or patient name
*** Select a request/consult with whose ***
***  TIU note to associate this image   ***
Enter patient or request/consultation: 6   3-11-1993@14:06:00   REQ/CON #6   CARDIOLOGY
IMAGPATIENT,FOUR
        ...OK? Yes// <enter>  (Yes)


PATIENT: IMAGPATIENT,FOUR                      SSN: 000000460
Req/Con No.   Procedure               To Service          Req Date
-----------   ---------               ----------------    --------
6                                     CARDIOLOGY          MAR 11, 1993@14:06
Exam status:   ACTIVE
  ****Please review the following: *****
  Previous name: IMAGPATIENT,FOUR
      New name: IMAGPATIENT,FOUR
  Previous ssn: 000000460
      New ssn: 000000460
  Previous request/consultation #: UNK
      New request/consultation #: GMRC-6
Social Security numbers do not match. Update? (Y/N/D/Q/P)//Y
  Will change the following:
  Previous name: IMAGPATIENT,FOUR
      New name: IMAGPATIENT,FOUR
  Previous ssn: 000000460
      New ssn: 000000460
  Previous request/consultation #: UNK
      New request/consultation #: GMRC-6
Are you sure you want to correct this entry? No// Y  (Yes)
Updating the file....
```

7.2.3   Scanning the List of Failed Images by Date Range

The following example uses the Date utility:

```
Correct Clinical Specialties DICOM File Entries

    Select one of the following:


       P          Patient
       L          Loop thru file
       D          Specify a Date Range

Update entries by: D  Specify a Date Range
Enter start date:  8/6/2009
Enter stop date:   8/10/2009
```

```
***************Processing entry**********

  PATIENT: IMAGPATIENT,FOUR                              SSN: 000000689
Request/Consultation #: UNK'
  Equipment: CR                               Model: CR
  Date Processed: AUG 6,2009                  Problem with: NO CASE #
  Comment:
  Correcting file on server ID: ISW-hostname
     C:\DICOM\Image_In\ISW-hostname00070.DCM
Do you want to Correct this entry? (Y/N/D/Q)//
***************Processing entry**********

  PATIENT: IMAGPATIENT,FIVE                              SSN: 000009798
Request/Consultation #:
  Equipment: CT                               Model: CT
  Date Processed: AUG 10,2009                 Problem with: NO CASE #
  Comment:
  Correcting file on server ID: ISW-hostname
     C:\DICOM\Image_In\ISW-hostname00079.DCM

Do you want to Correct this entry? (Y/N/D/Q/P)//
```

7.3   List Unread Studies

This option lists the entries in the temporary Imaging/CPRS Consult Request Tracking association file. It reads the entries in file ^MAG(2006.5839). (The preferred way of listing unread consults studies is through the TeleReader application.)

```
UNREAD LIST FOR HEALTHCARE PROVIDERS

 1)  660 -- SALT LAKE CITY -- CARDIOLOGY
 2)  660 -- SALT LAKE CITY -- GASTROENTEROLOGY
 3)  660 -- SALT LAKE CITY -- OPHTHALMOLOGY
 4)  660 -- SALT LAKE CITY -- DENTISTRY

Select the proper service (1-4) or enter ALL: ALL <Enter>

Display studies older than how many days?  0//  <Enter> 0

Sort by patient name or examination date? (N or D) D//  <Enter> D

DEVICE: HOME//  <Enter>  HERE

Building

UNREAD LIST FOR HEALTHCARE PROVIDERS                    JAN 05, 2007@08:25:16
ALL SERVICES -- All studies regardless of age sorted by date
```

7.4   Print DICOM Failed Image File Entries

This option can be used to print entries in the DICOM Failed Image file (2006.575) either by dates or study instance UID number.

```
Select DICOM Menu Options Option:  P <Enter> rint DICOM Failed Image File Entries

    Select one of the following:

        D        Date
        F        Unique Entries
```

```
Enter response: Date <Enter>
Enter start date: 1 Jan 1980 <Enter>
Enter stop date: T <Enter>
Please hold sorting by Date.
DEVICE: <Enter>
```

7.5   Clean Up DICOM Gateway (DICOM Destinations)

When a computer for a DICOM Gateway is decommissioned, it may be desirable to remove the parameters that were registered for that computer.

The menu option MAGD REMOVE GATEWAY XMIT may be used to remove the registrations of the DICOM transmission destinations from the VistA database for a specific DICOM Gateway.

Note: This menu option uses the "system title", not the "host-name" to identify the DICOM Gateway.

```
Select DICOM Menu Options Option: CLEAN UP GATEWAY (DICOM Destinations)
Enter the current System Title of the DICOM Gateway: Ed's Cache Test Gateway <Enter>

WARNING: this operation will irrevocably remove all entries
for the DICOM Gateway named "ED'S CACHE TEST GATEWAY".

Are you certain you wish to remove these entries? No//y <Enter>

8 Entries removed.
```

7.6   Clean Up DICOM Gateway (Failed Images)

When a computer for a DICOM Gateway is decommissioned, it may be desirable to remove the parameters that were registered for that computer.

The menu option Clean Up DICOM Gateway [MAGD REMOVE GATEWAY FAILED] may be used to remove the registrations of the failed images from the VistA database for a specific DICOM Gateway.

Note: This menu option uses the "host-name" to identify the DICOM Gateway.

```
Select DICOM Menu Options Option: Clean Up DICOM Gateway (Failed Images)
Enter the current Host Name of the DICOM Gateway: ?
Enter the appropriate name for the DICOM Gateway.
The "Host Name" is the name of the computer that is assigned
by the site's IRM and that follows official naming rules.
The "System Title" is the name that is assigned by the staff
who operates the DICOM Gateway.

Enter the current Host Name of the DICOM Gateway: ISW-hostname-LT

WARNING: this operation will irrevocably remove all entries
for the DICOM Gateway named "ISW-hostname-LT".

Are you certain you wish to remove these entries? No//Y

50 Entries removed.
```

7.7 Rename DICOM Gateway (DICOM Destinations)

When a computer for a DICOM Gateway is replaced by a newer computer, it may be desirable to re-assign the parameters that were registered for that computer to the new computer.

The menu option MAGD RENAME GATEWAY XMIT may be used to modify the registrations of the DICOM transmission destinations from the VistA database for a specific DICOM Gateway so that they reflect the name of the new computer.

Note: This menu option uses the "system title", not the "host-name" to identify the DICOM Gateway. . The Gateway's 'system title' is stored in the DICOM TRANSMIT DESTINATION SERVICE file (#2006.587).

```
Select DICOM Menu Options Option: RENAM
    1     Rename DICOM Gateway (DICOM Destinations)
    2     Rename DICOM Gateway (Failed Images)
CHOOSE 1-2: 1  Rename DICOM Gateway (DICOM Destinations)
Enter the current System Title of the DICOM Gateway: SORNA - CD BURNER
Enter the new System Title of the DICOM Gateway: Consult Gateway

1 Entry renamed.
```

7.8 Rename DICOM Gateway (Failed Images)

When a computer for a DICOM Gateway is replaced by a newer computer, it may be desirable to re-assign the parameters that were registered for that computer to the new computer.

The menu option Rename DICOM Gateway (Failed Images) [MAGD RENAME GATEWAY FAILED] may be used to modify the registrations of the failed images from the VistA database for a specific DICOM Gateway so that they reflect the name of the new computer.

Note: This menu option uses the "host-name" to identify the DICOM Gateway. The lookup is performed on entries in the AFX cross reference so it only renames entries that have been marked as corrected.

```
Select DICOM Menu Options Option: RENAME DICOM G
    1     Rename DICOM Gateway (DICOM Destinations)
    2     Rename DICOM Gateway (Failed Images)
CHOOSE 1-2: 2  Rename DICOM Gateway (Failed Images)
Enter the current Host Name of the DICOM Gateway: A
Enter the new Host Name of the DICOM Gateway: ISW-Hostname-LT

1 Entry renamed.
```

7.9 Validate DICOM Correct Information

The menu option Validate DICOM Correct Information [MAG DICOM CORRECT VALIDATE] invokes a program that validates (and, if necessary, corrects) the table that describes all images that are waiting for corrections to be applied. The menu option will first delete all existing cross references and reset them accordingly to the entries in the tables. The menu option will first delete all existing cross references for all entries in DICOM FAILED IMAGES file (#2006.575) and reset them accordingly to the entries in the tables.

```
Select DICOM Menu Options Option: VALIDate DICOM Correct Information

Starting Validation of data in DICOM Failed Images Table.


100 entries currently in database.
```

Note: The Importer is used for DICOM Correct. For information about this, see the *Imaging DICOM Gateway Importer User Manual*.

Chapter 8 Re-Define Access and Verify Codes

8.1   Overview

The procedure to modify access and verify codes is not directly available from any of the menus. This is to provide an additional level of security and protection to prevent these codes from being changed inadvertently.

In order to modify the access or verify code, first obtain programmer's access (see Section 6.5). With programmer's access, follow the dialog below.

Note: In the sample text below, the text **password** appears several times. For each instance, use a different site-specific password for each code.

```
>DO INIT^MAGDLOGN <Enter>

Change Login Security Codes
---------------------------

  1 - Change ACCESS Code
  2 - Change VERIFY Code
  3 - Change PROGRAMMER ACCESS Code
  4 - Change PRINT/VIEW ONLY Code
  5 - Change SUPPORT Code

