



# **IMAGING DICOM GATEWAY USER MANUAL**

Version 3.0

March 2002

Department of Veterans Affairs  
System Design and Development  
**VISTA** Imaging



# 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

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MSM	InterSystems, Corp., Cambridge, MA
OEC C-Arm	OEC Medical Systems, Inc., Salt Lake City, UT
PACS	Broker Mitra Imaging Inc., Waterloo, Ontario Canada
Siemens	Siemens, Iselin, NJ
TARGA, TGA	Truevision, Inc. Indianapolis, IN
<b>VISTA</b>	U.S. Department of Veterans Affairs
Windows NT, etc.	Microsoft, Redmont, WA

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



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# Chapter 1 Introduction

## 1.1 The System: *VISTA* Imaging

The *VISTA* Imaging System is an extension to 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 at one time or incrementally over a period of time. Even if equipment is purchased and installed at one time, 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 does require 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/vhacio/imaging>) 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<sup>1</sup> 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.

The software in the *VISTA* Imaging DICOM Gateway is intended to run on one or more PCs that are loosely coupled to the *VISTA* Hospital Information system. Several functions of this Gateway operate automatically without any user intervention. Other functions of this Gateway are controlled by the user 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 show complete details of setting all tuning parameters that pertain to the *VISTA* Imaging DICOM Gateway.

### **1.4 How to Get Software and Documentation Updates**

The *VISTA* Imaging DICOM Gateway is currently distributed on a CD-ROM which contains both software and documentation. Software will also be available via the network.

Updates to the software and documentation can be obtained from the ftp site for the Imaging Project that is maintained at the Office of Information Field Office in Silver Spring. Currently, the address for this ftp site is **152.128.2.50**. Access to this ftp site is restricted to registered users. Contact your Implementation Manager to register as a user that may access this ftp site.

### **1.5 Documentation Conventions**

The following conventions are used in this manual.

---

<sup>1</sup> The term “modality” is from the DICOM standard and denotes any equipment that produces images.

Convention	Description
<b>Bold type</b>	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
<Num Lock>	Top left key on the numeric keypad (above the 7), may also be labeled Numeric Lock; this makes any keypad key activate the number shown on its surface; it is the equivalent of a SHIFT LOCK for alphabetic keys

**Note:** This section is continued on the next page in landscape format.

## 1.6 VISTA Imaging DICOM Gateway Menu

1. Text Gateway
  - 1.1. Start Processing Text Messages from HIS
  - 1.2. Send DICOM Text Messages to Commercial PACS or Broker
  - 1.3. Display Text Gateway Statistics
  - 1.4. Display Modality Worklist Statistics
  - 1.5. Modality Worklist Query
  - 1.6. Display a HL7 Message
  - 1.7. Display a DICOM Message
  - 1.8. Modify the HL7 Message Pointer
  - 1.9. Generate a Daily Summary Report
  - 1.10. Purge Old Modality Worklist Entries
  - 1.11. Purge Old DICOM Message files
  - 1.12. Purge Old HL7 Transaction Global Nodes
  - 1.13. Purge Old Audit Records
2. Image Gateway
  - 2.1. Receive PACS Exam Complete Messages
  - 2.2. Send PACS Request Image Transfer Messages
  - 2.3. Process DICOM Images
  - 2.4. Increment DICOM Image Input Pointer
  - 2.5. Display Real-Time Storage Server Statistics
  - 2.6. Display Cumulative Storage Server Statistics
  - 2.7. Display Daily Image Processing Statistics
  - 2.8. Send DICOM Images to Another Storage Server
    - 2.8.1. Select DICOM Images for Transmission
    - 2.8.2. Transmit DICOM Images to a Storage SCP
    - 2.8.3. Initialize Image Transmission Queue
  - 2.9. Display a DICOM Image Header
3. ([Reserved for Future Enhancement])
4. System Maintenance
  - 4.1. System Operation
    - 4.1.1. Test VISTA -to-Gateway Networking (MUMPS DDP)
    - 4.1.2. Display DICOM Message Log
    - 4.1.3. Issue a DICOM Echo Request
    - 4.1.4. Display the version of the software
    - 4.1.5. Display Gateway Application Usage Statistics
    - 4.1.6. Support Telephone Numbers

## Chapter 1 - Introduction

4.1.7. Shut Down this System

### 4.2. Gateway Configuration and DICOM Master Files

4.2.1. Display Gateway Configuration Parameters

4.2.2. Update Gateway Configuration Parameters

4.2.3. Update INSTRUMENT.DIC

4.2.4. Update MODALITY.DIC

4.2.5. Update PORTLIST.DIC

4.2.6. Update SCU\_LIST.DIC

4.2.7. Update WORKLIST.DIC

4.2.8. Reinitialize All the DICOM Master Files

4.2.9. Update Radiology and MAS Routines

4.2.10. Create Shortcuts for Instruments

### 4.3. MUMPS Utilities

4.3.1. Access MUMPS Error Log

4.3.2. Global Variable Lister

4.3.3. Display MUMPS System Status

4.3.4. Display MUMPS System Information

4.3.5. Check Available Space in MUMPS Database

4.3.6. Check Available Disk Space

### 4.4. Enter Programmer's Mode

## 5. Quit

## Chapter 2 General Operation

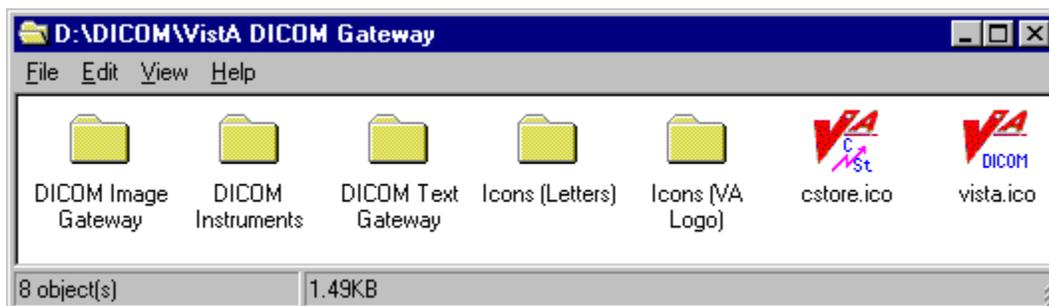
The *VISTA* Imaging DICOM Gateway runs on Windows NT™ Workstation as a set of tasks within an MSM™ Server system. In order to operate the system, the MSM Server needs to be running first. The various sub-tasks of the *VISTA* Imaging DICOM Gateway then run either invisibly in the background, or as telnet-sessions connected to the MSM Server process.

### 2.1 *VISTA* Imaging DICOM Gateway Master Icon Folder

On the desktop of the PC, there is an icon that gives access to the programs and files of the *VISTA* Imaging DICOM Gateway.



When the user double-clicks on the above icon, a directory window will open. Within this window, there are a number of further directory-icons, one for each of the major sub-systems of the *VISTA* Imaging DICOM Gateway.



The installation procedure creates folders for the DICOM Text Gateway and the DICOM Image Gateway. Each of these contains a number of icons that can be used to launch the software applications, as described below:

### 2.2 High-Level Overview of Components of the *VISTA* Imaging DICOM Gateway

The following section will familiarize the user with some of the software components of the *VISTA* Imaging DICOM Gateway.

#### 2.2.1 MSM Console



The icon labeled “MSM Console” can be used to initiate the MSM Server program. One instance of this program must be started for the *VISTA* Imaging DICOM Gateway.

### 2.2.2 MSM Terminal



The icon labeled “MSM Terminal” (and all similar ones) can be used to start telnet sessions with the MSM 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. (This software is not officially included in the Version 2.5 Release, but will be made available in the near future.)

### 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



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.



VERIFY CODE:

Use the “access code” and “verify code” that were entered as part of the installation procedure for the **VISTA** Imaging DICOM Gateway, to log onto the **VISTA** Imaging DICOM Gateway system.

The procedure to modify “access code” and/or “verify code” is, for obvious reasons, protected by a password of its own. See Appendix A 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 ([Reserved for Future Enhancement])
- 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 should maintain a single copy of the DICOM dictionary files in a **\DICOMDict** directory on a network drive, from which it can be accessed by all the systems.

In this document, the **\DICOM\data1** and **\DICOMImage\_in** directories are shown as being on the **d:** local drive. Also for illustrative purposes, the **\DICOMDict** 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.

## 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 have the capability to use this service to obtain information about their respective outstanding orders.

Two different methodologies are used in the **VISTA** 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 Appendix B.

### 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. Typically at least five pieces of information are returned in a modality worklist query: patient name, patient id (social security number), accession number (for example, the radiology date case number in mmddyy-nnnn format), procedure name, and date of procedure. (See Figure 3.1 below.)

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 to “drill 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 Mitra Broker or a DeJarnette MediShare, but these must be purchased and are rather expensive).