  A - Change ALL THE CODES

Enter 1-5 or "A" to change security codes, <Enter> to exit: 5 <Enter>

Enter new SUPPORT code: password <Enter>
 Re-enter SUPPORT code (to make sure I got it right): password <Enter>
```

The system requires that the password be a combination of six or more letters and numbers. It is not case-sensitive, however.

Note: When you log on using the password for **Print/View Only**, the only menu options that will be available are those that cannot modify the database. When the passwords for Normal access and View Only access are the same, the most restrictive access will be granted (i.e., View Only).

Note: This Access and Verify code is for stand-alone maintenance of the DICOM gateway only, and cannot be used for production. No remote procedure calls can be used with this maintenance Access and Verify code.

Chapter 9 Text Gateway File Modes of Operation

9.1   Overview

The VistA Imaging DICOM Gateway has two different mechanisms for handling text files. One mode of operation (DIRECT) is designed to handle incoming query requests, while the other (FIFO QUEUE) supports broadcasting messages to multiple destinations.

9.2   DIRECT Mode of Operation

In some applications, like responding to Modality Worklist queries, where the VistA Imaging DICOM Gateway operates as a server and handles individual requests, one process performs both the communication and the message handling functions. In these instances, one set of files in the D:\DICOM\DATA1\LOGxxx.nnn directory (where "xxx" is the three-letter system name, and "nnn" is the MUMPS job number) is used to pass the messages between the message handler and the communications phases of the same process (see Table 9.2).

Files Used in the DIRECT Mode of Operation

File Name	Usage	Type
INCOMING.PDU	Incoming association control protocol data units	Binary
OUTGOING.PDU	Outgoing association control protocol data units	Binary
INCOMING.DCM	Incoming DICOM message	DICOM
INCOMING.TXT	Text of incoming DICOM message	ASCII Text
OUTGOING.DCM	Outgoing DICOM message	DICOM
OUTGOING.TXT	Text of outgoing DICOM message	ASCII Text

Table 9.2

9.3   FIFO QUEUE Mode of Operation

In other applications, like the PACS text interface, where the VistA Imaging DICOM Gateway processes, stores, and forwards messages, separate message handling and communications processes are used, and the incoming and outgoing files that are passed between them are organized in prioritized first-in-first-out queues.

A queue consists of a numerically ordered sequence of message files, and pointers to the last-written and last-read files in the sequence. The queue pointer files, one for writing to the queue and one for reading from the queue, are located in the root directory for the queue, D:\DICOM\DATA1, for example. The actual message files are stored one level below, in subdirectories.

Each DICOM application entity (AE) generates a queue of **immediate, high, medium,** and **low** priority DICOM request and response messages for the other system to process. For each priority, these messages are stored in sequentially numbered files, and are processed in first-in-first-out order. A response message is returned for each request message. Separate message

queues are used to store the **immediate, high, medium,** and **low** priority request messages and their responses.

Sixteen queues handle the messages sent in each direction. Each queue is assigned a letter: A, B, C, D, E, F, G, and H are for the remote application entity request and response queues, and S, T, U, V, W, X, Y, and Z are for the VistA request and response queues (see Table 9.3).

Prioritized First-In-First-Out Queues

Application Entity	Queue Request – Response	Priority	Usage
Remote	A – B	High	
	C – D	Medium	
	E – F	Low	
	G – H	Immediate	C-ECHO only
VistA	S – T	Immediate	C-ECHO only
	U – V	High	Orders and Examination Verification
	W – X	Medium	ADT, Patient Demographics and Reports
	Y – Z	Low	Pull Lists

Table 9.3

Queues A, C, E, and G are for requests from remote AEs and B, D, F, and H are for their corresponding responses from VistA. Queues S, U, W, and Y are for requests from VistA and T, V, X, and Z for their corresponding responses from the remote AEs.

The DICOM message files are named Lnnnnnnn.DCM, where "L" is the queue letter, "nnnnnnn" is a sequentially assigned seven-digit number, and DCM is the message extension. (Depending on a configuration parameter, there may also be a Lnnnnnnn.TXT file, an ASCII formatted listing of the DICOM file.) The DICOM message files are stored in subdirectories in groups of one hundred. The queue subdirectories are named Lnnnnn, where "L" is the queue letter and "nnnnn" is a five-digit number. (For example, subdirectory L12345 holds message files L1234500.DCM through L1234599.DCM.)

Each queue has a pair of pointer files named as follows: L_READ.PTR and L_WRITE.PTR where L is the letter of the queue (A-H, or S-Z). There are a total of 32 pointer files located in the root directory of the queue. The *_READ.PTR is used by the VistA application reading from the queue and the *_WRITE.PTR is used by the VistA application writing to the queue. Note that depending upon the direction of the message, the VistA message handler and TCP/IP communicator can either be the queue reading or the writing application.

9.3.1 Queue Pointer File

The value of the queue pointer file is the sequential number of the last file that has been written to the queue, or the sequential number of the last file that has been read from the queue. Each queue pointer is stored in the file as a single record consisting of a seven-digit right justified ASCII numeric string terminated with <carriage return> <line feed>. The numbers are sequentially assigned in the inclusive range of 0-9999999. The initial value for the queue pointer is zero ("00000000"). When the last number ("9999999") is reached, the counter will reset and the next number will be zero ("0000000").

Example:

In this example, the VistA system is sending messages to a commercial PACS using queue "W". The VistA message handler has placed thirty messages on the queue and the VistA TCP/IP communications process has sent` twenty-eight of them to the commercial PACS. W_WRITE.PTR contains the ASCII number twenty-nine ("000029"), followed by <carriage return> <line feed>. (Remember, counting starts with zero!) W_READ.PTR contains the ASCII number twenty-seven ("0000027"), followed by <carriage return> <line feed>.

The following message files exist in subdirectory W00000:

          W0000000.DCM
          W0000001.DCM
          W0000002.DCM

             ...
          W0000027.DCM   W_READ.PTR=0000027
          W0000028.DCM
          W0000029.DCM   W_WRITE.PTR=0000029

Note: There may also be thirty W00000nn.TXT files as well.

9.3.2 Processing Algorithm – Message Source

When the source process puts a message into the queue, it must first read its queue write pointer file value "nnnnnnn" and increment it by one[3]. The source process must then create the message file on the queue with the temporary name Lnnnnnnn+1.TMP. When the message file is completely written, the source process must rename the message file to Lnnnnnnn+1.DCM, and store the incremented "nnnnnnn+1" value back into the queue write pointer file.

The extra step of creating the message file first with a temporary name, and then renaming it, is necessary to prevent a race condition where the message destination process could try to read the message file before it was completely written.

---

[3]The numbers are in the inclusive range of 0-9999999. The increment step must reset the counter at the end of the range.

9.3.3   Processing Algorithm – Message Destination

The destination process must satisfy any **immediate** requests before handling any **high** requests, all **high** requests before handling any **medium** requests, and all **medium** requests before handling any **low** requests. Response messages are processed in a similar prioritized fashion after all the request messages are done.

1. The destination process reads the **immediate** queue read pointer file and checks for existence of the next **immediate** request message file (G/Snnnnnnn+1.DCM) in the **immediate** queue.

2. If the next **immediate** request message file exists, the destination process reads it, performs the designated functions, and outputs the next response file to the destination process's **immediate** response queue. It then updates the **immediate** request queue read pointer file with the next value, and repeats the cycle (at step 1).

3. If the next **immediate** request message file does not exist, the process reads the **high** request queue read pointer file and checks for existence of the next **high** request message file (A/Unnnnnnn+1.DCM) in the **high** request queue.

4. If the next **high** request message file exists, the destination process reads it, performs the designated functions, and outputs the next response file to the destination process's **high** response queue. It then updates the **high** request queue read pointer file with the next value, and repeats the cycle (at step 1).

5. If the next **high** request message file does not exist, the process reads the **medium** request queue read pointer file and checks for existence of the next **medium** request message file (C/Wnnnnnnn+1.DCM) in the **medium** request queue.

6. If the **medium** routine request message file exists, the destination process reads it, performs the designated functions, and outputs the next response file to the destination process's **medium** response queue. It then updates the **medium** request queue read pointer file with the next value, and repeats the cycle (at step 1).

7. If the next **routine** request message file does not exist, the process reads the **low** request queue read pointer file and checks for existence of the next **low** request message file (E/Ynnnnnnn+1.DCM) in the **low** request queue.

8. If the next **low** request message file exists, the destination process reads it, performs the designated functions, and outputs the next response file to the destination process's **low** request queue. It then updates the **low** request queue read pointer file with the next value, and repeats the cycle (at step 1).

9. If the next **low** message request message file does not exist, the destination process reads the first outstanding response message and repeats the cycle (at step 1).

10. If no outstanding response messages exist, the process hibernates for a specified period of time (one second), and then repeats the cycle (at step 1).

9.3.4   Message Queue File Deletion

Old message files and status files are automatically deleted after a predefined number of days by a VistA batch job.

Chapter 10 Image Acquisition Devices - Modalities

This chapter describes the steps to define the initial set of image acquisition devices and modalities, and how to modify the configuration at a later time to add more devices.

Begin by taking an inventory of all the image acquisition devices and mapping them to the VistA DICOM Image Gateways. Such an inventory should include the information shown in the tables below. Then register each instrument with the VistA Modality Worklist Provider on the VistA DICOM Text Gateway. Section 10.3 presents the details on how to do this. Finally, set up the image processing parameters for each different instrument modality. This is described below in Section 10.4.

10.1   Image-Producing Equipment

Table 10.1 contains information about all image acquisition equipment at the site. (The example below shows equipment at a fictitious site.) Site personnel have assigned port numbers for the VistA DICOM Storage processes different pieces of equipment, based on the scheme described in the VistA Imaging DICOM Installation Guide.

Note: The parameters that are shown in the shaded columns in Table 10.1 will be entered in the **Instrument.DIC** master file (see also the VistA Imaging DICOM Gateway Installation Guide, Chapter 8).

Instrument Name	VA Network Name	IP Address	Port Assigned	Mnemonic	Location	Imaging Service
DeJarnette ImageShare	VHAXXXIMG1	111.222.333.229	60100	CR1	2D-130	RAD
DeJarnette ImageShare	VHAXXXIMG2	111.222.333.230	60101	CR2	C2-72	RAD
DeJarnette ImageShare	VHAXXXIMG3	111.222.333.231	60102	CR3	OPC	RAD
GE CT/i CT Scanner	VHAXXXCTS1	111.222.333.111	60120	CT1	2D-124	RAD
OEC C-Arm 9400	VHAXXXOEC1	111.222.333.120	60140	DRS1	Portable	RAD
OEC C-Arm 9700	VHAXXXOEC2	111.222.333.121	60141	DRS2	Portable	RAD
Acuson 128 Ultrasound	VHAXXXACU1	111.222.333.117	60160	US1	Portable	RAD
Acuson 128 Ultrasound	VHAXXXACU2	111.222.333.118	60161	US2	Portable	RAD
Acuson 128 Ultrasound	VHAXXXACU3	111.222.333.119	60162	US3	Portable	RAD
ADAC Vertex	VHAXXXADAC1	111.222.333.178	60170	NM1	2D-166	RAD
ADAC Solus	VHAXXXADAC2	111.222.333.184	60171	NM2	2D-163	RAD
ADAC Siemens Basicam	VHAXXXADAC3	111.222.333.185	60172	NM3	2D-162	RAD
ADAC Siemens Orbiter	VHAXXXADAC4	111.222.333.177	60173	NM4	2D-158	RAD
Lumisys 75	VHAXXXLUM1	111.222.333.150	60190	LUMISYS	2D-116	RAD
GE Advantage Workstation	VHAXXXAWS1	111.111.333.113	60200	ADW1	2D-135	RAD
Philips EasyVision	VHAXXXEV1	111.222.333.130	60201	EV1	2D-155	RAD
Philips MRI	VHAXXXMRI1	111.222.333.131	60300	MRI1	2D-155	RAD
Olympus EndoWorks	VHAXXXENDO1	111.222.333.140	60400	ENDO1	4E-124	CON

Table 10.1

Note: All imaging instruments should be assigned unique port numbers for storage, even though different VistA DICOM Image Gateways are going to provide the service. This convention is highly recommended because it allows the instruments to be easily reassigned to a different processor, in the event of a hardware failure.

10.2 Distribute Modalities over Processors

Table 10.2 has a column for each processor at the site. The rows in this table indicate how the image-producing modalities are distributed over the processors, e.g.:

Gateway	VHAXXXDIG1	VHAXXXDIG2	VHAXXXDIG3	VHAXXXDIG4	VHAXXXDIG5
IP Address:	111.222.333.238	111.222.333.239	111.222.333.240	111.222.333.241	111.222.333.242
Allocation	CT1	MRI1	CR1	CR2	CR3
Mnemonic	DRS1	DRS2	US1	US2	US3
	NM1	NM2	NM3	NM4	ENDO1
	LUMISYS		ADW1	EV1	

Table 10.2

10.3 Image Acquisition

10.3.1 Add IP Addresses to HOSTS File

When a modality connects to a VistA Imaging DICOM Gateway, the gateway attempts to determine the network identity (i.e., the IP address) of the modality that is making the connection. It does this by invoking the Windows operating system function `gethostbyaddr()`. This works most efficiently when the IP address of the instrument is registered in the VistA Imaging DICOM Gateway's **HOSTS** file (stored in **c:\WinNT\System32\Drivers\etc\hosts**).

For each instrument, add the information from the columns labeled **Instrument IP Address** and **Mnemonic** (in that order), separated by a tab-character, to the **HOSTS** file. A comment may be entered anywhere in the line, beginning with the sharp (#) character.

The following is an example of a HOSTS file.

```
127.0.0.1       localhost

# local host telnet connections for the VistA DICOM PACS Interface
127.0.0.1       TEXT_INTERFACE_1_1              # HIS to DICOM Test Interface
127.0.0.1       MITRA_BROKER_1_2_1             # MITRA / FUJI Communications
127.0.0.1       DEJARNETTE_MEDISHARE_1_2_2     # DEJARNETTE / FUJI Communications
127.0.0.1       PACS_EXAM_COMPLETE_2_1         # Receiver for exam complete
127.0.0.1       PACS_REQUEST_IMAGE_TRANSFER_2_2 # Request image transfer from PACS
127.0.0.1       PROCESS_DICOM_IMAGES_2_3       # Process DICOM Images
127.0.0.1       IMAGE_STATUS_2_5               # Status of Image Transfer/Processing

# Frequently used IP addresses
111.222.333.130  VistA                          # HIS/RIS

111.222.333.40    GECT1                          # GE High Speed CTI, Room F24
111.222.333.41    GEADW                          # GE Advantage Workstation F24
111.222.333.42    GEMR                           # GE Signa MRI, Room Mobile Trailer
#End of File
```

10.3.2 Configuring the Instruments

Once the instruments have been assigned port numbers on a VistA DICOM Image Gateway, it is necessary to configure them with the corresponding network parameters of the VistA DICOM Service Class Provider (SCP), as shown in Table 10.3.

Storage SCP		Required Values
	IP Address	VistA DICOM Image Gateway's IP Address
	Port Number	Port number assigned for the Instrument
	Called AE Title	**VISTA_STORAGE**
Modality Worklist SCP		
	IP Address	VistA DICOM Text Gateway's IP Address
	Port Number	**60010**
	Called AE Title	**VISTA_WORKLIST**

Table 10.3

10.3.3   Registering the Instrument with VistA Modality Worklist SCP

For the instrument to use the VistA Modality Worklist service, the instrument must first be properly registered with the VistA Imaging DICOM Gateway. The DICOM Application Entity Title of the image acquisition device, its location, imaging service, the accession number format and a description of the instrument must be entered in the **WorkList.DIC** master file (see also the VistA Imaging DICOM Gateway Installation Guide, Chapter 8). Typical data in this file might look like:

```
#AE Title|Institution Name|Imaging Service|Imaging Type|S/L|Description
IM_CR|sitename|RAD|RAD|LONG|DeJarnette Fuji CR
MS_FCRIDGW|sitename|RAD|RAD|LONG|DeJarnette Fuji CR
SCANNER1|sitename|RAD|RAD|LONG|Film Scanner
OLYMPUS_ENDO1|sitename|CON||LONG|Endoscopy
```

Note: The column in this file that reads *sitename* in the preceding and the following examples should be replaced by the actual name (or number) of the location as it occurs in the Institution file (stored in `^DIC(4,…)`).

The data in **WorkList.DIC** must be loaded into the VistA Imaging DICOM Gateway via the corresponding master file build routine as described previously in Section 6.3.8.

10.3.4   Registering the Instrument with VistA Storage Provider SCP

The parameters that are shown in the shaded columns in Table 10.1 will be entered in the **Instrument.DIC** master file (see also the VistA Imaging DICOM Gateway Installation Guide, Appendix B.4.1). For the preceding site in the example in section 10.3.3, the contents of this file would look like this:

```
# Mnemonic|Description|Institution Name|Imaging Service|Port
CR1|DeJarnette ImageShare, 2D-130|sitename|RAD|60100
CR2|DeJarnette ImageShare, C2-72|sitename|RAD|60101
CR3|DeJarnette ImageShare, |sitename|RAD|60102
CT1|GE CT/i CT Scanner, 2D-124|sitename|RAD|60120
DRS1|OEC C-Arm 9400, Portable|sitename|RAD|60140
DRS2|OEC C-Arm 9700, Portable|sitename|RAD|60141
US1|Acuson 128 Ultrasound, Portable|sitename|RAD|60160
US2|Acuson 128 Ultrasound, Portable|sitename|RAD|60161
US3|Acuson 128 Ultrasound, Portable|sitename|RAD|60162
```

```
NM1|ADAC Vertex, 2D-166|sitename|RAD|60170
NM2|ADAC Solus, 2D-163|sitename|RAD|60171
NM3|ADAC Siemens Basicam, 2D-162|sitename|RAD|60172
NM4|ADAC Siemens Orbiter, 2D-158|sitename|RAD|60173
LUMISYS|Lumisys 75, 2D-116|sitename|RAD|60190
ADW1|GE Advantage Workstation, 2D-135|sitename|RAD|60200
EV1|Philips EasyVision|sitename|RAD|60201
MRI1|Philips MRI|sitename|RAD|60300
ENDO1|Olympus EndoWorks|sitename|CON|60400
```

The data in **Instrument.DIC** must be loaded into the VistA Imaging DICOM Gateway via the corresponding master file build routine as described above in Section 6.3.3.

Once the **Instrument.DIC** master file has been created (or each time it is updated), you can run the **Create Shortcuts for Instruments** menu option to create the shortcuts for the various instruments (see Section 6.3.10).

10.4   Setting up DICOM Image Processing

10.4.1   Registering the Type of Modality with VistA

After an entry has been added to **Instrument.DIC** for the image acquisition device (and the corresponding configuration are made on the instrument), the device may start transmitting images to the VistA Imaging DICOM Gateway. If there is no entry in **Modality.DIC** for the device, the DICOM Gateway uses the default definitions to process objects.

The image acquisition device should have a corresponding entry in the **Modality.DIC** master file. Some modalities (such as those that produce secondary capture images) may also have multiple entries in the file.

Image processing is a six-step process performed automatically by the VistA DICOM Image Gateway (see Section 4.11 for more details):

1. Determine the manufacturer, model, and modality (obtain this information from the image header).
2. Obtain the accession number from the image header (different manufacturers store the accession number in different places for different models, so various methods are needed).
3. Look up patient and study.
4. Get number of bits per pixel, x and y dimensions and process the image (convert to TARGA, if necessary, create .BIG file, if necessary, create the abstract file).
5. Store the images.
6. Format the DICOM text information for VistARad and store it in the .TXT file.

The master file named **Modality.DIC** provides the parameters used to control these steps.

If an image acquisition instrument does not have a corresponding entry in that master file and if there is no default entry in the file, when the image is being processed by the function **Process DICOM Images** (see Section 4.11), the following warning message may be displayed:

```
D:\DICOM\Image_In\A0000001.DCM -- ULTRASOUND^GE^^ -- 000-00-0000
*****************************************************************************
*** DICOM IMAGE PROCESSING WARNING                                        ***
*** The following device is not yet defined in the system:               ***
*** Mfgr: G.E. Medical Systems Model: LOGIQ 700 Modality: US              ***
*****************************************************************************
```

A warning message is also output by menu option **Display Real-Time Storage Server Statistics** (see Section 4.13).