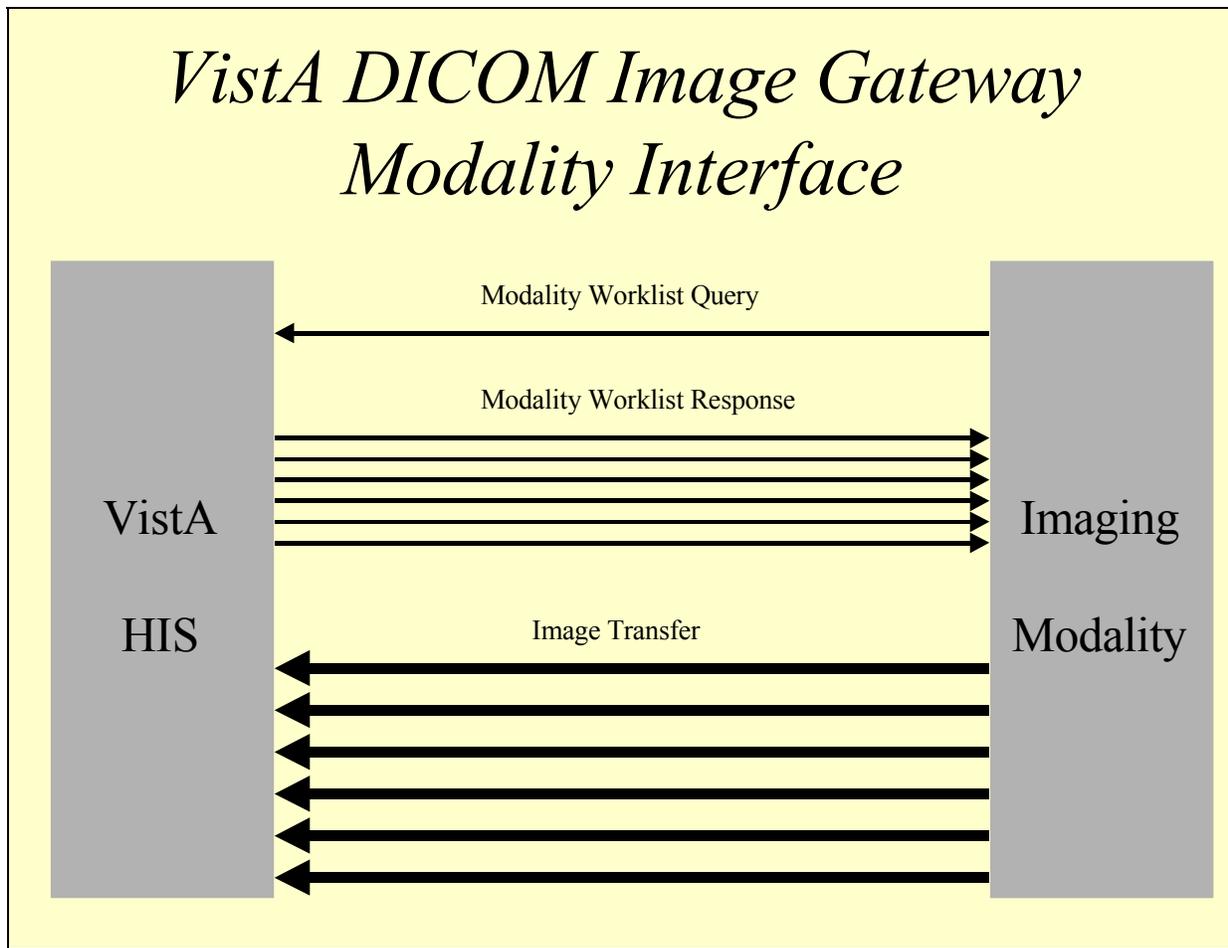


Figure 3.1b

The *VISTA* Modality Worklist Provider works with the radiology package and can also be used for non-radiology examinations. Two events in the radiology department are used to add and delete entries 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 short case number (that is, without the leading date component). When a study is not in the Modality Worklist database, it can be accessed with an accession number query using the date case number (that is, with the leading date component).

In this situation, the main hospital system database is used to lookup 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, CT's, MRI's, 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.

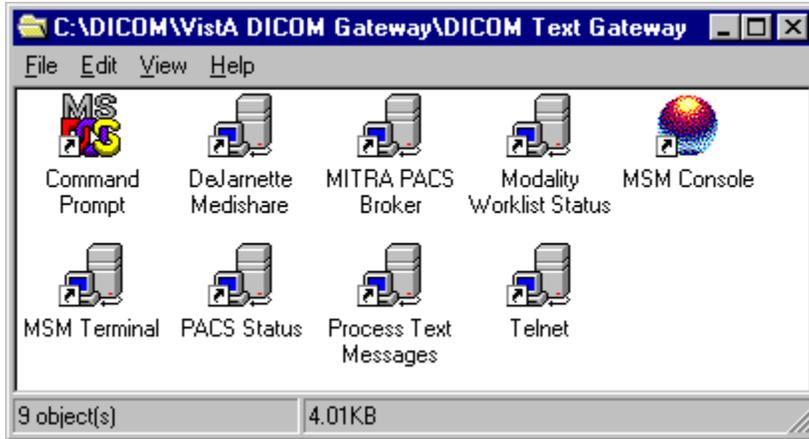
Some studies are performed on more than one acquisition instrument, for example a “Barium Enema” which has one procedure step that is performed on a general xray (computed radiography (CR) or digital radiography (DX)) device and another that is performed via digital radio fluoroscopy (RF). In order to direct the studies to the specific instruments, the entry in the RAD/NUC MED PROCEDURE file (^RAMIS(71)) needs to be mapped to the RAD MODALITY DEFINED TERMS file (^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 date case number (that is mmddyy-nnnnn) should be used on subsequent days to retrieve the patient information for the same study.

DICOM capabilities outside of radiology are beginning. *VISTA* Modality Worklist service maps non-radiology instruments to their corresponding specialties and directs accession number queries to the appropriate package within the main hospital system database to retrieve the information.

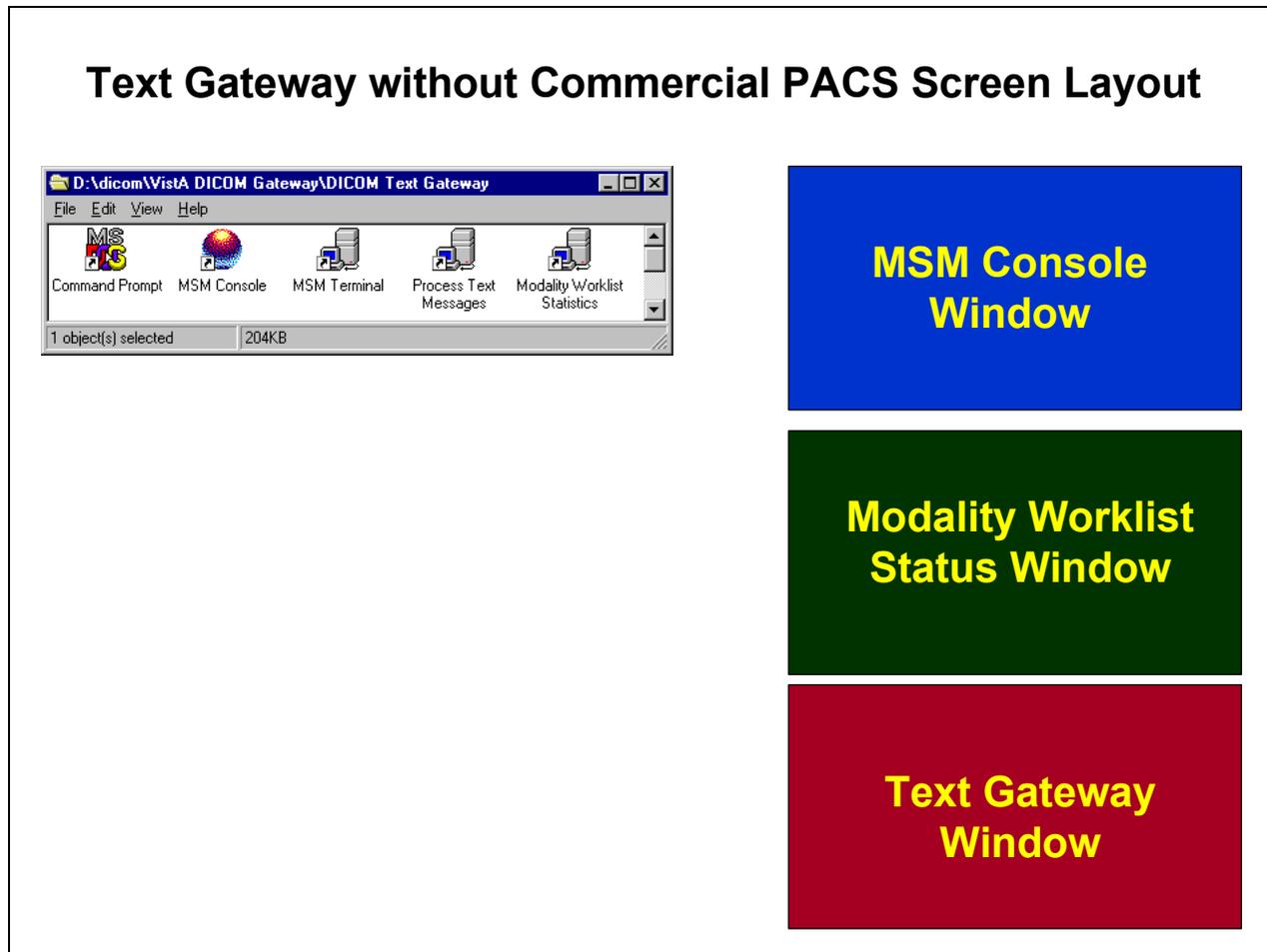
### 3.2 Text Gateway Folder Icons and Screen Layouts

The directory window for the Text Gateway contains the icons shown below. Typically, a site will use only a subset of these icons, corresponding to the kind of activities at the site.