```
*** The following images have undefined modalities ***
Manufacturer                 Model                          Modality  #Images
------------                 -----                          --------  -------
G.E. Medical Systems         LOGIQ 700                      US        2
LUMISYS                      LS75                           CR,DX     3
Philips Medical Systems      Cassette Holder Type 9840 500 70201CR    1
VAMC Image Acquisition Corp. VA Image Camera                OT        1
```

Information about the image can be shown using the menu option **Display a DICOM Image Header** (see Section 4.17). In the example below, the information the highlighted lines is used for the parameters that need to be entered into **d:\DICOM\Modality.DIC**.

```
DUMP of DICOM file D:\DICOM\Image_In\A0000001.DCM

  O    G    E    L                    Created at 11:17 AM on 18-AUG-1999
  f    r    l    e
  f    o    e    n
  s    u    m    g
  e    p    e    t
  t    n    h    A t t r i b u t e      V a l u e
       t         ----------------------------------
000084:0002,0000 UL 0004 Group Length            "206 (0x000000CE)"
000090:0002,0001 OB 0002 File Meta Information Ver "0 (0x00)"
                                                  "1 (0x01)"
00009E:0002,0002 UI 001C Media Storage SOP Class U "1.2.840.10008.5.1.4.1.1.6.1"
                                                   Ultrasound Image Storage
0000C2:0002,0003 UI 0034 Media Storage SOP Instanc "1.2.840.11361907579238402167
             ... 00.4.0.1.19970120102042"
0000FE:0002,0010 UI 0012 Transfer Syntax UID      "1.2.840.10008.1.2"
                                                   Implicit VR Little Endian
000118:0002,0012 UI 0016 Implementation Class UID  "1.2.840.113754.2.1.1.0"
000136:0002,0013 SH 000E Implementation Version Na "VA DICOM V2.5"
00014C:0002,0016 AE 000A Source Application Entity "DICOM_TEST"
00015E:0008,0008 CS 001C Image Type               "ORIGINAL"
                                                   "PRIMARY"
                                                   "OBSTETRICAL"
000182:0008,0016 UI 001C SOP Class UID            "1.2.840.10008.5.1.4.1.1.6.1"
                                                   Ultrasound Image Storage
0001A6:0008,0018 UI 0034 SOP Instance UID         "1.2.840.11361907579238402167
             ... 00.4.0.1.19970120102042"
0001E2:0008,0020 DA 0008 Study Date               "19970120"
0001F2:0008,0030 TM 0006 Study Time               "102042"
000200:0008,0050 SH 0000 Accession Number         "<unknown>"
000208:0008,0060 CS 0002 Modality                 "US"
000212:0008,0070 LO 0014 Manufacturer             "G.E. Medical Systems"
00022E:0008,0080 LO 0012 Institution Name         "GE MEDICAL SYSTEMS"
000248:0008,0090 PN 0000 Referring Physician's Nam "<unknown>"
000250:0008,1010 SH 0006 Station Name             "mvme22"
00025E:0008,1090 LO 000A Manufacturer's Model Name "LOGIQ 700"
000270:0008,2122 IS 0002 Stage Number             "0"
```

```
00027A:0008,2124 IS 0002 Number of Stages        "1"
000284:0008,2128 IS 0002 View Number             "0"
00028E:0008,212A IS 0002 Number of Views in Stage "1"
000298:0010,0010 PN 0010 Patient's Name          "IMAGPATIENT1^ONE^^"
0002B0:0010,0020 LO 000C Patient ID              "000-00-0000"
0002C4:0010,0030 DA 0000 Patient's Birth Date    "<unknown>"
0002CC:0010,0032 TM 0000 Patient's Birth Time    "<unknown>"
0002D4:0010,0040 CS 0002 Patient's Sex           "F"
0002DE:0010,1020 DS 0008 Patient's Size          "0.000000"
0002EE:0010,1030 DS 0008 Patient's Weight        "0.000000"
0002FE:0010,21B0 LT 0000 Additional Patient Histor "<unknown>"
000306:0018,1000 LO 0008 Device Serial Number    "4121885"
000316:0018,1020 LO 0006 Software Version(s)     "R1.0.D"
000324:0018,6011 SQ FFFF Sequence of Ultrasound Re 1
00032C:FFFE,E000 SQ FFFF >Item Begin             1.1
000334:0018,6012 US 0002 >Region Spatial Format  "0 (0x0000)"
00033E:0018,6014 US 0002 >Region Data Type       "0 (0x0000)"
000348:0018,6016 UL 0004 >Region Flags           "0 (0x00000000)"
000354:0018,6018 UL 0004 >Region Location Min X0 "0 (0x00000000)"
000360:0018,601A UL 0004 >Region Location Min Y0 "0 (0x00000000)"
00036C:0018,601C UL 0004 >Region Location Max X1 "0 (0x00000000)"
000378:0018,601E UL 0004 >Region Location Max Y1 "0 (0x00000000)"
000384:0018,6020 SL 0004 >Reference Pixel X0     "0 (0x00000000)"
000390:0018,6022 SL 0004 >Reference Pixel Y0     "0 (0x00000000)"
00039C:0018,6024 US 0002 >Physical Units X Directi "0 (0x0000)"
0003A6:0018,6026 US 0002 >Physical Units Y Directi "0 (0x0000)"
0003B0:0018,6028 FD 0008 >Reference Pixel Physical "0"
0003C0:0018,602A FD 0008 >Reference Pixel Physical "0"
0003D0:0018,602C FD 0008 >Physical Delta X       "0"
0003E0:0018,602E FD 0008 >Physical Delta Y       "0"
0003F0:0018,6030 UL 0004 >Transducer Frequency   "0 (0x00000000)"
0003FC:0018,6032 UL 0004 >Pulse Repetition Frequen "0 (0x00000000)"
000408:FFFE,E00D SQ 0000 >Item End               1.1
000410:FFFE,E000 SQ FFFF >Item Begin             1.2
000418:0018,6012 US 0002 >Region Spatial Format  "0 (0x0000)"
000422:0018,6014 US 0002 >Region Data Type       "0 (0x0000)"
00042C:0018,6016 UL 0004 >Region Flags           "0 (0x00000000)"
000438:0018,6018 UL 0004 >Region Location Min X0 "0 (0x00000000)"
000444:0018,601A UL 0004 >Region Location Min Y0 "0 (0x00000000)"
000450:0018,601C UL 0004 >Region Location Max X1 "0 (0x00000000)"
00045C:0018,601E UL 0004 >Region Location Max Y1 "0 (0x00000000)"
000468:0018,6020 SL 0004 >Reference Pixel X0     "0 (0x00000000)"
000474:0018,6022 SL 0004 >Reference Pixel Y0     "0 (0x00000000)"
000480:0018,6024 US 0002 >Physical Units X Directi "0 (0x0000)"
00048A:0018,6026 US 0002 >Physical Units Y Directi "0 (0x0000)"
000494:0018,6028 FD 0008 >Reference Pixel Physical "0"
0004A4:0018,602A FD 0008 >Reference Pixel Physical "0"
0004B4:0018,602C FD 0008 >Physical Delta X       "0"
0004C4:0018,602E FD 0008 >Physical Delta Y       "0"
0004D4:0018,6030 UL 0004 >Transducer Frequency   "0 (0x00000000)"
0004E0:0018,6032 UL 0004 >Pulse Repetition Frequen "0 (0x00000000)"
0004EC:FFFE,E00D SQ 0000 >Item End               1.2
0004F4:FFFE,E000 SQ FFFF >Item Begin             1.3
0004FC:0018,6012 US 0002 >Region Spatial Format  "0 (0x0000)"
000506:0018,6014 US 0002 >Region Data Type       "0 (0x0000)"
000510:0018,6016 UL 0004 >Region Flags           "0 (0x00000000)"
00051C:0018,6018 UL 0004 >Region Location Min X0 "0 (0x00000000)"
000528:0018,601A UL 0004 >Region Location Min Y0 "0 (0x00000000)"
000534:0018,601C UL 0004 >Region Location Max X1 "0 (0x00000000)"
000540:0018,601E UL 0004 >Region Location Max Y1 "0 (0x00000000)"
00054C:0018,6020 SL 0004 >Reference Pixel X0     "0 (0x00000000)"
000558:0018,6022 SL 0004 >Reference Pixel Y0     "0 (0x00000000)"
000564:0018,6024 US 0002 >Physical Units X Directi "0 (0x0000)"
```

```
00056E:0018,6026 US 0002 >Physical Units Y Directi "0 (0x0000)"
000578:0018,6028 FD 0008 >Reference Pixel Physical "0"
000588:0018,602A FD 0008 >Reference Pixel Physical "0"
000598:0018,602C FD 0008 >Physical Delta X        "0"
0005A8:0018,602E FD 0008 >Physical Delta Y        "0"
0005B8:0018,6030 UL 0004 >Transducer Frequency    "0 (0x00000000)"
0005C4:0018,6032 UL 0004 >Pulse Repetition Frequen "0 (0x00000000)"
0005D0:FFFE,E00D SQ 0000 >Item End                 1.3
0005D8:FFFE,E000 SQ FFFF >Item Begin               1.4
0005E0:0018,6012 US 0002 >Region Spatial Format   "0 (0x0000)"
0005EA:0018,6014 US 0002 >Region Data Type        "0 (0x0000)"
0005F4:0018,6016 UL 0004 >Region Flags            "0 (0x00000000)"
000600:0018,6018 UL 0004 >Region Location Min X0  "0 (0x00000000)"
00060C:0018,601A UL 0004 >Region Location Min Y0  "0 (0x00000000)"
000618:0018,601C UL 0004 >Region Location Max X1  "0 (0x00000000)"
000624:0018,601E UL 0004 >Region Location Max Y1  "0 (0x00000000)"
000630:0018,6020 SL 0004 >Reference Pixel X0      "0 (0x00000000)"
00063C:0018,6022 SL 0004 >Reference Pixel Y0      "0 (0x00000000)"
000648:0018,6024 US 0002 >Physical Units X Directi "0 (0x0000)"
000652:0018,6026 US 0002 >Physical Units Y Directi "0 (0x0000)"
00065C:0018,6028 FD 0008 >Reference Pixel Physical "0"
00066C:0018,602A FD 0008 >Reference Pixel Physical "0"
00067C:0018,602C FD 0008 >Physical Delta X        "0"
00068C:0018,602E FD 0008 >Physical Delta Y        "0"
00069C:0018,6030 UL 0004 >Transducer Frequency    "0 (0x00000000)"
0006A8:0018,6032 UL 0004 >Pulse Repetition Frequen "0 (0x00000000)"
0006B4:FFFE,E00D SQ 0000 >Item End                 1.4
0006BC:FFFE,E0DD SQ 0000 >Sequence End             1
0006C4:0020,000D UI 002A Study Instance UID       "1.2.840.113619.2.21.216.700.
                 ... 0.757923840.4"
0006F6:0020,000E UI 002C Series Instance UID      "1.2.840.113619.2.21.216.700.
                 ... 0.757923840.4.0"
00072A:0020,0010 SH 0002 Study ID                 "4"
000734:0020,0011 IS 0002 Series Number            "0"
00073E:0020,0013 IS 0002 Image Number             "1"
000748:0020,0020 CS 0000 Patient Orientation      "<unknown>"
000750:0028,0002 US 0002 Samples per Pixel        "1 (0x0001)"
00075A:0028,0004 CS 000C Photometric Interpretatio "MONOCHROME2"
00076E:0028,0010 US 0002 Rows                     "480 (0x01E0)"
000778:0028,0011 US 0002 Columns                  "640 (0x0280)"
000782:0028,0100 US 0002 Bits Allocated           "8 (0x0008)"
00078C:0028,0101 US 0002 Bits Stored              "8 (0x0008)"
000796:0028,0102 US 0002 High Bit                 "7 (0x0007)"
0007A0:0028,0103 US 0002 Pixel Representation     "0 (0x0000)"
0007AA:7FE0,0010 OB B000 Pixel Data               "<image>"
"length=307200 (0x0004B000)"
"offset=1970 (0x07B2)"

End of File D:\DICOM\Image_In\A0000001.DCM  (printed 11:23 AM  18-AUG-99)
```

DICOM Element	Name
(0008,0070)	Manufacturer
(0008,1090)	Model
(0008,0060)	Modality

Table 10.4

10.4.2　　　Format of entries in Modality.DIC

For a specification of the format and content of this master file, see the *VistA Imaging DICOM Gateway Installation Guide, Appendix B.4.2* for more information about the parameters and their values.

The parameters in the line to be constructed are:

1. Manufacturer
2. Model
3. Modality
4. MAG_DCMTOTGA.exe parameters
5. Case# lookup code
6. Data extraction code
7. Data extraction file
8. Imaging Service (RAD or CON)

10.4.2.1　Parameters Numbers 1 through 3

The entry in Modality.DIC for this instrument will start with the manufacturer, model, and modality:

```
G.E. Medical Systems|LOGIQ 700|US|
```

10.4.2.2　Parameter Number 4, Image Processing

This parameter specifies how the DICOM Gateway processes the image: the format in which the full size image is stored in VistA. If a reduced-size image is stored, the parameter also specifies the framing and reduction factors the DICOM Gateway uses to produce the image.

10.4.2.3　Parameter Number 5, Accession Number Lookup Routine

This parameter specifies how the DICOM Gateway processes the image: the format in which the full size image is stored in VistA. If a reduced-size image is stored, the parameter also specifies the framing and reduction factors the DICOM Gateway uses to produce the image.

10.4.2.4　Parameter number 6, Data Extraction Routine

This parameter specifies the name of the routine that is invoked to extract and process data from the header of the image file for the diagnostic workstation.

Some commercial PACS place the proper value in the Accession Number field before sending the image to VistA.

10.4.2.5　Parameter Number 7, Text Data Extraction Element List

This parameter specifies the name of the file that contains the list of DICOM elements passed to a diagnostic workstation.

10.5 Loading data from Modality.DIC into VistA

The data in **Modality.DIC** must be loaded into the VistA Imaging DICOM Gateway via the corresponding master file build routine as described in Section 6.3.5.

10.6 Setting up the MAG CT PARAMETER File for VistARad

The MAG CT PARAMETER File (#2006.621) is used to correct problems with Hounsfield Unit (HU) calculations on certain historical CT images that have been stored in the Targa (.tga) file format. The problem may occur for some images processed by a DICOM Gateway that was configured with incorrect or inconsistent DCM-to-TGA processing parameters for the CT device. VistARad Patch 65 (and subsequent versions) can compensate for the incorrect modality processing parameters to perform corrected Hounsfield calculations, provided that some parts of the processing parameters that were used can be determined. The MAG CT PARAMETER file provides a place to maintain a date-indexed history of the processing parameters for each CT device which the VistARad client software can use to apply the correction, if needed.

Note: Images that could potentially be affected by this problem include those from any CT that was processed by a DICOM gateway *prior* to the installation of Imaging DICOM Patch 50. Images processed after installation of Patch 50 (beginning with test build T29) are *not* subject to the problem; Patch 50 was released on July 13, 2006.

Note: If this problem occurs with images acquired with different CT models, the required fix must be implemented independently for each model.

The following sections explain how to verify if this problem exists and how to correct it. Note that to research the problem and apply the fix described below, you will need:

- Access to the DICOM Menu Options menu [MAGD DICOM MENU] on the VistA system.

- Access to the Imaging server/shares where images' associated text files are stored.

- An Imaging professional or support staff member with access to VistARad for viewing CT images and performing the Hounsfield measurement function.

10.6.1 Verifying the CT HU Calculation Problem

One indicator of the problem may be noted when a standard CT preset is applied to a CT image, and the displayed image grayscale adjustment does not correspond to what a radiologist or imaging professional would expect to see (i.e., the relative gray values of different tissues do not appear correct). The other indicator of the problem is that Hounsfield measurements on the problem images will report obviously incorrect results—the incorrect measurements could be off by as little as 20 HU, or as much as 1024 HU.

A simple test to confirm that the problem exists is to perform a Hounsfield measurement of the air space captured in some images. To do this, the exam must have some images where the field of view includes some air space around the patient (i.e., between the patient and the wall of the

scanner). Note that some exams (e.g., spines) do not have any air space, so these cannot be used to confirm the problem; most head or body CT exams will be useful for researching the problem.

After locating an appropriate exam, display the exam in VistARad. Using the Hounsfield measurement tool, perform a measurement on an image by selecting some air space outside the patient. Avoid blankets or clothing, etc., and be sure to measure only inside the circular region of the chamber—avoid the corners of the image, as most CT devices hard-code dummy values in the corners.

Tip: Before using the Hounsfield measurement tool, adjust the window/level on the image to an extreme that reveals the air as gray, not black; the circular shape of the chamber should be clearly distinguishable. When selecting a region to measure, select the darkest portion of the air space. See the illustrations below that show the correct location of a Hounsfield measurement of air. One image shows a "normal" presentation, and the other illustrates how the "extreme" window/leveling can help locate the best locations for measuring the air space.
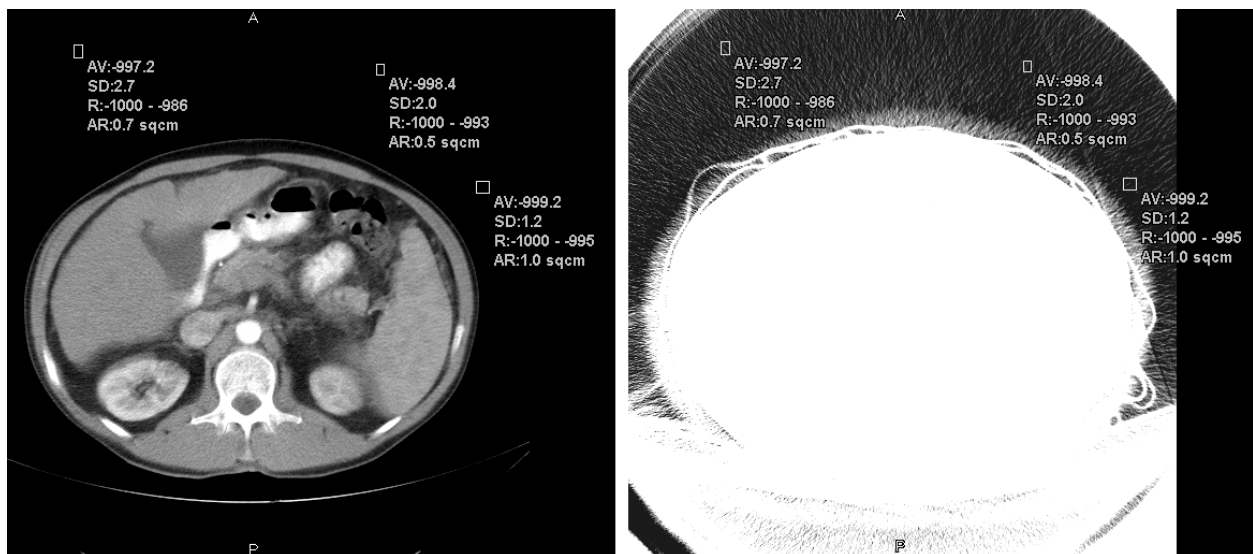
The actual HU value for air is -1,000 (minus 1,000). Perform several measurements on the image; if the Average measurements you obtain are more than 8 HU off from -1,000 (i.e., outside the range -1,008 to -992), and the Range indicated does not show a low end almost exactly equal to -1,000, then the problem is in evidence.

The above examples show expected correct HU values—note the Average (AV:) and Range (R:) values for comparison.

10.6.2 Applying the Correction

If you have confirmed that the problem exists, then log a support request with National VistA Support (NVS)—specify "Need HU Calibration" in the Remedy ticket. NVS Imaging support staff will provide assistance in determining the correct parameters needed, and make sure that the time frames that need to be covered are correctly accounted for.

You will need to provide NVS with:

1. A sample image that exhibits the problem, with the corresponding .TXT file.

2. A screen dump from the VistA menu option MAGD DICOM MENU / Display MAGD CT PARAMETER entries for your location code.

NVS will provide to you the information needed to make appropriate entries to the MAG CT PARAMETER file.

10.7   Setting up the MAG CR PARAMETER File for VistARad

The MAG CR PARAMETER File (#2006.623) is used to correct measurement problems in images acquired by Fuji CRs using specific versions of the Flash IIP console software. The affected software versions (as indicated by Fuji) were:

A09-17	A11-18
A10-06	A11-21
A11-02	A11-22
A11-12	V1.0(B)
A11-15	V2.0(B)
A11-16	V3.0(B)
A11-17	

Fuji notified sites of this problem and took corrective action in May 2004. However, images acquired before the problem was fixed will continue to underreport measurements because of an incorrect value in their DICOM header (and associated text file).

> **Note** If an intermediary device such as a DeJarnette ImageShare CR is present, affected images may be identified as being from the intermediary device, rather than from a Fuji device.

> **Note** Sites running VistARad Patch 32 are not affected by this problem. However sites that use newer VistARad versions (18 and 65) will experience this problem because newer versions of VistARad use the tag (Pixel Spacing (0018,1164)) that was incorrectly populated at acquisition.

The following sections explain how to verify if this problem exists and how to correct it. Note that to apply the fix described below, you will need:

- Access to the DICOM Menu Options menu [MAGD DICOM MENU] on the VistA system.

- Access to the Imaging server/shares where images' associated text files are stored.

10.7.1 Verifying the CR Measurement Problem

In VistARad Patch 18 and later, images with this problem will underreport length or area measurements by as much as 50 percent. If this is reported by users, locate and display the text file associated with the problematic image.

In the part of the file that contains the DICOM header information, locate the lines related to pixel spacing:

```
0018,1164|Imager Pixel Spacing^DS|1,1|0.10
...
0028,0030|Pixel Spacing^DS|1,1|0.20
```

If the values in each of these fields are the same, there is a different basis for the problem that will need to be determined (contact NVS if necessary). If the values for Imager Pixel Spacing and Pixel Spacing are different, use steps in the next section to correct the problem.

10.7.2 Applying the Correction

If it is not open already, open a text file from an image where you have verified that pixel spacing values are incorrect. Then identify the fields listed below (specific values may vary).

```
0008,0070|Manufacturer^LO|1,1|FUJI PHOTO FILM Co., ltd.
...
0008,1090|Manufacturer's Model Name^LO|1,1|5000
...
0018,1020|Software Version(s)^LO|1,1|A11-02
```

Use the Edit CR PARAMETER File [MAGD CR PARAMETER EDIT] option to update the MAG CR PARAMETER File (#2006.623) as shown below.

> **Note:** Enter values exactly as they are shown in the text file. Be sure to use the same case, spaces, punctuation etc.

```
Select OPTION NAME: MAGD CR
     1   MAGD CR PARAMETER EDIT        Edit CR PARAMETER File
     2   MAGD CR PARAMETER INQUIRY      Display MAGD CR PARAMETER entries
CHOOSE 1-2: 1  MAGD CR PARAMETER EDIT     Edit CR PARAMETER File
Edit CR PARAMETER File


          ** Enter/Edit MAG CR PARAMETER data **

Select MAG CR PARAMETER LOCATION: 363  <division where images were acquired>
LOCATION: 363//
Select MANUFACTURER: FUJI// FUJI PHOTO FILM Co., ltd.
  Are you adding ' FUJI PHOTO FILM Co., ltd.' as a new MANUFACTURER (the   2ND
for this MAG CR PARAMETER)? No// Y  (Yes)
  Select MODEL: 5000
Are you adding '5000' as a new MODEL (the 1ST for this MANUFACTURER)? No// Y
(Yes)
    Select SOFTWARE VERSION: A11-02
Are you adding 'A11-02' as a new SOFTWARE VERSION (the 1ST for this MODEL)?
No// Y  (Yes)
      USE OLD PIXEL SPACING VALUE: Y  YES
    Select SOFTWARE VERSION:
  Select MODEL:
Select MANUFACTURER:
```

When you have finished, use VistARad to open the exam in question and make sure measuments are reported correctly.

Chapter 11   Diagnostic Tests

This chapter describes some simple diagnostic tests that are useful when troubleshooting a problem in an installation containing a VistA Imaging DICOM Gateway. (See the VistA Imaging DICOM Gateway Installation Guide for additional tests.)

11.1   PING

Probably the most useful command for network troubleshooting is PING, which, like the navy destroyers of old, listens for an echo response from its destination. The pinging of Forum, the VA email system, is shown below:

```
C:\> ping forum <Enter>

Pinging FORUM [11.22.33.44] with 32 bytes of data:

Reply from 11.22.33.44: bytes=32 time<10ms TTL=254
Reply from 11.22.33.44: bytes=32 time<10ms TTL=254
Reply from 11.22.33.44: bytes=32 time<10ms TTL=254
Reply from 11.22.33.44: bytes=32 time<10ms TTL=254
```

or

```
Request timed out.
Request timed out.
Request timed out.
Request timed out.
```

The above example shows the results of a successful and an unsuccessful PING. PING issued four impc requests, and four (or zero) impc responses were received.

A system should <u>always</u> be able to ping its TCP/IP default gateway. A good initial test for physical network integrity is to try to ping the system's default gateway.

Note: While most DICOM devices support PING in both directions, at least one commercial DICOM image acquisition device (the GE Digital Radiofluoro DRS 3.1) simulates an artificial PING function by attempting to establish an FTP session with the destination system. This does not work with the VistA DICOM system, since Windows workstations do not normally provide an FTP server.

11.2   DICOM Echo

This program verifies that a connection can be made between the processor on which it is started and a DICOM compatible instrument on a specified network location. It is the most useful tool for testing DICOM application connectivity.

This program can be started from the MS-DOS prompt. The syntax to call the program is:
```
> DICOM_Echo <ip_address> <port>
```

For example:

```
D:\>DICOM_Echo 127.0.0.1 60010 <Enter>
Echo context: Context
Verification Response
  Message ID Responded to:     1
  Verification Status:      0000
Echo Response
Message ID Responded To: 1
Data Set Type:             0101
Status:                    0000  Status Information:-
        Successful operation
Class UID:                 1.2.840.10008.1.1

D:\>
```

When no connection can be established, the error message will look like:

```
D:\>DICOM_Echo 127.0.0.1 60010 <Enter>
Abnormal exit
   60012 TCP Initialization Error: Bad file descriptor
  130012 Peer aborted Association (or never connected)
  180012 Failed to establish association

D:\>
```

When troubleshooting any problem related to the communication between two DICOM-compatible instruments, the first step should always be to verify that PING works, and the second step should be to verify that the DICOM Echo works.

11.3   Sending a Test Image

Normally, the instruments send images. For testing or training purposes, it is convenient to transmit images at will. The utility program Send_Image transmits a specified image file to a designated storage server and can be used for testing.

This program can be started from the MS-DOS prompt. The syntax to call the program is:
```
> Send_Image <ip_address> <port> <image_file> <image_file> …
```

For example:

```
D:>Send_Image 127.0.0.1 60120 I:\samples\pacemkr.dcm <Enter>
Association accepted, parameters:
APP CTX NAME:1.2.840.10008.3.1.1.1
            Application Context Name, NEMA
AP TITLE:      DICOM_TEST
AP TITLE:      DICOM_STORAGE
AP TITLE:      DICOM_STORAGE
MAX PDU:       16384
Peer MAX PDU: 32768
PRES ADDR:     isw-de
PRES ADDR:     127.0.0.1:60120
REQ IMP UID:  1.2.840.113654.2.3.1995.2.10.0
```