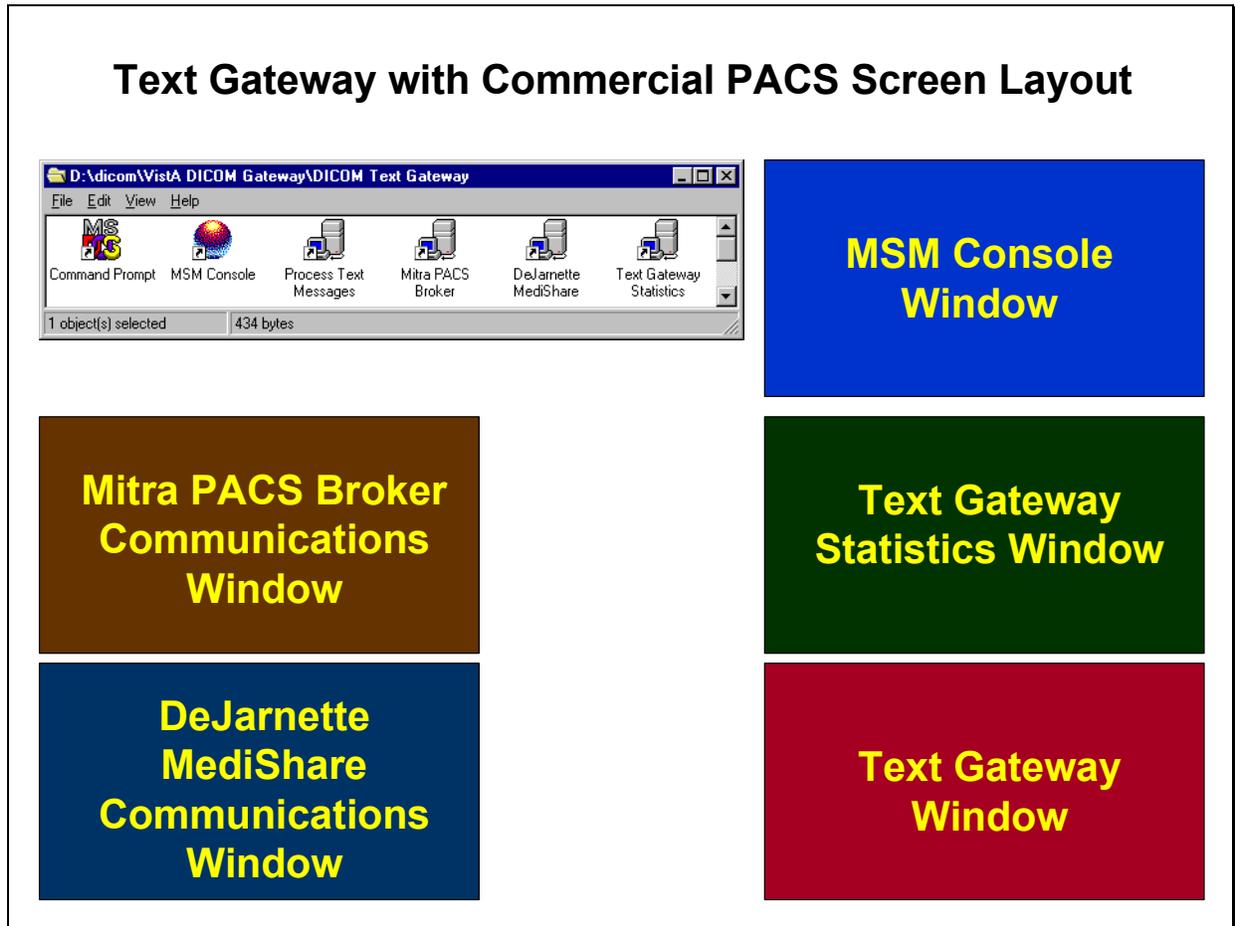


The following figures show how to allocate screen real estate for all the different DICOM Text Gateway processes running on the desktop.

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.



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).



**Note:** This figure is for screen layout illustration purposes only, and represents what is used at a few older sites. There is no longer 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.

### 3.3 Start MSM Console

The first step in the operation of any component of the *VISTA* Imaging DICOM Gateway is to start the MUMPS Server (MSM Console, see Section 2.3). Once this program has been started, it should continue to run, until it is explicitly “shut down” (see Section 5.2.7).

The *VISTA* Modality Worklist Provider is started automatically once the MSM Server is running.

### 3.4 Text Gateway Menu

The menu-options for the Text Gateway software are:

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 an Audit 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:** MSM must be running for any of these menu options to be used. Any additional prerequisites are listed, and must be started before the menu-option can be invoked (typically in the order listed).

### 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 then 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 other process.

The prerequisite for this menu-option is:

- **VISTA** Hospital Information System (must be running and accessible via DDP)

Within the folder for the 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.)



This icon in the DICOM Text Gateway folder will start a Telnet session with the MSM server.

When the user double-clicks on this icon, a telnet window will pop up. 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” and the user selects 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 been started, 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 upon 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	C-STORE of Storage Service
Get Image Response☛	PACS→ VISTA	C-MOVE response of Query/Retrieve
Report Transfer	VISTA →PACS	Interpretation Management, Interpretation Updated

#### ☛ VISTA DICOM Image Gateway with 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 the First In First Out (FIFO) message queues on the gateway (see Section 3.11). All these messages will be listed in the log. The user will first be asked if ready to begin processing as follows:

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

```
Testing DDP... success
```

```
*****
*** 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 so 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 look as follows:

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

```
Testing DDP... success
```

```
*****
***  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

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 **F:\DICOMDictPortList.DIC**.

The icon could look like one of these:



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

When the user double-clicks on this icon, a telnet window will pop up. 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 #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 the user is prompted to select the destination.

The list of “TCP/IP Port Applications” that is presented is defined in the master file named **F:\DICOM\Dict\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

Testing DDP... success

```

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

```

Socket Available on Port 60041

## Chapter 3 – Text Gateway

```
*****  
*** 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) --

```

## Chapter 3 – Text Gateway

```
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 the user to check that 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.



When the user double-clicks on this icon, a telnet window will pop up. 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 the user is 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” that is presented is the same as that for the previous communications tasks and is defined in the master file named **F:\DICOM\Dict\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 & W/X Hospital Request/Response Queues (top, right-hand side), the daily message tally (lower, center), and Space (center, left-hand 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. It is possible to “push back” the HL7 message pointer (see Section 3.12), in which case a significant delay will be observed as the gateway “catches up”.

The U/V & W/X Hospital Request/Response Queues tell how many messages have been created (U & W) and how many have been transmitted (V & 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

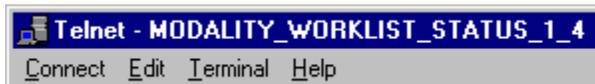
The DICOM Modality Worklist service transfers patient and study information to the image acquisition devices, so that this information does not have to be keyed in manually. This information is later placed in the DICOM header of the image so that it can be matched with the patient's record.

The MUMPS Modality Worklist Provider process is a user-defined network service that is launched by the MSM utility program `^MSERVER` 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 that 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 the user double-clicks on this icon, a telnet window will pop up. 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 that is displayed shows the numbers of exams per day for the various imaging types in reverse chronological order (most recent date first).

The next table shows the number of queries that have been issued for each "Instrument Name" that is currently known to the system.

The list of "Instrument Names" that is presented are "Application Entities" defined in the master file named **F:\DICOM\Dict\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 Date	Imaging Type				
	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	

Instrument Name	Modality Worklist Activity		
	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 “today”. 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 operation use. (This section can be skipped on a first reading.)

Prerequisites:

- **VISTA** Hospital Information System (for historical radiology or medicine package queries only, where the data resides on the main hospital system). It is not needed for looking up active radiology 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 MSM Terminal icon to start a session to simulate a Modality Worklist User.



MSM 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 **F:\DICOM\Dict\SCU\_List.DIC**. (In the case of the example below, the Modality Worklist Provider is identified as “**LOCAL MODALITY WORKLIST**”.)

The user is then asked to identify the Modality Application Entity<sup>2</sup> to be simulated. The list of Application Entities that is presented is defined in the master file named **F:\DICOM\Dict\WorkList.DIC**.

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

- By patient
- By study
- By modality

Enter the first letter(s) of the preferred grouping for the query (**P**, **S** or **M**).

Further questions will depend on the type of query.

---

<sup>2</sup> The term “Application Entity” is from the DICOM standard and refers to any provider or user of a DICOM service.

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 patient(s)/study(ies) 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).

```
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>

Query by Patient, Study, or Modality? P <Enter>

Enter Patient Name or ID: L <Enter>

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) | 082-96-9676 | LISCELZKO,POLEHG A. | 1025  | CR CHEST 2 VIEWS PA&LAT            |
| 2) | 007-88-7748 | LZEFJUILZ,VAKFEK P  | 687   | US ECHOGRAM RETROPERITONEAL COMPLE |
| 3) | 007-88-7748 | LZEFJUILZ,VAKFEK P  | 688   | US ECHOGRAM PELVIC B-SCAN &/OR REA |
| 4) | 071-05-1613 | LAFZOL,POGF P.      | 975   | INTRODUCTION OF CATHETER, AORTA    |
| 5) | 071-05-1613 | LAFZOL,POGF P.      | 976   | AORTO ABDOMEN CATH W/SERIAL FIL    |
| 6) | 071-05-1613 | LAFZOL,POGF P.      | 977   | X-RAY EXAM OF ABDOMEN 1 VIEW, P    |
| 7) | 071-05-1613 | LAFZOL,POGF P.      | 978   | SEDATION WITH OR WITHOUT ANALGE    |
| 8) | 071-05-1613 | LAFZOL,POGF P.      | 979   | CR ANGIO EXTREMITY BILAT S&I       |

Enter 1-8 to see study details: 1 <Enter>

```

Patient Name: LISCELZKO,POLEHG A.
Patient Sex: M
Patient Identifier: 082-96-9676
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: MATOS, ADA 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 the Date-Case Number, formatted “mmddyy-nnnnn”, where “mmddyy” is derived from the date and “nnnnn” is the Case Number.

- 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 (File number 70, Rad/Nuc Med Patient, stored in ^RADPT). If the study is found there, that information is returned. This capability is very useful “in the real world” 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

Query by Patient, Study, or Modality? M// **S** <Enter>

Query by Accession Number or Requested Procedure ID? R// **A** <Enter>

Enter the Accession Number or the Case Number: **1025** <Enter>

Performing Query...

Sending the PDU to the SCP  
completed!

    Patient Name: LISCELZKO,POLEHG A.

    Patient Sex: M

    Patient Identifier: 082-96-9676

    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: MATOS,ADA 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 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

Query by Patient, Study, or Modality? S// **<Enter>** S

Query by Accession Number or Requested Procedure ID? A// **<Enter>** A

Enter the Accession Number or the Case Number: **102198-1025 <Enter>**

Performing Query...

Sending the PDU to the SCP  
completed!

Patient Name: LISCELZKO,POLEHG A.

Patient Sex: M

Patient Identifier: 082-96-9676

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: MATOS,ADA 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

Query by Patient, Study, or Modality? S// **S <Enter>**

Query by Accession Number or Requested Procedure ID? A// R <Enter>

Enter the Requested Procedure ID: 1025 <Enter>

Performing Query...

Sending the PDU to the SCP  
completed!

Patient Name: LISCELZKO,POLEHG A.

Patient Sex: M

Patient Identifier: 082-96-9676

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: MATOS,ADA 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

Two more questions will be asked for a “modality” query:

- The type of modality
- A date/time range

The type of modality is identified by its two-character abbreviation. Valid codes are shown below (file RAD Modality Defined Terms, stored in ^RAMIS (73.1, ...)) This file is only present when the radiology software is at patch level **RA\*5\*3** or later).

AS: Angioscopy

BI: Biomagnetic imaging

CD: Color flow Doppler

CF: Cinefluorography

CP: Culposcopy

CR: Computed Radiography

CS: Cystoscopy

|     |                                                 |
|-----|-------------------------------------------------|
| CT: | Computed Tomography                             |
| DD: | Duplex Doppler                                  |
| DF: | Digital fluoroscopy                             |
| DG: | Diaphanography                                  |
| DM: | Digital microscopy                              |
| DS: | Digital Subtraction Angiography                 |
| DX: | Digital Radiography                             |
| EC: | Echocardiography                                |
| ES: | Endoscopy                                       |
| FA: | Fluorescein angiography                         |
| FS: | Fundoscopy                                      |
| IO: | Intra-oral Radiology                            |
| LP: | Laparoscopy                                     |
| LS: | Laser surface scan                              |
| MA: | Magnetic resonance angiography                  |
| MG: | Mammography                                     |
| MR: | Magnetic Resonance                              |
| MS: | Magnetic resonance spectroscopy                 |
| NM: | Nuclear Medicine                                |
| OT: | Other                                           |
| PT: | Positron emission tomography (PET)              |
| RF: | Radio Fluoroscopy                               |
| RG: | Radiographic imaging (conventional film/screen) |

ST: Single-photon emission computed tomography (SPECT)

TG: Thermography

US: Ultrasound

VF: Videofluorography

VL: Visible Light

XA: X-Ray Angiography

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

Query by Patient, Study, or Modality? S// **M** <Enter>

Enter 2-character Modality Code: **CR** <Enter> -- Computed Radiography

Enter Procedure Start Date (yyyymmdd or yyyymmdd-yyyymmdd): **19900101** <Enter>

Enter Procedure Start Time (hhmmss or hhmmss-hhmmss): **020304** <Enter>

Performing Query...

Sending the PDU to the SCP  
completed!

|     | Social Sec# | Patient's Name        | Case# | Procedure Description           |
|-----|-------------|-----------------------|-------|---------------------------------|
|     | -----       | -----                 | ----- | -----                           |
| 1)  | 082-96-9676 | LISCCELZKO, POLEHG A. | 1025  | CR CHEST 2 VIEWS PA&LAT         |
| 2)  | 086-76-1318 | WOOXFEEK, VISSIAD     | 962   | CR CHEST 2 VIEWS PA&LAT         |
| 3)  | 039-62-3667 | XOSRKITQ, XEKAKR K.   | 1041  | CR CHEST 2 VIEWS PA&LAT         |
| 4)  | 071-03-0904 | HIDEFZAS, FESLOF      | 778   | CR CHEST SINGLE VIEW            |
| 5)  | 099-80-6542 | TASSEFREK, ASWEKZ E.  | 1044  | CR CHEST 2 VIEWS PA&LAT         |
| 6)  | 004-76-4891 | VITQEFGILEK, POGF K   | 692   | CR CHEST 2 VIEWS PA&LAT         |
| 7)  | 085-72-7867 | FAYSOK, GEKWEKZ L.    | 1038  | CR CHEST 2 VIEWS PA&LAT         |
| 8)  | 081-86-3557 | GAKKIFXZOF, XEKASR N. | 1024  | CR SPINE CERVICAL MIN 2 VIEWS   |
| 9)  | 081-70-5463 | WOXAFFAD, KITGAKR F   | 1035  | CR HAND 1 OR 2 VIEWS            |
| 10) | 081-70-5463 | WOXAFFAD, KITGAKR F   | 1036  | CR FINGER(S) 2 OR MORE VIEWS    |
| 11) | 005-52-3902 | TGADWEKSAIF, RACIR S. | 1029  | FLURO CHEST (SEPARATE PROCEDURE |

Enter 1-11 to see study details: **1** <Enter>

Patient Name: LISCELZKO, POLEHG A.

Patient Sex: M

Patient Identifier: 082-96-9676

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: MATOS, ADA 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 problem debugging purposes.

Prerequisite:

- **VISTA** Hospital Information System (the ^MAGDHL7 global is on the main hospital system)

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



MSM 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 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.

Each uses the MUMPS vendor's output device selection utility to direct output to various destinations. For MSM, at the "Enter output device" prompt, select the default for the monitor or enter the number 3 for the printer.

### 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~001^3789535^P^2.1
...1^^^^USA
PID^^020-12-4067^93092~4~D99^^WEKXEKOF~KXKX~V^^19220514^M^^^^^^^^^^080986043
ORC^CA^^^^CA^^^^19981014000017
OBR^^7018986.8646-1~101398-495~L^71021~CHEST X-RAY~CPT4~59~CHEST APICAL LORDOTI
...IC~99RAP^^19981014000017^^^^^^^^^^^^16661~XBAXXIZ~ZQXL~P^^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) = 020-12-4067
3           Patient ID (Internal ID) = 93092~4~D99
5           Patient Name = WEKXEKOF~KOXEK~V
7           Date of Birth = 19220514
8           Sex = M
19          SSN Number - Patient = 080986043

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~ZKOZZEK~KUZG~P
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 NT Explorer™ using **notepad**™. An easy way to launch Windows NT Explorer is to push “Windows-E”. (The “Windows” keys are lateral 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 5.2.2.) The acquired image files are stored in D:\DICOM\Image\_in\Lnnnnnnn.dcm. (The user may also want to refer to Appendix B.)

**First-In-First-Out Data Queues**

| Direction                    | Queue Letter | Type     | Priority  | Usage                                            |
|------------------------------|--------------|----------|-----------|--------------------------------------------------|
| INCOMING<br>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<br>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<br>(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 MSM 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 DICOM Message).

The example below shows the formatted output of the information in the file D:\DICOM\Data1\W00000\W0000001.DCM.

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

The application uses the MUMPS vendor’s output device selection utility to direct output to various destinations. For MSM, at the “Enter output device” prompt, select the default for the monitor, enter the number 3 for the printer, or type “HFS” to store the output in the host file system.

```
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
                        -----
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"
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"
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 "LZEFJUILZ^VAKFEK^P"
000210:0010,0020 LO 000C Patient ID "007-88-7748"
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 displayed, the program will pause with the prompt “more...”. If the user wishes to terminate the display, this question can be answered with “^”, “**No**”, “**Quit**” or “**Exit**” (this response is not case sensitive).

The \*.TXT files 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 MSM Terminal icon to start a session for this menu option.



MSM Terminal

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 (file PACS Messages, 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** 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 have the effect that old HL7 messages in the **VISTA** Hospital Information System will be processed again (Reprocessing HL7 messages has no adverse side-effects). Incrementing this pointer will have the effect that HL7 messages will be skipped, and associated data will not be sent to the destination (This should not be done).

The user may either enter 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 look like

:

```
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.

Prerequisite:

- **VISTA** Hospital Information System (the data is stored on the main hospital system)

Use the MSM 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 #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 verified) 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** DICOM Gateway. (When a study is “case edited”, an Exam Verification HL7 message is generated and sent to the 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 MSM Terminal icon to start a session for this menu option.



MSM 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 file 2006.1, Imaging Site Parameters.

```
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**” in file 2006.1, Imaging Site Parameters.

The default number of days to retain messages is specified in the site parameter “**Retention Days DICOM msgs**” in file 2006.1, Imaging Site Parameters.