```
           Implementation Class UID, MIR
REQ VERSION:  MIRCTN03AUG98
ACC IMP UID:  1.2.840.113754.2.1.1.0
           Unknown UID
ACC VERSION:  VA DICOM V2.5
Requested Presentation Ctx
  Context ID:          1
  Abstract Syntax:       1.2.840.10008.5.1.4.1.1.1
                         Computed Radiography Image Storage, NEMA
  Result field:         0
  Proposed SCU/SCP Role:  SCU
  Accepted SCU/SCP Role:  Default
  Proposed Xfer Syntax(es)
              1.2.840.10008.1.2
              Implicit Little-Endian Transfer Syntax, NEMA
  Accepted Xfer Syntax:
                         No UID
Accepted Presentation Ctx
  Context ID:          1
  Abstract Syntax:       1.2.840.10008.5.1.4.1.1.1
                         Computed Radiography Image Storage, NEMA
  Result field:         0
  Proposed SCU/SCP Role:  SCU
  Accepted SCU/SCP Role:  Default
  Proposed Xfer Syntax(es)
  Accepted Xfer Syntax: 1.2.840.10008.1.2
                         Implicit Little-Endian Transfer Syntax, NEMA
Initial call to sendCallback
       0 bytes transmitted of  6557696 (context string)
   16364 bytes transmitted of  6557696 (context string)
   32728 bytes transmitted of  6557696 (context string)
. . .
 6545600 bytes transmitted of  6557696 (context string)
 6556330 bytes transmitted of  6557696 (context string)
 6557696 bytes transmitted of  6557696 (context string)
Store Response
Message ID Resp:1
Data Set Type:  0101
Status:         0000  Status Information:-
     Successful operation
Class UID:       1.2.840.10008.5.1.4.1.1.1
Instance UID:    1.3.46.670589.8.9221400214003.96.8.12.11.12.53.26711
Store Response
Message ID Resp:1
Data Set Type:  0101
Status:         0000  Status Information:-
     Successful operation
Class UID:       1.2.840.10008.5.1.4.1.1.1
Instance UID:    1.3.46.670589.8.9221400214003.96.8.12.11.12.53.26711
D:>
```

When the destination DICOM Storage Server is not running, the error message will look like:

```
D:>Send_Image 127.0.0.1 60120 I:\samples\pacemkr.dcm <Enter>
D:\edm\MAG 10:38:43>send_image 127.0.0.1 60120 i:\samples\pacemkr.dcm
Abnormal exit
```

```
   60012 TCP Initialization Error: Bad file descriptor
  130012 Peer aborted Association (or never connected)
  180012 Failed to establish association

D:>
```

Sometimes it is necessary to transmit a set of images. A **FOR-LOOP** can be used with `Send_Image` for this purpose. The following steps describe one way to do this:

1. Create a temporary directory to contain the set of image.
2. Copy all of the images to the temporary directory.
3. Start a **CMD** session and **CD** to the temporary directory. You should have just the images that you want to send.
4. Run the following command line:

> **for %f in (*.dcm) do send_image <ip_address> <port> %f**

This procedure will send each DICOM image in the directory to the Storage process running on the specified port of the system with the designated IP address.

Chapter 12 Image Transfer from Commercial PACS - DICOM Exam Complete

This is the method used by the GEMS PACS when configured with the Mitra PACS Broker and by the EMED PACS.

12.1   Overview

The following sequence of messages and events are used in the commercial PACS interface (see Figure 12.1 below).

1. The Order Entry message is sent to the commercial PACS when the patient arrives in Radiology and the case number is assigned to the study. This also puts the imaging service request on the VistA Modality Worklist Provider.

2. The patient is moved to the image acquisition modality.

3. The image acquisition modality retrieves the information about the study from the VistA Modality Worklist.

4. The modality acquires the images and sends them to the commercial PACS.

5. The technologist performs CASE EDIT using the VistA Radiology package to mark the completion of the acquisition of the images. This information is conveyed to the PACS in the Exam Verification message (where it is usually ignored). The same event removes the imaging service request from the VistA Modality Worklist Provider.

6. The PACS sends the Exam Complete message to VistA when it is ready to transfer the images. At what time this occurs depends upon the commercial PACS implementation. The Exam Complete message contains the Study Instance UID (0020,000D) that is needed to retrieve the images.

7. The VistA DICOM Image Gateway issues a C-MOVE Request to initiate the transfer of copies of the images from the commercial PACS to the VistA DICOM Image Gateway.

8. The commercial PACS uses the MAG_C-STORE service to transfer each image to the VistA DICOM Image Gateway.

9. The commercial PACS sends one or more C-MOVE Responses to the VistA DICOM Image Gateway. The last C-MOVE Response is required to complete the transfer operation. (Intermediate C-MOVE Responses are optional, and are used to provide progress information about the request.)

The detailed operation of steps 6-9 is presented in the following sections.
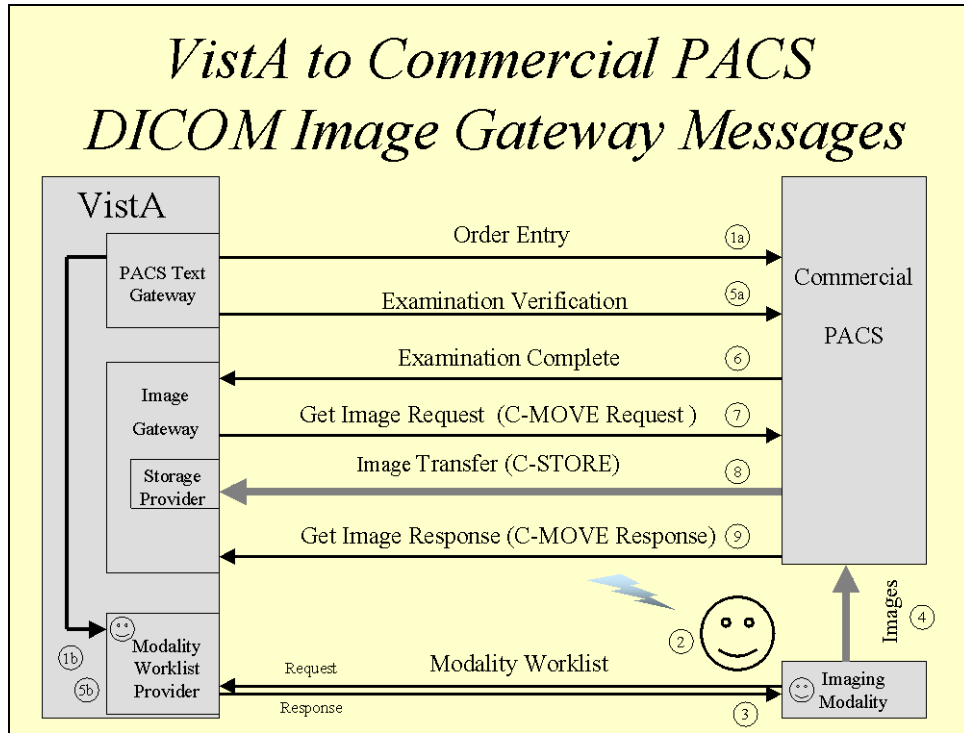
Figure 12.1

12.2 Query/Retrieve

Query/Retrieve is the name of a set of DICOM functions (SOP Classes) that are used to interrogate a DICOM image server for patient, study, and image text data, and to obtain images. In general, there are three separate DICOM services involved:

C-FIND	Queries a DICOM server for information about stored objects. (Not used for this application, but needed for the ACR-NEMA protocol.)
C-MOVE	Requests a set of images to be transferred from one DICOM Application Entity to a DICOM Storage Application Entity.
MAG_C-STORE	Transfers images from one DICOM Application Entity to a DICOM Storage Application Entity.

With the VistA – commercial PACS interface, the first service is not necessary, since the Exam Complete message provides the Study Instance UID.

Image retrieval is then a two-step process combining the last two services. The Study Instance UID from the Exam Complete message is used to specify in a **C-MOVE** request the set of images to be transferred to a designated storage application entity, and then the images are transferred using **MAG_C-STORE**.

12.3   VistA DICOM Image Gateway Processes

Five window processes need to run on a VistA DICOM Image Gateway to receive images from a commercial PACS:

1. Receive Exam Complete – listener process that accepts Exam Complete messages sent by the commercial PACS.

2. Request Image Transfer – sends the C-MOVE request to the commercial PACS and receives and handles the C-MOVE response messages from the commercial PACS.

3. MAG_C-STORE Provider – receives the images from the commercial PACS.

4. Process DICOM Images – creates the association between study in the main patient record database and corresponding images; stores the images on the file server.

5. Imaging Status – provides up-to-date statistics on the entire sequence of processes.

12.4   Configuration Preparation for PACS Interface

12.4.1   Gateway Parameters for PACS

The VistA DICOM Image Gateway parameters must be configured to handle transmission of images from the commercial PACS. On the "System Maintenance" menu, "Gateway Configuration and DICOM Master Files" submenu, select the "Update Gateway Configuration Parameters" option. Answer the following two questions as shown:

```
Is a PACS going to send Exam Complete messages to VistA? YES// Y

Select the kind of commercial PACS at this site
-------------------------------------------------
    1 - GE Medical Systems PACS with Mitra PACS Broker
    2 - GE Medical Systems PACS with ACR-NEMA Text Gateway
    3 - eMed Technology Corporation PACS
    4 - Other commercial PACS

What kind of a PACS?  2// 1  GE Medical Systems PACS with Mitra PACS Broker
```

This will enable the "Receive PACS Exam Complete Messages" and "Send PACS Request Image Transfer Messages" options on the "Image Gateway" menu.

12.4.2   Receive Exam Complete Messages

Create an entry in the **Portlist.DIC** master file to designate the port on which the VistA DICOM Image Gateway will receive Exam Complete messages.
The port number in such an entry should be 60041. The entry in the Portlist.DIC should look as follows:

```
#Menu Option|AE Title|Port|File Mode (FIFO QUEUE or DIRECT)|CHANNEL
Exam Complete|VistA_PACS_IF|60041|DIRECT|1
```

Notify the commercial PACS personnel that they must create an entry on their system to send the Exam Complete messages to:

- AE Title: "**VISTA_PACS_IF**"
- IP-Address: address of the VistA DICOM Image Gateway
- Port number: 60041

12.4.3 C-STORE Provider

Create an entry for the PACS in the **Instrument.DIC** master file to designate the port on the VistA DICOM Image Gateway for receiving images.

Select a convenient image acquisition port number (that is, 60100-60999, or possibly 104). The recommended abbreviation for this C-STORE Provider is "**PACS**". Create the associated shortcut to MAG_cstore.exe.

Notify the commercial PACS personnel that they must create an entry on their system to send images to.

- AE Title: "**VISTA_STORAGE**"
- IP-Address: address of the VistA DICOM Image Gateway
- Port number: 60nnn (or 104)

12.4.4 Send PACS Request Image Transfer Messages

Create an entry for the PACS in the **SCU_List.DIC** master file to designate the IP address, port number, and application entity title on the commercial PACS for the C-MOVE requests send by VistA.

The entry must have the name **PACS QUERY/RETRIEVE**.

Example:

```
# User Application List
# Format:
# line 1:Application Name|Called AET|Calling AET|Destination IP Address|Port
# line 2:|Presentation Context Name|Transfer Syntax Name
# line 3:||Transfer Syntax Name (if there are more than one)
#
PACS Query/Retrieve|QueryRetrieve|VISTA_QR_SCU|111.222.333.444|104
|Verification SOP Class|Implicit VR Little Endian
|Study Root Query/Retrieve Information Model – FIND|Implicit VR Little Endian
|Study Root Query/Retrieve Information Model – MOVE|Implicit VR Little Endian
# End of File
```

Note that the Called Application Entity Title, Destination IP Address and Port Number are obtained from the commercial PACS vendor. The Calling Application Entity Title must be **VistA_QR_SCU**.

Observe also that the "Study Root Query/Retrieve Information Model – **FIND**" is included in the presentation context name list. (It is needed for future applications.)

12.4.5 Process DICOM Images

No additional setup required.

12.4.6 Display Real-Time Storage Server Statistics

No additional setup required.

12.5 Startup Sequence for Commercial PACS Interface

Use the following sequence of steps to start the VistA DICOM Image Gateway for the commercial PACS:

1. Make sure that the Caché Server is running (the Caché Cube should be blue). If the cube is grey, right-click it, and select **Start Caché**.
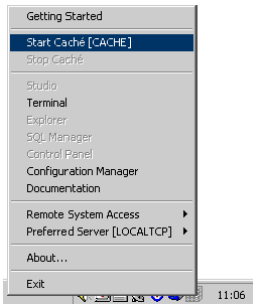
2. From the Windows Start Menu, select the C-Store program for the application labeled PACS (start at the **Start** Button, the navigate to **All Programs → VistA Imaging Programs → DICOM → Instruments → PACS**).
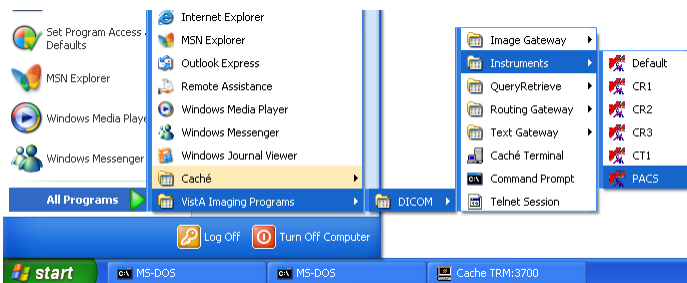

If a session is running the application that displays current activity logs, some activity should be visible in the window for that session.

3. From the Windows Start Menu, select the telnet session for the application that processes Exam Complete Messages (start at the **Start** Button, the navigate to **All Programs → VistA Imaging Programs → DICOM → Image Gateway → Exam Complete**).
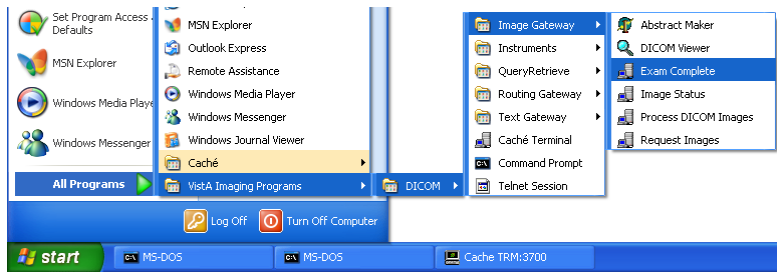
4. From the Windows Start Menu, select the telnet session for the application that requests Images from the PACS (start at the **Start** Button, the navigate to **All Programs → VistA Imaging Programs → DICOM → Image Gateway → Request Images**).
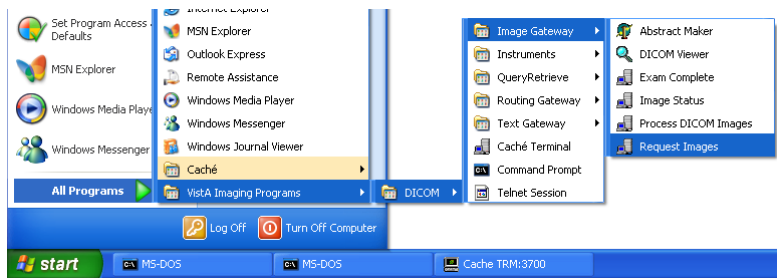
5. From the Windows Start Menu, select the telnet session for the application that displays the status of Image Processing (start at the **Start** Button, the navigate to **All Programs → VistA Imaging Programs → DICOM → Image Gateway → Image Status**).
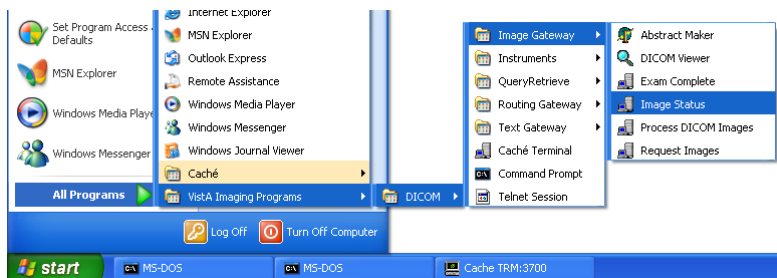
Chapter 13 Autorouting Images from PACS to VistA

Some commercial PACS (like AGFA, BRIT, and KODAK CEMAX-ICON) automatically route all images to VistA and do not use the Exam Complete message and Query/Retrieve C-MOVE service described in Chapter 12.

The VistA interface for these PACS is simpler to setup and easier to operate. The commercial PACS looks like a single-image acquisition modality to VistA, albeit a prolific one.

13.1   Configuration Preparation for PACS Interface

13.1.1   Gateway Parameters

The VistA DICOM Image Gateway parameters must be configured to handle transmission of images from the commercial PACS . On the "System Maintenance" menu, "Gateway Configuration and DICOM Master Files" submenu, select the "Update Gateway Configuration Parameters" option. Answer "NO" to the following question:

```
Is a PACS going to send Exam Complete messages to VistA? NO
```

This will disable the "Receive PACS Exam Complete Messages" and "Send PACS Request Image Transfer Messages" options on the "Image Gateway" menu.

13.1.2   C-STORE Provider

Create an entry for the PACS in the **Instrument.DIC** master file to designate the port on the VistA DICOM Image Gateway for receiving images.

Select a convenient image acquisition port number (that is, 60100-60999, or possibly 104). The recommended abbreviation for this C-STORE Provider is "**PACS.**" Create the associated shortcut to MAG_cstore.exe.

Notify the commercial PACS personnel that they must create an entry on their system to send images to:

- AE Title: "**VISTA_STORAGE**"
- IP-Address: address of the VistA DICOM Image Gateway
- Port number: 60nnn (or 104)

13.2   Startup Sequence for commercial PACS

The startup of the VistA DICOM Image Gateway is exactly the same as that for an image acquisition modality interface.

Chapter 14 VistA DICOM Interface for Healthcare Providers Operation

14.1 Introduction

DICOM was developed for radiology and was first supported for that service. The VistA DICOM Interface for Healthcare Providers supports image acquisition devices in the clinical specialties outside of radiology. It is a bi-directional interface that allows the image acquisition device to download patient and study information from CPRS Consults Request Tracking and to upload images to VistA, where they are automatically associated with the corresponding patient consult or procedure request and stored in the multimedia database.

The VistA DICOM Interface for Healthcare Providers uses CPRS Consult Request Tracking and the Appointment/Scheduling module of the Patient Information Management System (PIMS) to pass data to the DICOM Text Gateway. Each image acquisition device downloads the patient name, patient id, and accession number from the DICOM Text Gateway, and stores them in the header of every image. When the gateway receives the images, it uses these three values to identify the patient and the corresponding consult or procedure request. The gateway then links the images to the most recent TIU note for the request. If a TIU note is not present at that moment, the application waits for it to be generated and links the images to it when it is created. The interface is totally automatic and completely transparent to the CPRS user.

The DICOM interface supports CPRS Consults, Procedures and Clinical Procedures, but not Progress Notes.

14.2 Workflow for the Healthcare Providers

The CPRS Consult Request Tracking application is used in the clinical specialties for order entry, request tracking, and result reporting. The PIMS Scheduling/Appointment module (which is separate from CPRS) is used for scheduling clinic visits. The following steps are performed for both consult and procedure requests:

1. The clinician enters an order for a consultation, a procedure, or a clinical procedure.
   a. The consult service gets notified about the request.
   b. The consult service may accept the request with notification sent back to the patient's clinician.
   c. Alternatively, the consult service may forward the request to a different service; or
   d. The consult service can discontinue or cancel the request.
2. The consult service schedules an appointment for the patient.
3. The consult service checks the patient in when the patient arrives for the appointment.
4. The patient arrives at the image acquisition workstation.

5. The technologist at the image acquisition workstation uses Modality Worklist to download patient and study information to the workstation.

6. The technologist acquires the images from the patient and sends them to VistA.

7. The technologist verifies that the images are correctly associated with the patient's study on VistA.

8. The patient leaves the image acquisition workstation. The consult service checks the patient out when s/he leaves.

9. The specialist performs a diagnostic reading of the images.

10. The diagnostic report is entered.

11. The consult request is completed by electronic signing the report.

12. Clinicians review the diagnostic report and the images.

There is quite a bit of flexibility for different workflow scenarios. Some of the CPRS steps can be omitted and all of the PIMS Scheduling/Appointment module messages are optional. It is absolutely essential, however, to complete each CPRS consult/procedure request by entering a signed TIU result note. Otherwise, the images will not be properly associated and the request will remain on the worklist.

14.3   DICOM Modality Worklist for Healthcare Providers

The VistA DICOM Text Gateway supports a DICOM service called Modality Worklist, which is used to pass patient demographics and ordering information to the image acquisition device. All new DICOM image acquisition devices (that is, the modalities) are required by the VA to support the Modality Worklist service and be able to automatically download selected patient and study information. The DICOM interface receives information from the CPRS Consult/Procedure Request Tracking application and the VistA Appointment Management package during various steps of the workflow. The ordering, accepting, scheduling, check-in, and result entry steps in the workflow are used to create and update the Modality Worklist database, while the consult/procedure completion step causes entries to be deleted.

14.3.1   Obtaining Information for the Modality Worklist Database

The DICOM interface assumes that each clinical specialty uses the CPRS Consult Request Tracking package to manage consult and procedure workflow, and uses the VistA Appointment Management package to handle scheduling details (see Figure 14.1 below). Information about the request (patient demographics, ordering details -- why is the consult or procedure ordered, what service will perform the request, etc.) flows from the CPRS Consult Request Tracking package to the VistA DICOM Text Gateway. Similarly, scheduling information (when will the request will be performed and in which clinic) is sent from the Appointment Management package to the VistA DICOM Text Gateway.
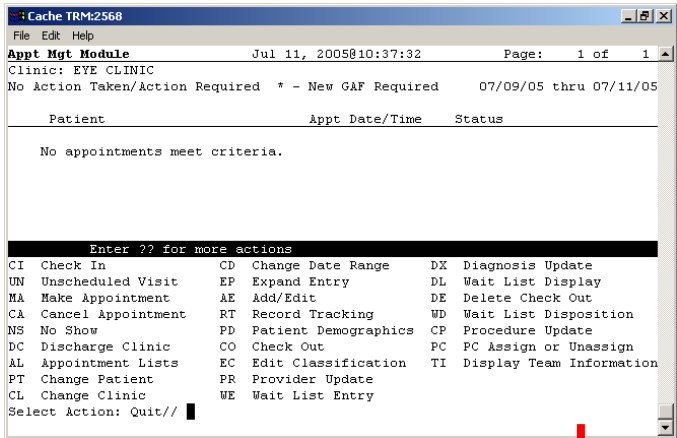
CPRS Consult Request
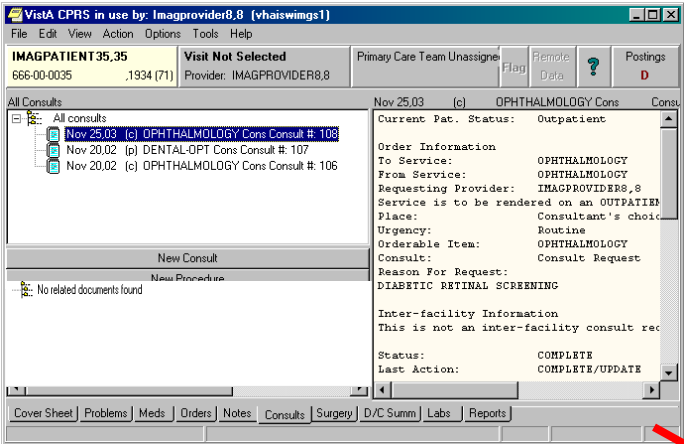
VistA Appointment

Figure 14.1 – Two Inputs to DICOM Gateway

14.3.2   Image Acquisition Devices Queries the Modality Worklist

The image acquisition device queries the DICOM Text Gateway to obtain information about the patients and studies that are currently active (see Figure 14.2 below). This information is then stored in the DICOM objects generated by the image acquisition device.

A broad modality worklist query produces a list for all the pending and scheduled consults and procedures for that clinical specialty. The DICOM Text Gateway also supports a "Quick PID" patient query, which may be more useful. This is a hash index, which uses an abbreviated identifier consisting of the first letter of the last name follow by the last four digits of the social security number (for example, K1234). This value is then used in either the Patient Name or Patient ID matching key to retrieve all of the consult/procedure requests for the patient. Using "Quick PID" is the fastest and most reliable way to obtain this data.

The internal entry number (IEN) of the consult or procedure request is used as the accession number.   The accession number identifies the consult/procedure and is displayed on the CPRS screen with the request.   This value can be used in either the Accession Number or Requested Procedure ID matching key to retrieve the specific request. (This is more useful for radiology than the clinical specialties, however.)
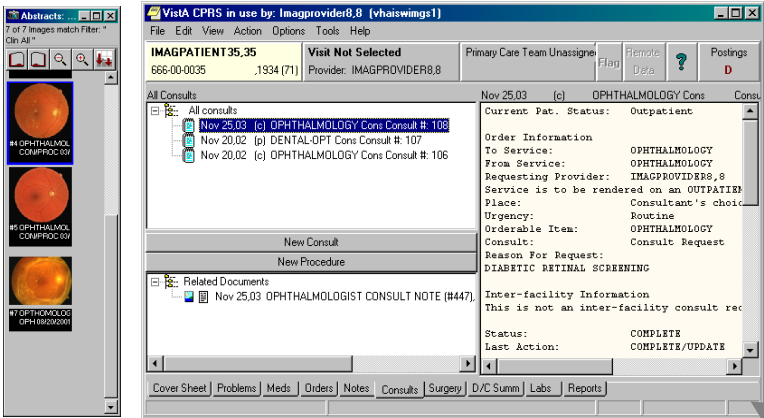

Figure 14.2 – Modality Worklist Query

14.4   Image Acquisition and Association

When images are acquired by the modality and are sent to VistA, they are associated with the corresponding CPRS consult or procedure request and are stored on VistA (see Figure 14.3 below). The images are attached to the most recent TIU result note for the request. If no TIU result note exists, the images are placed in a temporary file until the result note is entered. The images are then attached to the first TIU result that is entered.
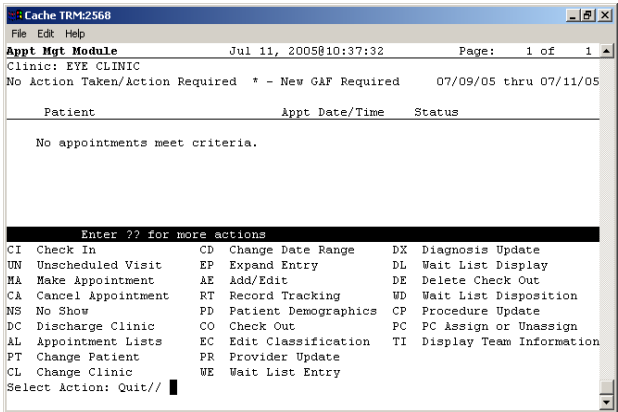
CPRS Consult Request

VistA Appointment

Abstracts: ...
7 of 7 images match Filter: "
Clin All "

#4 OPHTHALMOL
CON/PROC 03/

#5 OPHTHALMOL
CON/PROC 03/

#7 OPTHOMOLOG
OPH 08/20/2001

VistA CPRS in use by: Imagprovider8,8 (vhaiswimgs1)
File Edit View Action Options Tools Help

IMAGPATIENT35,35 | **Visit Not Selected** | Primary Care Team Unassigned | Flag | Remote Data | ? | Postings
666-00-0035 | ,1934 (71) | Provider: IMAGPROVIDER8,8 | | | | D

All Consults   Nov 25,03   (c)   OPHTHALMOLOGY Cons   Consu

All consults
  Nov 25,03 (c) OPHTHALMOLOGY Cons Consult #: 108
  Nov 20,02 (p) DENTAL-OPT Cons Consult #: 107
  Nov 20,02 (c) OPHTHALMOLOGY Cons Consult #: 106

New Consult
New Procedure

Related Documents
  Nov 25,03 OPHTHALMOLOGIST CONSULT NOTE (#447),

Current Pat. Status: Outpatient

Order Information
To Service: OPHTHALMOLOGY
From Service: OPHTHALMOLOGY
Requesting Provider: IMAGPROVIDER8,8
Service is to be rendered on an OUTPATIEN
Place: Consultant's choic
Urgency: Routine
Orderable Item: OPHTHALMOLOGY
Consult: Consult Request
Reason For Request:
DIABETIC RETINAL SCREENING

Inter-facility Information
This is not an inter-facility consult rec

Status: COMPLETE
Last Action: COMPLETE/UPDATE

Cover Sheet | Problems | Meds | Orders | Notes | Consults | Surgery | D/C Summ | Labs | Reports

Cache TRM:2568
File Edit Help

Appt Mgt Module   Jul 11, 2005@10:37:32   Page: 1 of   1
Clinic: EYE CLINIC
No Action Taken/Action Required * - New GAF Required   07/09/05 thru 07/11/05

    Patient   Appt Date/Time   Status

    No appointments meet criteria.

          Enter ?? for more actions
CI Check In   CD Change Date Range   DX Diagnosis Update
UN Unscheduled Visit   EP Expand Entry   DL Wait List Display
MA Make Appointment   AE Add/Edit   DE Delete Check Out
CA Cancel Appointment   RT Record Tracking   WD Wait List Disposition
NS No Show   PD Patient Demographics CP Procedure Update
DC Discharge Clinic   CO Check Out   PC PC Assign or Unassign
AL Appointment Lists   EC Edit Classification TI Display Team Information
PT Change Patient   PR Provider Update
CL Change Clinic   WE Wait List Entry
Select Action: Quit//

Imaging Modality

DICOM Gateway

Figure 14.3 – Image Acquisition

14.5   Image Verification

After the images have been acquired and sent to VistA, the technologist should view the images using the VistA Imaging Display application (see Figure 4 below). The ICON on the CPRS note will not be present because a result has not yet been entered.

The technologist should verify that all the images that were acquired are present on VistA, that they are displayed properly, that they are the correct images, and that there are no unexpected additions (that is, images from another patient).

The patient should be allowed to leave the image acquisition device only after the technologist has successfully verified the images.

14.6   Entering a TIU Result Note and Completing the Consult

The specialist should perform a diagnostic interpretation of the images, enter the TIU result note, and complete the consult by electronically signing it.   These two steps are necessary for the proper operation of the interface. The images are permanently linked to the TIU result note so that they can be viewed from the CPRS Consult tab. Completing the consult removes the request from the Modality Worklist.

14.7   Viewing Images

Images can be viewed from the VistA Imaging Display application (see Figure 14.4 below). After a TIU result note is entered for the consult/procedure, they can also be viewed from the CPRS Consult tab. (Until the TIU result note is entered, this capability is not supported.)

CPRS Consult Request Tracking

Image icon on CPRS note
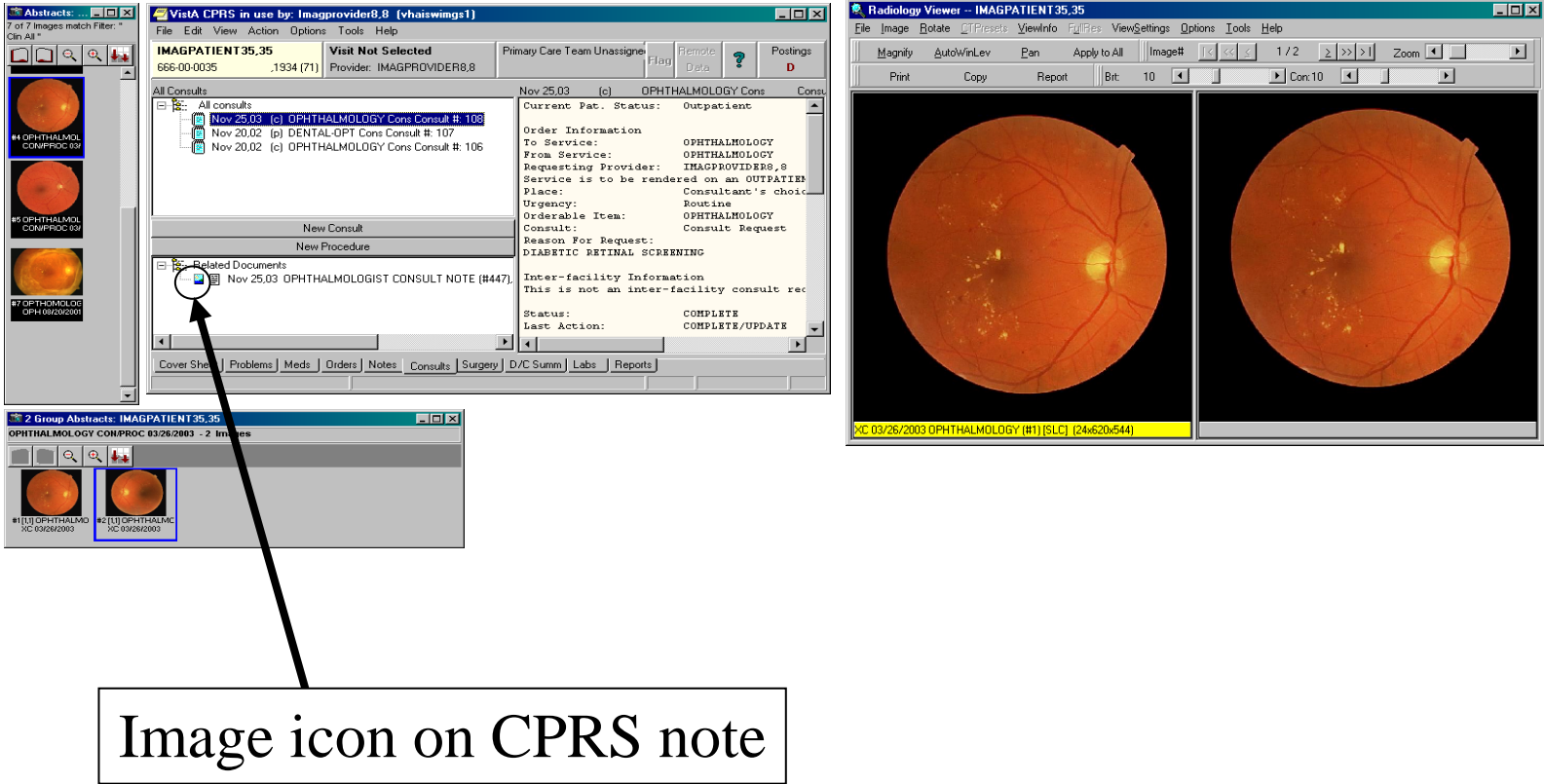
Figure 14.4 – Viewing Images

14.8   Handling Follow-Up Visits

There is a requirement on follow-up visits to acquire addition images for the original request but to keep them separate from those obtained earlier. Since the consult was most likely already completed and the worklist entry was deleted, this almost always requires the modality worklist entry to be recreated in order for additional images to be entered. This can be accomplished by entering an unsigned TIU result note to re-open the request. Images that are subsequently acquired are associated with this TIU result note. Signing this TIU result note "completes the request again" and removes it from the worklist.

This process can be repeated any number of times. The images that are acquired are always associated with the most recently opened TIU result note.

14.9   Listing of Unread Studies

The List Unread Studies [MAGD LIST UNREAD STUDIES] option on the VistA HIS can be used to provide a listing of the CPRS consult and procedure requests for which images have been acquired but have not yet been resulted. See Section 14.6 above about resulting and completing consults requests.