This menu-option may be used to remove old DICOM message files from the *VISTA* 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 MSM 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 #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
```

```
Save Directory: S99998
```

```
Save Directory: S99997
```

These directories are too new to delete.

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

These directories are too new to delete.

Scanning the U queue  
D:\DICOM\Data1\U\*.  
Save Directory: U00032  
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  
Save Directory: W00024  
Save Directory: W00023

These directories are too new to delete.

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.

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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 file 2006.1, Imaging Site Parameters.

Prerequisite:

- *VISTA* Hospital Information System (the ^MAGDHL7 global resides on the main HIS)

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



MSM 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 only removes 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.

Prerequisite:

- *VISTA* Hospital Information System (data is in the ^MAGDAUDT global on the main HIS)

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



MSM 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 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 (**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 `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 of 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 `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 **F:\DICOM\Dict\Instrument.DIC** dictionary.

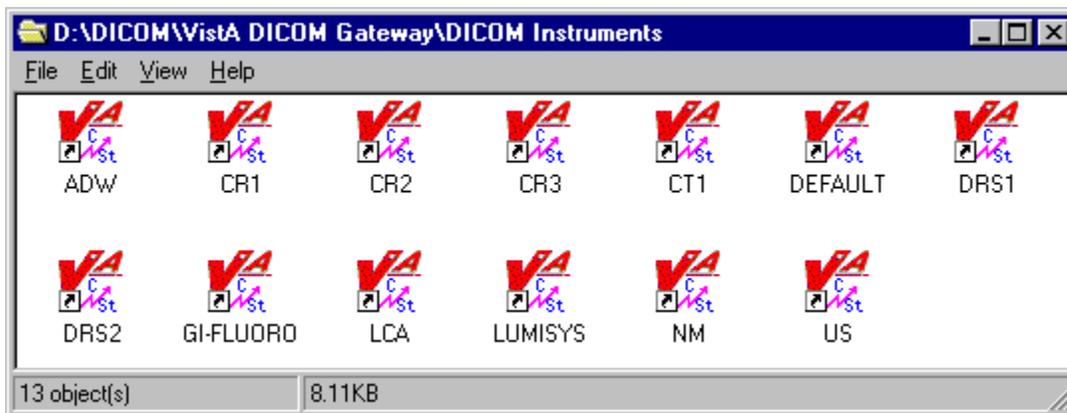
After this initial handshake, the foreground `cstore.exe` process listens on its designated port for image storage association requests generated by the instruments. When they are presented, they are passed to the MUMPS DICOM storage controller for validation and negotiation. Once the association is established, the instruments send image storage requests to *VISTA*. These are received by the foreground `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 transfers complete, the instrument terminates the association, and the two processes go back to their “listening” state.

#### 4.1.2 VISTA Storage Server Processes

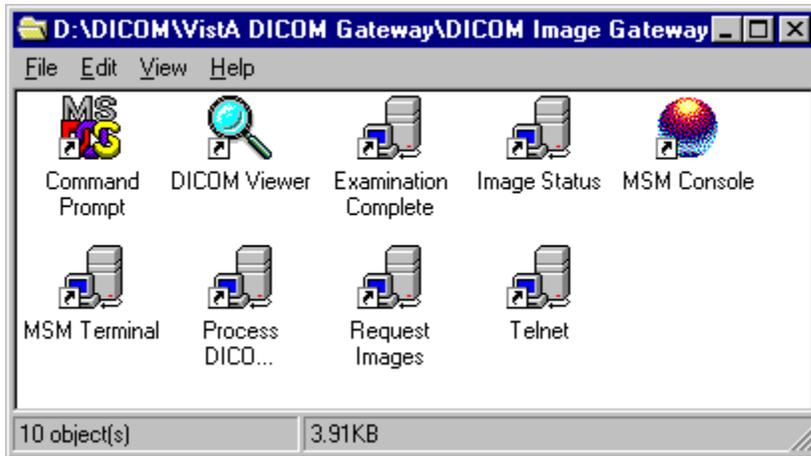
Each individual image acquisition instrument must be defined in the master file named **F:\DICOM\Dict\Instrument.DIC**. There is a shortcut (to `cstore.exe`) in the DICOM Instruments folder for every image acquisition instrument that can send images to the system.

The shortcuts in the folder **D:\DICOM\ VISTA DICOM Gateway\DICOM Instruments** correspond to the entries in the master file **F:\DICOM\Dict\Instrument.DIC**.



**Note:** If there are multiple image gateways at a site, the instruments will usually be spread out between them.

The folder for the Image Gateway contains the shortcuts shown below. Typically, only a subset of these will be used, depending upon the kind of image acquisition equipment at the site.

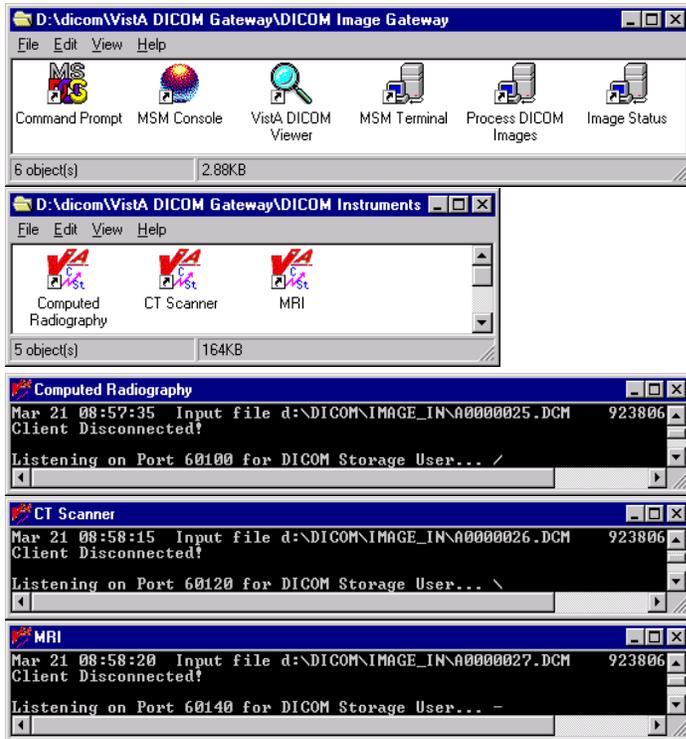


**Note:** Refer to the **VISTA** DICOM Gateway Installation Guide for information on how to modify the setup parameters for these shortcuts.

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 on 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

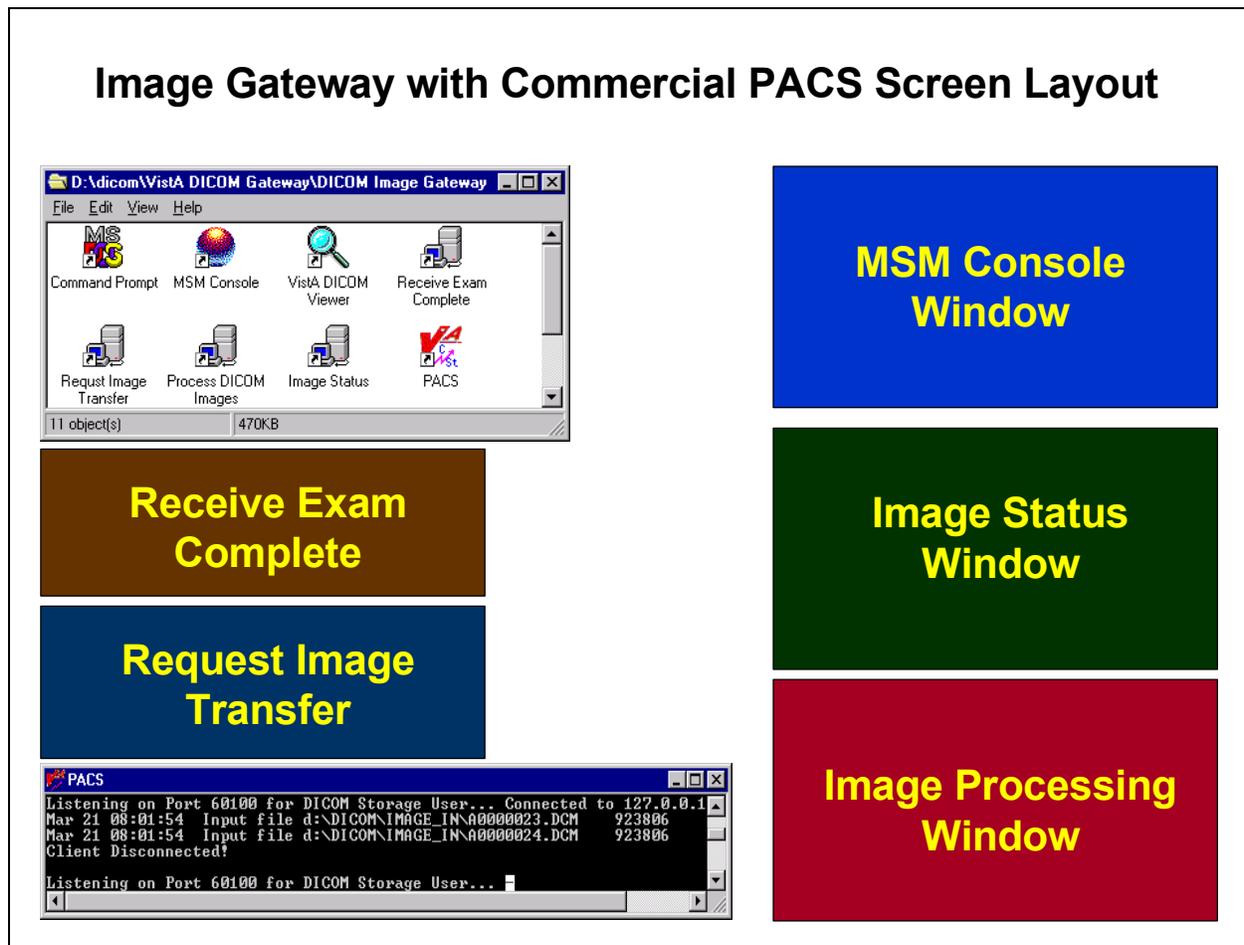


**MSM Console Window**

**Image Status Window**

**Image Processing Window**

The next figure illustrates the screen layout when *VISTA* is configured to receive images from a commercial PACS. 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 Start MSM Console

The first step in the operation of any component of the *VISTA* Imaging DICOM Gateway is to start the MUMPS Server (MSM Console, see Section 2.3). Once this program has been started, it should continue to run, until it is explicitly “shut down” (see Section 5.2.7).

### 4.3 Starting a Storage Server for an Instrument

After the MSM Server process has been started, the storage server for each image acquisition device may be started by double clicking on its icon in the DICOM Instruments window. This will launch an instance of the `cstore.exe` program for each instrument. Upon starting, each `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 Sections G.3.1 and G.3.3 for error-conditions that may occur at this stage, and how to resolve them.

The MSM Console Window may be used to monitor the MUMPS DICOM Storage Controller. If the MSM Console Window is free, messages describing the activity of the `cstore.exe` program should be visible in this window.

Once the `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 `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 on:

```

MS-DOS CR1
UistA DICOM Storage Provider
Trying to connect to MUMPS storage controller... Success!
Listening on Port 60100 for DICOM Storage User... \

```

The port number assigned to the image acquisition instrument, **60100** in this example, is supplied to the `cstore.exe` program by the MUMPS DICOM storage controller and is specified in the **F:\DICOM\Dict\Instrument.DIC** master file.

Each time a new image is being received, the 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 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:



```

CT1
Vista DICOM Storage Provider
Trying to connect to MUMPS storage controller... Success!
Listening on Port 60120 for DICOM Storage User... ↵

```

As the image is being received:



```

CT1
Vista DICOM Storage Provider
Trying to connect to MUMPS storage controller... Success!
Listening on Port 60120 for DICOM Storage User... Connected to 127.0.0.1
Jul 30 10:56:34 Input file d:\DICOM\IMAGE_IN\A0000068.DCM 523648

```

After the image is received and the instrument terminates the association:



```

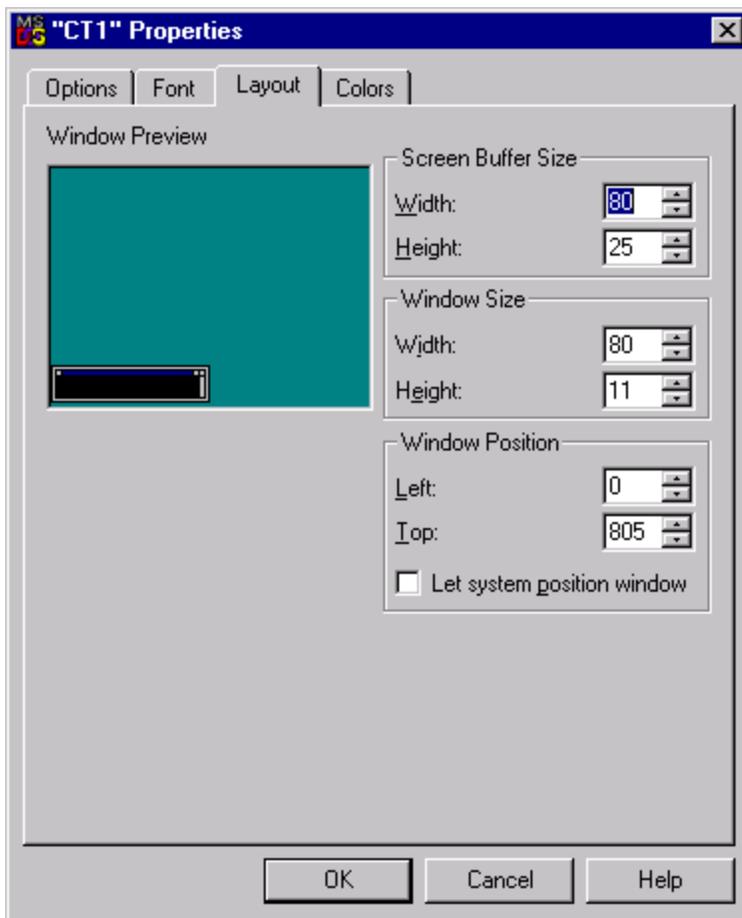
CT1
Vista DICOM Storage Provider
Trying to connect to MUMPS storage controller... Success!
Listening on Port 60120 for DICOM Storage User... Connected to 127.0.0.1
Jul 30 10:56:34 Input file d:\DICOM\IMAGE_IN\A0000068.DCM 6556330
Client Disconnected!
Listening on Port 60120 for DICOM Storage User... ⏴

```

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 mouse click on the window’s active title bar to open the properties window. Click on the “Layout” tab as shown below.



Third, clear the “Let system position window” box and click on “OK”.



The “Apply Properties to Shortcut” window will appear. Check the “Modify shortcut which started this window” option and click on “OK”.

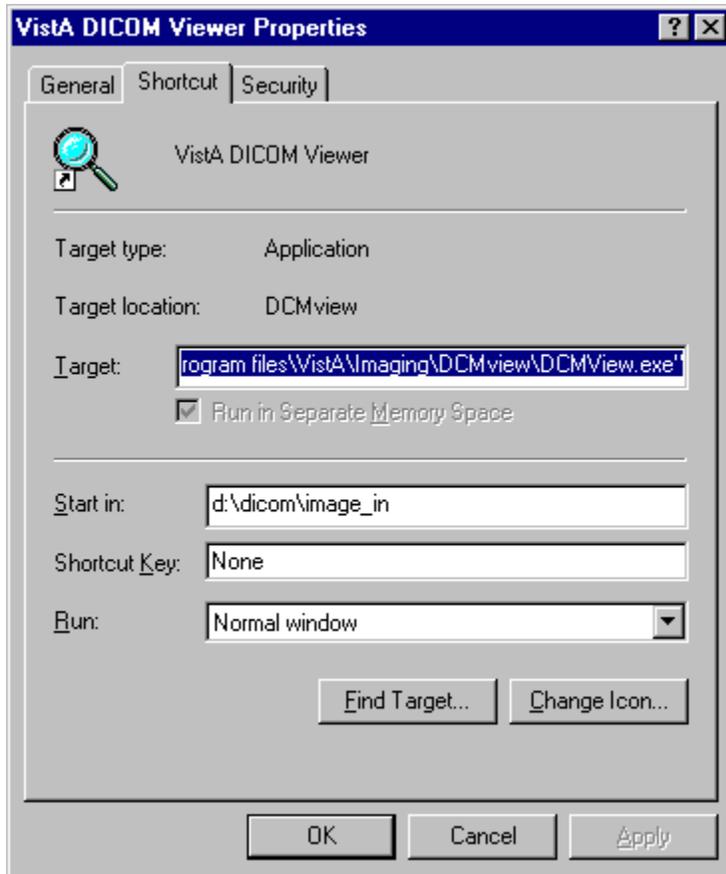
The window properties will then be applied to the shortcut.

#### 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 only be installed on a 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:

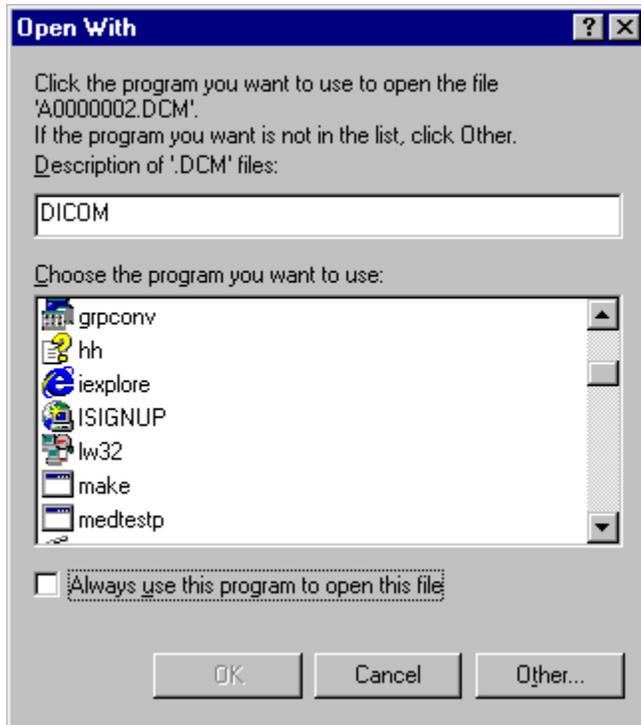


It is also very useful to associate the “.dcm” filename extension with “DICOM” and the **VISTA DICOM Viewer**. The procedure for doing this is listed below.

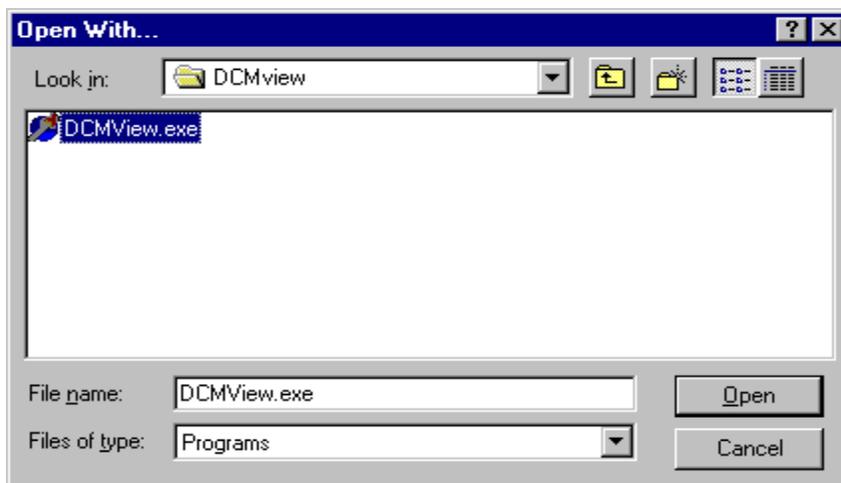
Initially, the \*.dcm files will not be associated, and the Explorer listing will look something like this:

| 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 on one of the “.dcm” files. The “Open With” window will appear. Enter DICOM as the description of the ‘.dcm’ files.



Then mouse click on Other. The “Open With...” window will appear. Select the **c:\program files\Vista\Imaging\DICOM\DCMview\DCMview.exe** program.



After doing these steps, Explorer should identify every DICOM file and always launch the **VISTA DICOM Viewer** for every DICOM image.

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

#### 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 Appendix D.

#### 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
  - a. Select DICOM Images for Transmission
  - b. Transmit DICOM Images to a Storage SCP
  - c. Initialize Image Transmission Queue
9. Display a DICOM Image Header

## 4.9 Receive PACS Exam Complete 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 mechanism is described in detail in Appendix E.)

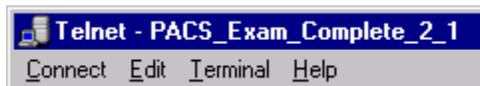
Prerequisites:

- Commercial PACS
- *VISTA* Hospital Information System
- Storage Server
- MSM Console (only to provide real-time display of messages)



Exam Complete

When the user double-clicks on the above icon, a telnet window will pop up. 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” and the user selects 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 Appendix E for the implementation for EMED, GE PACS and other commercial systems using the DICOM protocol, and Appendix F for Agfa, CeMax/Icon, Brit and other commercial systems using autorouting with the DICOM 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
- MSM Console (only to provide real-time display of messages)



When the user double-clicks on the above icon, a telnet window will pop up. 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
```

```
Testing DDP... success
*****
*** 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
Recvng 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) --
```