```
UNREAD LIST FOR HEALTHCARE PROVIDERS

 1)   660 -- SALT LAKE CITY -- OPHTHALMOLOGY
 2)   660 -- SALT LAKE CITY -- DENTISTRY
 3)   688 -- WASHINGTON, DC -- CRITICAL CARE, MED

Select the proper service (1-3) or enter ALL: 1

Display studies older than how many days?  0// 10

Sort by patient name or examination date? (N or D) D// n

DEVICE: HOME//   TELNET

Building........

UNREAD LIST FOR HEALTHCARE PROVIDERS                    AUG 19, 2003@10:00:10
660 -- SALT LAKE CITY -- OPHTHALMOLOGY
Studies more than 10 days old sorted by name

IMAGPATIENT,ONE   000-84-4831   (MALE)   1929
  NOV 12,02 (a) OPHTHALMOLOGY  Consult #100                 Exam: NOV 12,02
  NOV 12,02 (a) OPHTHALMOLOGY  Consult #100                 Exam: NOV 12,02

IMAGPATIENT,TWO   000-67-1123   (MALE)   1919
  MAR 27,03 (p) OPHTHALMOLOGY  Consult #125                 Exam: MAR 27,03
  JUN 30,03 (p) OPHTHALMOLOGY  Consult #145                 Exam: JUN 30,03

IMAGPATIENT,THREE   000-02-6001   (MALE)   1936
  JUN 20,03 (pr) OPHTHALMOLOGY  Consult #142                Exam: JUN 20,03
  JUN 20,03 (pr) OPHTHALMOLOGY  Consult #143                Exam: JUN 20,03

IMAGPATIENT,FOUR   000-05-2361   (MALE)   1896
  MAY 27,03 (p) OPHTHALMOLOGY  Consult #137                 Exam: MAY 27,03

IMAGPATIENT,FIVE   000-91-9678   (MALE)   1932
  NOV 14,02 (p) OPHTHALMOLOGY  Consult #101                 Exam: JUN 13,03
```

Appendix A   VistA Imaging Query/Retrieve Application

A.1   Overview

The Query/Retrieve application is used by outside devices to retrieve studies from VistA Imaging. 'Outside devices' are devices such as a commercial PACS or specialty systems such as cardiology workstations, PET/CT fusion workstations, or radiation treatment planning systems.

Once the Query/Retrieve application is configured and running, it operates without manual intervention. There are no application-level limitations on the number of devices that can be serviced by an instance of the Query/Retrieve application. However, hardware and network capacity considerations do apply.

Use of the Query/Retrieve application is subject to the following requirements:

- The Query/Retrieve application must be installed and configured as described in the *VistA Imaging DICOM Gateway Installation Guide*.

- Any device that will be using the Query/Retrieve application to retrieve studies from VistA must be validated before use. A list of approved devices, contact information, and an explanation of the device validation test procedure is posted at: http://www.va.gov/IMAGING/docs/VistA_Imaging_DICOM_Modality_Interfaces.pdf .

- Images associated with patients designated as "sensitive" can also be retrieved. The data elements are not masked, allowing both the patient and the provider to be identified.

WARNING: Because the medical records of sensitive patients are not blocked and because the data in these records is not masked, control of these records is achieved through the set of authorized users that can query and access the VistA database. It is the responsibility of the VA Medical center that is providing the records that are retrieved using Patch 66 (and Query/Retrieve) to ensure that the privacy guidelines of HIPAA, the Federal Privacy Act, VA Directive 6500, and all other applicable regulations are met. For more information about patient privacy and patient privacy regulations, consult your local Privacy and Security Officers.

WARNING: If a VA Medical Center plans to provide access to Query/Retrieve (Patch 66) to a DICOM device outside the VA, before implementing and activating the connection, the system administrator at the site must consult the site Information Security Officer and ensure that the facility has a properly signed Business Associate Agreement (BAA).

A. 1.1 DICOM Requirements

The Query/Retrieve application supports the following SOP (Service Object Pair) classes as a DICOM (Digital Imaging and Communications in Medicine) SCP (Service Class Provider).

- Study Root Query/Retrieve Information Model – FIND

- Study Root Query/Retrieve Information Model – MOVE

The Query/Retrieve application will respond to query and move requests from valid DICOM SCUs (Service Class Users). Only Study Root/Study Level queries are supported.

The following is a partial list of the attributes that can be used in a query:

DICOM Attribute	VistA Equivalent
Study Date (0008,0020)	Exam Date field in RAD/NUC MED PATIENT file (#70.02,.01)
Study Time (0008,0030)	Exam Date field in RAD/NUC MED PATIENT file (#70.02,.01)
Study ID (0020,0010)	Case Number field in RAD/NUC MED PATIENT file (#70.03,.01)
Patient's Name (0010,0010)	Name field in PATIENT file (#2,.01)
Patient ID (0010,0020)	Social Security Number field in PATIENT file (#2,.09)
Accession Number (0008,0050)	Exam Date and Case number fields in RAD/NUC MED PATIENT file (#70.02,.01) and (#70.03,.01)

For complete list of attributes, see the *VistA Imaging DICOM Conformance Statement* as revised for Patch 66.

A1.2 Query/Retrieve vs. Other Methods for Moving Images

With the introduction of the Query/Retrieve application, there are three ways to send exams from VistA to outside devices such as a commercial PACS or specialty workstation. All methods assume that the outside device is a DICOM-compliant Storage SCP (Service Class Provider).

Method	Details
Query/Retrieve application	Ad hoc retrieval of studies on a patient-by-patient basis. Retrieval is initiated by the outside device.
Automatic routing	Rules-based delivery of newly acquired studies; rules are highly configurable; automatic retrieval of related priors is available. Once a rule is implemented and applicable studies are acquired, no manual intervention is needed. For more information, see the *Routing User Guide*.

Method	Details
On-demand routing	Ad hoc delivery of studies; a VistARad user or a DICOM Gateway administrator selects each study and pushes each study to the outside device. For more information, see the *Routing User Guide*.

Note that for all methods, the authoritative copy of the image remains in the VistA System. There is no transfer of image ownership to any outside device.

A.1.3 Implementation

The Query/Retrieve application is a Java-based application installed on the DICOM Gateway. Apart from the use of the DICOM Gateway's SCU_List.dic dictionary file, there is no relationship between the Query/Retrieve application and the DICOM Gateway software.

The Query/Retrieve application communicates with VistA using a Java-encapsulated version of the RPC (Remote Procedure Call) client. Connection information is specified in \DICOM\Java\jaas.config. The configuration files used by the Query/Retrieve application are described in section A.6.

A.2 How Query/Retrieve Works

The following figure illustrates the flow of information between the Query/Retrieve application, outside devices, and the VistA System. Numbered items correspond to detailed steps below.
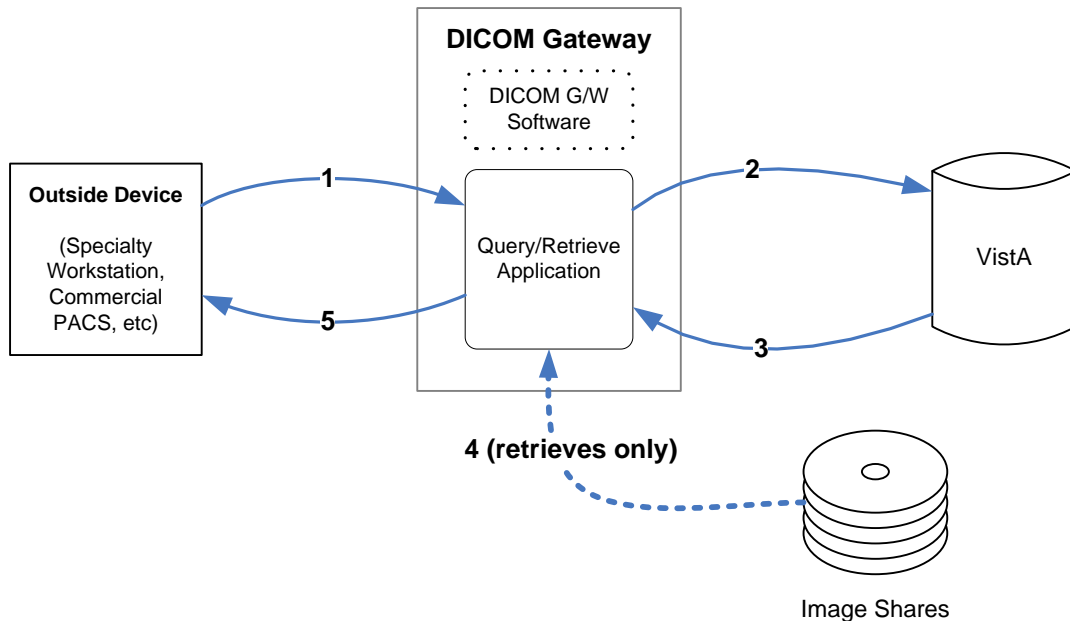
1. The outside device (a DICOM Q/R SCU) issues a request to the Query/Retrieve application. The request can be a query for study information (C-FIND), or a request to retrieve specific studies using information from a previous query (C-MOVE).

2. On receipt of a request, the Query/Retrieve application checks the VistA DICOM TRANSMIT DESTINATION File (#2006.587) for an entry that corresponds to the outside device. If an entry for the device is present and has the appropriate information, the Query/Retrieve application proceeds to the next step.

3. Using the information provided by the outside device, the Query/Retrieve application checks VistA for any matching studies.

4. If the outside device requested specific studies for retrieval (C-MOVE), the Query/Retrieve application locates those studies in the Imaging System.

5. The Query/Retrieve application sends the requested data (either study information or study images) back to the outside device, or it sends a 'no matches' response if nothing was found.

A.3 Starting Query/Retrieve

The VistA user account to run the Query/Retrieve application must have MAG DICOM QUERY RETRIEVE assigned as a secondary menu option in the New Person File (#200).

To start the Query/Retrieve application:

1. Choose **Start | All Programs | VistA Imaging Programs | DICOM | QueryRetrieve | Start QueryRetrieve Listener**.

2. In the QueryRetrieve window that displays, click **Start**.
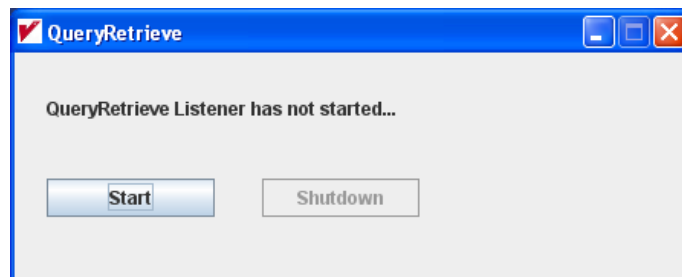
3. When the VistA Login dialog displays, enter the Access and Verify codes for the VistA account to run the Query/Retrieve application, then click **OK**.

4. If the Select Division dialog box displays, select the division to log into, then click **OK**. (This dialog box only appears at multi-divisional sites.)

   Note: At a multi-divisional site, the Query/Retrieve application must be logged into the same division assigned to the DICOM Gateway software.

5. The Start QueryRetrieve Listener window will display. Check the bottom of the window for the `Starting to Listen...` message that indicates that the application is listening for connections.
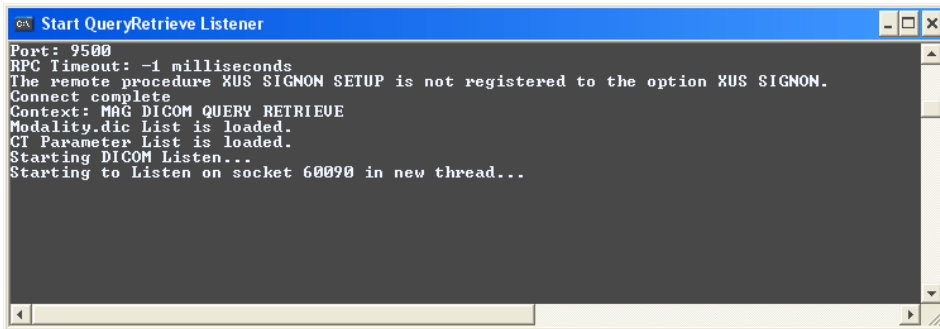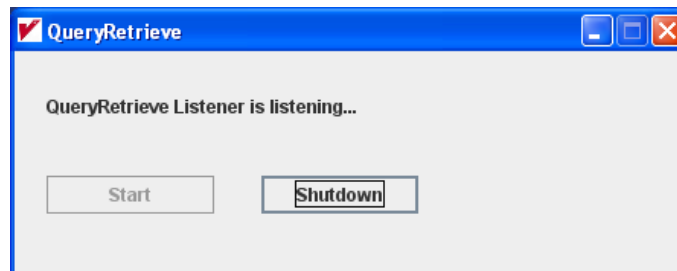

A.4   Stopping Query/Retrieve

Note: Do not close the Listener window by clicking ✖ ; this does not cleanly terminate the Query/Retrieve application. If the Listener window is closed by mistake, use the Windows Task Manager to stop any processes named `javaw.exe` or `java.exe`.

To stop the Query/Retrieve application:

1. Check the Listener window. Wait until there are no active associations.

2. In the QueryRetrieve window, click **Shutdown**.

A.5 Monitoring Query/Retrieve

When the Query/Retrieve application is running, status messages are displayed in the Query/Retrieve Listener window and are stored in the `\DICOM\Java\QRLog.txt` file.

All messages have one of the status levels listed below, with 'fatal' being the most severe.

> **fatal**
> **error**
> **warning**
> **info**
> **debug**

A.5.1 Listener Window

The Listener window shows messages associated directly with the Query/Retrieve application (**info** level or higher), or with the Laurel Bridge DICOM toolkit used by the Query/Retrieve application (**warning** level or higher).

A.5.2 Log File

The `\DICOM\Java\QRLog.txt` file should be reviewed periodically for severe or recurring issues.

- Each message in the log file is preceded by a timestamp and a logging level.

- If a message originated from the Laurel Bridge DICOM toolkit, a `DCF` flag is shown after the logging level.

- For information about specific Query/Retrieve-related error messages, refer to the *VistA Imaging Error Message Guide*.

When the size of the active log file reaches 5 MB, a new instance of the log file is generated. If more than 5 instances of this file accumulate, the oldest instance is deleted.

A.5.3 Changing Logging Levels

By default, the logging level for the Query/Retrieve application is **info**. To change the logging level:

1. On the DICOM Gateway where the Query/Retrieve application is installed, open the `DICOM\Java\LoggingConfig.xml` file.

2. Near the end of the file, locate the <root> tag.

```
<root>
  <level value ="info"/>
  <appender-ref ref="rollingFileAppender"/>
</root>
```

3. Change the level as desired. Valid values are:

> **fatal**
> **error**
> **warning**
> **info**
> **debug**

4. Save and close the file (changes affect the log file only, not the Listener window).

5. Restart the Query/Retrieve application for the changes to take effect.

Note: Logging uses system resources. Because of this, we recommend using **info** and **debug** only when necessary for troubleshooting.

A.5.4 Setting Up the Social Security Number Format

By default, the Query/Retrieve application returns the social security number, which appears in the **PatientID** (PID) field, without dashes. If a Text Gateway at your site is configured to include dashes in the social security numbers it sends to commercial PACS and other medical devices (a setting that is defined in the configuration of the Modality worklist), you must configure the Query/Retrieve application to output the social security numbers with dashes.

The parameter **DashesInPatientID** in the file `application.properties` controls whether the Query/Retrieve application returns the social security number with or without dashes. The possible values are:

- **False** – When this setting is used, the social security numbers do not have dashes.

- **True** – When this setting is used, the social security numbers have dashes.

To configure Query/Retrieve to insert dashes in the social security numbers:

1. Navigate to `\DICOM\Java` and open the `application.properties` file in a text editor such as Notepad.

2. Set the value of the parameter **DashesInPatientID** to **True**.

   Note: Do not change any other values in this file.

3. Save and close the file.

The new settings will take effect when you start the Query/Retrieve application.

The property **DashesInPatientID** controls the entire output of the specific Query/Retrieve application instance. If you need to have the social security number output in both formats (with and without dashes), you must install, license and configure another instance of the Query/Retrieve application with a different setting (without dashes) and direct both instances to send the results of the query to the proper devices.

A.6 Configuration Files

The table below lists configuration files related to Query/Retrieve. Once the Query/Retrieve application is up and running, settings in these files typically do not need to be changed. (With the possible exception of adding or removing devices in `SCU_List.dic`).

For detailed information about modifying these files, see the *VistA Imaging DICOM Gateway Installation Guide*.

File Name	Details
`<share name>` `\DICOM\SCU_List.dic`	Used to enter DICOM-related information for the Query/Retrieve application and by any devices that use the Query/Retrieve application.
`\DCF_Runtime\cfg\` `apps\defaults\Listen`	The `server_tcp_port` parameter (used by the Query/Retrieve application to listen for service requests from SCUs) is set to 60090 and usually does not need to be changed. If this port number must be changed, the value must be even, less than 64K, greater than values used by Windows, and not used by any other process on the DICOM Gateway where the Query/Retrieve application is installed. Other settings in this file should not be changed.
`\DICOM\Java\` `application.properties`	Used to enable/disable the VistA "message of the day" displayed when logging into the Query/Retrieve application and to control whether the social security number in the **PatientID** field contains dashes; other settings should not be changed.
`\DICOM\Java\jaas.config`	Stores the IP address/hostname and port number used by the Query/Retrieve application to connect to VistA.

Glossary

Annotation   The ability to attach notes to images.

Architecture   The design of the components of a computer, network, or software system.

Archive   The long-term storage of data or images.

Audit trail   Record of activity on a particular file or computer.

Background processing   Simultaneous running of a "job" on a computer while working on another job. Examples would be printing one document while working on another, or the software may do automatic saves while you are working on something else.

BLOB   Stands for Binary Large Object and refers to the non-textual elements of a mail message.

Brightness   The balance of light and dark shades in an image.

Composite video   TV signal which sends all colors, and vertical and horizontal signals together.

Contrast   Range between the lightest and darkest tones in an image.

Density   The degree of darkness in an image.

DHCP   Decentralized Hospital Computer Program the earlier name of the VA's hospital information system, now called VistA.

DICOM   Digital Imaging and Communications in Medicine. A medical imaging standard, DICOM is standard for Radiology equipment and is being adopted by the other members of the medical imaging community.

Digital camera   A camera that transforms a picture into a system of numbers. The picture can then be manipulated pixel (dot) by pixel, and stored and transmitted in the manner as textual data.

File   All the data that describes a document or image.

File protection   Techniques for preventing files from being erased.

File server   A machine where shared software is stored.

Frame grabber   A device that changes a video picture into a digital computer language.

Gray scale	The range of shades of black in an image. The more shades recognized by the device, the clearer and sharper the image will be.
High resolution	Refers to a better quality of display over the original achieved by increasing the number of pixels (dots) per inch.
Hot spot	The single pixel that is activated by selection using a mouse, light pen, or other means.
Image	The computerized representation of a picture, or graphic.
Image abstract	A "thumbnail" version of an image, which requires less computer processing resources to display than the actual image.
Image group	A group of images associated with a medical examination.
Image processing	The translation of an image into a digital computer language so that it may be manipulated in size, color, clarity, or to enhance portions of it.
Image resolution	The fineness or coarseness of an image.
Imaging system	Collection of units that work together to capture and recreate images.
Jitter	The flickering of a displayed image.
Jukebox	A device that holds multiple optical discs and can swap them in and out of the drive as needed.
Login (Logon)	Procedure for gaining access to the system or program.
Multimedia	Combining more than one media for the dissemination of information (i.e., text, graphics, full video motion, audio).
On-line	Something that is available for access on the system.
Optical disc	A direct access storage device that is written to and read by laser light. Optical discs have greater storage capacity than magnetic media. Many optical discs are Write Once Read Many (WORM).
Pan	To view different parts of the image that extend beyond the borders of the screen.

Pixel	The individual dots that define a picture.
Resolution	Measure of output quality (dpi—dots per inch) or halftone quality (lpi—lines per inch).
Retrieval	The ability to search for, select, and display a document or image from storage.
RGB	Red, Green, Blue. The colors used in varying combinations and intensities on monitors, TV screens, etc.
Scaling	Uniformly changing the size of an image.
Scanner	A device that converts a hardcopy image into machine-readable code.
Server	A computer which is dedicated to one task.
Storage media	The physical device onto which data is recorded.
TWAIN	An interface standard for scanners, cameras and other input devices.
User preferences	The preferences that each user sets in the User Preferences window that control the circumstances and ways in which the Imaging package displays images.
Video camera	Camera which records full motion video.
Video digitizer	A device that changes a video picture into a digital computer language.
VistA	Veterans Health Information System Technology Architecture. VistA replaces DHCP.
Workstation	A computer that is dedicated to a single type of task.
Write Once Read Many (WORM)	Once written to the disc, data is only available for reading and cannot be altered.
Zoom	To enlarge an image or a portion of an image.

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