## Chapter 4 – Image Gateway

```
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 to the corresponding patient and study in the **VISTA** medical record. The “Process DICOM Images” task makes this association and inserts each image into the database.

In order 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 right values for the patient name, patient identification and accession number.

Prerequisites:

- **VISTA** Hospital Information System (images will be stored in the patient record)
- C-Store program for specific instrument(s)



Process  
DICOM  
Images

When the user double-clicks on the icon, a telnet window will pop up. 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 the file **DICOM RAW IMAGE** (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 the file **DICOM INCOMPLETE IMAGE** (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).
3. Assuming that 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 **F:\DICOM\Dict\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(2006.592, ...)).)

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 file **RADIOLOGY MODALITY INSTRUMENT** (stored in ^MAGDICOM(2006.582,...)), add an entry to the **DICOM UNDEFINED MODALITIES** (stored in ^MAGD(2006.592,...)) for later processing, update the counter 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 medicine/endoscopy). 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 file **DICOM FAILED IMAGES** (stored in ^MAGD(2006.575,...)) for manual correction (see Appendix B), update the counter 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 file **DICOM FAILED IMAGES** (stored in ^MAGD(2006.575,...)) for manual correction (see Appendix B), update the counter 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 (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**).

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 file **DICOM INCOMPLETE IMAGE** (stored in ^MAGD (2006.593, ...)). If entries in this file are over an hour old, delete the image file from the directory D:\DICOM\Image\_In.
18. Process completed entries in the file **DICOM UNDEFINED MODALITIES** (stored in ^MAGD (2006.592, ...)).
19. Process completed entries in the file **DICOM FAILED IMAGES** (stored in ^MAGD (2006.575, ...)).
20. Go back to step 1

#### 4.11.2 Operational Details of DICOM Image Processing

When the association is created, the *VISTA* image file name is assigned to the image file, it is “processed”, and the resulting images are stored.

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

```
Testing DDP... success
```

```
C0000031.DCM -- BAKER^JOSEPHINE^^ -- 202-02-0200 -- 119
DCMTOTGA D:\DICOM\Image_In\C0000031.DCM \\VHAISWIMM1\IMAGE1$\LA101662.TGA X640
Y480 O2506 B8 F0 C255 b12 f0
ABSTRTGA \\VHAISWIMM1\IMAGE1$\LA101662.TGA \\VHAISWIMM1\IMAGE1$\LA101662.ABS /8

DEL D:\DICOM\Image_In\C0000031.DCM \
```

#### 4.12 Increment DICOM Image Input Pointer

On rare occasion, 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 with this function.

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



MSM Terminal

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 “Display Real-Time Storage Server Statistics” option 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.

Prerequisites:

- VISTA Hospital Information System (part of the data is on the main hospital system)
- C-Store program for specific instrument(s)
- Process DICOM Images (should always be running)



Image Status

When the user double-clicks on the above icon, a telnet window will pop up. 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 #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 **F:\DICOM\Dict\Modality.DIC..**

The list of “Instruments” that is presented is defined in the master file named **F:\DICOM\Dict\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 above 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, either because the patient or study information was miss-entered on the instrument (see Appendix C).

The *VISTA* Imaging DICOM Gateway system may not be able to process certain images because the image parameters are not defined in the **F:\DICOM\Dict\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 Appendix C.)

#### 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.

Prerequisite:

- *VISTA* Hospital Information System (audit data is stored in the patient record)

Use the MSM 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 #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
S
C   C
    
```

|          | 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 number presented represent the number of individual images, not exams.

Prerequisite:

- **VISTA** Hospital Information System (images will be stored in the patient record)

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



MSM 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 image 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 Appendix C).

#### 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 three-step process:

1. Initialize the transmission queue.
2. Manually select images for transmission.
3. Transmit the images.

The first step can be initiated from any PC that has the **VISTA** Imaging DICOM Gateway software available; the second step can only be run on PCs that are set up to transmit files to the designated DICOM storage server.

Before the menu options described below can be invoked, the destination DICOM storage providers must be setup as described in the **VISTA** Imaging DICOM Installation Guide. Their AE Titles, IP address, and port number must be in the **D:\DICOM\Dict\SCU\_List.DIC** master file and stored in the ^MAGDICOM(2006.585) global. After modifications have been made to the master file, it needs to be loaded in the active database using the menu option **Update SCU\_List.DIC** (see section 5.3.6).

### 4.16.1 Select DICOM Images for Transmission

Prerequisite:

- **VISTA** Hospital Information System (data is stored in ^MAGDOUTP on the main HIS)

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



MSM 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 (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).

```
Ready to select studies to send via DICOM?  y// <Enter> Yes
Select images to send via DICOM
Enter Case Number (or `ien):  26 <Enter>  ??? report does not exist
Press <Enter> to try another case number... <Enter>
Ready to select studies to send via DICOM?  y// <Enter>  Yes
Select images to send via DICOM
Enter Case Number (or `ien):  102197-57 <Enter>
Image File Information
-----
Number: 50215          Accession Number: 102197-57
Name: "CAT,ALLEY 283746293 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
```

## Chapter 4 – Image Gateway

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

-----

Number: 50216

Name: "CAT,ALLEY 283746293 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

-----

Number: 50217

Name: "CAT,ALLEY 283746293 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

-----

Number: 50218  
 Name: "CAT,ALLEY 283746293 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

Prerequisites:

- **VISTA** Hospital Information System (data is stored in ^MAGDOUTP on the main HIS)
- Remote DICOM Storage Server (properly configured to receive images from **VISTA**).

Use the MSM 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 (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 DCMTOTGA.EXE program.) The regenerated DICOM image is stored in the D:\DICOM\Image\_Out directory. Then a VISTA\_SEND\_IMAGE.EXE process is started to create an association to the destination storage server and transmit the images. (In the future, when images are stored internally in DICOM format, the “reconstitution step” will be skipped, but the images will still be copied to the D:\DICOM\Image\_Out directory.)

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>
```

```
Testing DDP... success
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 ***
*****
VISTA_SEND_IMAGE LOCALHOST 10005

Socket Available on Port 10005
Recvng <<Connection established to MUMPS>>
Sending <<CONNECT LOCALHOST 60100>>
Recvng <<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>>

```

```

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 ***
*****
VISTA_SEND_IMAGE LOCALHOST 10005

```

```

Socket Available on Port 10005
Recving <<Connection established to MUMPS>>
Sending <<CONNECT LOCALHOST 60100>>
Recving <<CONNECTION SUCCESSFUL>>
*****
*** Sending A-ASSOCIATE-REQUEST to Vista_Storage ***
*****

```

## Chapter 4 – Image Gateway

```
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 10:36:30 ***
*****
```

```
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\RELEASE.IN>>
Recving <<ASSOCIATION ENDED>>
Sending <<END_SESSION>>
```

```
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 ***
*****
VISTA_SEND_IMAGE LOCALHOST 10005
```

```
Socket Available on Port 10005
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>REENTRY+9^MAGDIW2:::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 Initialize Image Transmission Queue

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

Prerequisite:

- *VISTA* Hospital Information System (data is stored in ^MAGDOUTP on the main HIS)

Use the MSM 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 #3 (Initialize Image Transmission Queue).

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

```
Image Transmission Queue has been initialized
```

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

### 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 MSM Terminal icon to start a session for this menu option.



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).

The user 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\A0000001.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).

The application uses the MUMPS vendor’s output device selection utility to direct output to various destinations. For MSM, at the “Enter output device” prompt, select the default for the monitor, enter the number 3 for the printer, or type “HFS” to store the output in the host file system.

```
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
                        -----
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"
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"
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"
0001A8:0008,0018 UI 0034 SOP Instance UID         "1.3.46.670589.8.922140021400
... 3.96.8.12.11.12.53.26711"

```

## Chapter 4 – Image Gateway

```

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 "Testpatient"
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...”. If the user wishes to terminate the display, this question can be answered 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.)

Some modalities store the Accession Number in a DICOM element other than the standard one (0008,0050). For these instruments, it is 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.



# Chapter 5 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.

## 5.1 System Maintenance Menu-options

The menu-options for the System Maintenance software are:

1. System Operation
  - a. Test *VISTA* -to-Gateway Networking (MUMPS DDP)
  - b. Display DICOM Message Log
  - c. Issue a DICOM Echo Request
  - d. Display the Version of the Software
  - e. Display Gateway Application Usage Statistics
  - f. Support Telephone Numbers
  - g. Shut Down this System
2. Gateway Configuration and DICOM Master Files
  - a. Display Gateway Configuration Parameters
  - b. Update Gateway Configuration Parameters
  - c. Update Instrument.DIC
  - d. Update Modality.DIC
  - e. Update PortList.DIC
  - f. Update SCU\_List.DIC
  - g. Update WorkList.DIC
  - h. Download Current All the DICOM Master Files
  - i. Update Radiology and MAS Routines
  - j. Create Shortcuts for Instruments

3. MUMPS Utilities
  - a. Access MUMPS Error Log
  - b. Global Variable Lister
  - c. Display MUMPS System Status
  - d. Display MUMPS System Information
  - e. Check Available Space in MUMPS Database
  - f. Check Available Disk Space
4. Enter Programmer's Mode

## 5.2 System Operation Tools

### 5.2.1 Test VistA-to-Gateway Networking (MUMPS DDP)

The PCs that run the *VISTA* Imaging DICOM Gateway are connected to the main *VISTA* Hospital Information System using a protocol called **DDP (Distributed Data Processing)**. This protocol exchanges information between the DSM or Caché environment on the main Hospital Information System and MSM on the DICOM Gateway PCs.

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 the user may notice a disruption in communication.

The following processes run continuously on the *VISTA* Imaging DICOM Gateway and constantly monitor DDP connectivity status. They will restart the internal DDP server whenever there is a need to do so:

- Process Text Messages
- Text Communication for PACS
- Image processing
- Status Jobs

The first menu-option on the System Maintenance menu tests whether the DDP connectivity is currently operational. This program will check that all translated global variables of the *VISTA* Imaging DICOM Gateway are currently accessible.

Prerequisite:

- **VISTA** Hospital Information System (all the globals checked are on the main HIS).

Use the MSM 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 #1 (Test VistA-to-Gateway Networking (MUMPS DDP)).

The output should look like this:

```
Testing ^DD ----- Success!
Testing ^DG ----- Success!
Testing ^DGMT ----- Success!
Testing ^DGPM ----- Success!
Testing ^DIAR ----- Success!
Testing ^DIC ----- Success!
Testing ^DPT ----- Success!
Testing ^MAG ----- Success!
Testing ^MAGDHL7 --- Success!
Testing ^RA ----- Success!
Testing ^RADPT ----- Success!
Testing ^RAMIS ----- Success!
Testing ^RARPT ----- Success!
Testing ^VA ----- Success!
```

The main hospital **VISTA** network connection (DDP) is working properly

Push <Enter> to continue...

If you get errors, check the DDP network circuit, the translation table, the main hospital system, and the physical network components, and try to locate the problem and correct it. See the **VISTA** Imaging DICOM Gateway Installation Guide for additional information.

### 5.2.2 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.

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



MSM 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 #2 (Display DICOM Message Log).

These log files may be viewed with the menu option 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 <b>VISTA</b> 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 ***
*****
```

Receiving 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.

### 5.2.3 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 **F:\DICOMDict\SCU\_List.DIC**.

Prerequisite:

- Target DICOM Validation Service Class Provider (configured to respond to **VISTA**)

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



MSM 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 ***
*****
```

### 5.2.4 Display the Version of the Software

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



MSM 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** DICOM gateway software.

This is version "Vista Imaging DICOM Gateway 2.5" created on 29 SEP 2000.

Push <Enter> to continue...

### 5.2.5 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 MSM Terminal icon to start a session for this menu option.



MSM 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).
- In the third menu, select #5 (Display Gateway Application Usage Statistics).

```

Test VistA-to-Gateway Networking (MUMPS DDP)
  25 Feb 2000:    1 invocation
  Total:         1
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:

## 5.2.6 Support Telephone Numbers

When a user encounters 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 MSM Terminal icon to start a session for this menu option.



MSM 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...

### 5.2.7 Shut Down this System

This menu-option may be used to invoke the MSM System Shut Down procedure. This should be done whenever the pc is being powered off.

The MSM Database Management software should never be terminated without allowing the MSM software to “shut down” gracefully.

Failure to run the MSM System Shut Down procedure may cause the internal database to become corrupted, or may prevent the most recent transactions from being stored permanently.

**Note:** This option may only be invoked from the “MSM Console window”.

Prerequisites:

- MSM Console

Use the MSM Console Window to start a session for this menu option.



After login, type **D ^MAGDMENU <Enter>**, then 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 #7 (Shut this System Down).

MSM - System Job Status  
02-JUN-99 10:36 AM

|         |              | Max Partitions: 21 | Current in Use: 12 |         |                       |                 |
|---------|--------------|--------------------|--------------------|---------|-----------------------|-----------------|
| JOB NUM | UCI/VOL NAME | ROUTINE NAME       | P-SIZE CURR/MAX    | STATUS  | #-COMMANDS TOTAL/INCR | DEVICES OWNED   |
| 1       | * * *        | M S M              | * * *              |         |                       |                 |
| 2       | MGR,EDM      | %SS                | 3.3/200            | Running | 47877/0               | 1pc             |
| 3+      | MGR,EDM      | DDPSRV             | 0.8/200            | DDP     | 372/22                |                 |
| 4+      | MGR,EDM      | DDPSRV             | 0.8/200            | DDP     | 372/22                |                 |
| 6       | MGR,EDM      | MSERVER            | 0.7/200            | TCP_IO  | 316/316               | 56c             |
| 7       | MGR,EDM      | MSERVER            | 0.7/200            | TCP_IO  | 324/324               | 56c             |
| 8       | MGR,EDM      | MSERVER            | 0.9/256            | TCP_IO  | 370/370               | 56c (127.0.0.1) |

```

10   DCM,DCE  MSMSHELL  1.8/200  TermI-3      3631/157  3pc(localhost~1336~
12   MGR,EDM  MSERVER    0.7/40    TCP_IO       316/316  56c
13   MGR,EDM  MSERVER    0.7/40    TCP_IO       316/316  56c
20   DCM,DCE  %MSMWEB   4.9/256    TCP_IO      283275/283275 56c
21   DCM,DCE  %MSMWEB   4.6/256    TCP_IO       734/734  56c

```

p - Principal Device

c - Current Device

```

Total Buffers In System: 1024, Modified#=0
Disk Cache Efficiency: 98.0%

```

How long (in seconds) to wait for users to logoff <60>? 0 <Enter>

Do you want to force a shutdown? y <Enter>

DDP Shutting down ...

DSD ... Circuit Disabled

DSC ... Circuit Disabled

DDP #4: DDP server halting

DDP #3: DDP server halting

DDP Shutdown ... Link 1 is now disabled

DDP Shutdown Complete.

Telnet Service is Disabled.

Shutdown initiated

Exit

At this point, the gateway may be shut down, if needed, using the normal Windows NT shut down procedures.

### 5.3 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 should maintain a single copy of the DICOM dictionary files in the **D:\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.

### 5.3.1 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 ^MAGDICOM(2006.563)) may be changed and updated using the menu option **Update Gateway Configuration Parameters** (see Section 5.3.2).

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



MSM 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).

```

Gateway Configuration Parameters
-----

ASCII DICOM TEXT = YES
COMMERCIAL PACS = N/A
  DATA PATH / 1 = D:\DICOM\Data1
  DATA PATH / 2 = D:\DICOM\Data2
  DICT PATH = F:\DICOM\Dict
FREE DISK SPACE = 15
  HIS/RIS = VISTA
  HL7_PTR = 466632
IMAGE INPUT PATH = D:\DICOM\Image_In
IMAGE OUTPUT PATH = D:\DICOM\Image_Out
INSTRUMENT PATH = D:\DICOM\Instrument
  MACHINE ID = C
  MESSAGE LOG = YES
MODALITY WORKLIST = YES
PACS EXAM COMPLETE = NO
  ROUTE ALPHA TEST = YES
  ROUTING RULES = NO
SEND CPT MODIFIERS = YES
  SEND PACS TEXT = YES
  SYSTEM TITLE = Silver Spring Test System
  TEXT GATEWAY = YES
  UID ROOT = 1.2.840.113754
  VERSION = VA DICOM V2.5

```

Push <Enter> to continue...

### 5.3.2 Update Gateway Configuration Parameters

There are some parameters that will be different for every Imaging DICOM Gateway PC. 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 MSM Terminal icon to start a session for this menu option.



MSM 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).

This option may be used to define a number of the configuration parameters, as follows:

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

### 5.3.3 Update INSTRUMENT.DIC

The list of individual instruments that are being used at a site is maintained in master file **F:\DICOM\Dict\Instrument.DIC**. This menu option loads the contents of this file into the **VISTA** Imaging DICOM Gateway MUMPS database.

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



MSM 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 #3 (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 Modality Instruments>>
Comment: <<>>
Comment: << Mnemonic|Description|Institution Name|Imaging Service|Port|>>
Comment: << Imaging services are defined as follows>>
Comment: <<   RAD ----- Radology>>
Comment: <<   MED-ENDO ---- Medical Endoscopy>>
Comment: <<   MED-FLURO --- Medical Fluoroscopy>>
Comment: <<   MED-DENT ---- Medical Dental>>
Comment: <<   SUR-URO ----- Surgery Urology>>
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 -- MED-ENDO -- 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>>

```

### 5.3.4 Update MODALITY.DIC

Image processing is controlled by fields in the **F:\DICOM\Dict\Modality.DIC** master file. This menu option loads the contents of this file into the *VISTA* Imaging DICOM Gateway MUMPS database.

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



MSM 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 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: <<manufacturer|model|modality|dcmtotga.exe parameters|case# lookup code
|data extraction code|data extraction file>>
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
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
```

### 5.3.5 Update PORTLIST.DIC

**Note:** This dictionary is only needed 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 **F:\DICOM\Dict\PortList.DIC**. This menu option loads the contents of this file into the *VISTA* Imaging DICOM Gateway MUMPS database.

Use the MSM 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 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>>

```

### 5.3.6 Update SCU\_LIST.DIC

**Note:** This site-specific dictionary is rather complicated and should be only edited with the assistance of *VISTA* Imaging Support Personnel.

The list of descriptions of User Applications that are being used at a site is maintained in master file **F:\DICOMDict\SCU\_List.DIC**. This menu option loads the contents of this file into the *VISTA* Imaging DICOM Gateway MUMPS database.

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



MSM 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 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 Little Endian>>
Comment: <<>>
Comment: << GEMS PACS Query/Retrieve|QueryRetrieve|VISTA_QR_SCU|111.222.333.73|104>>
Comment: << |Verification SOP Class|Implicit VR Little Endian>>
Comment: << |Study Root Query/Retrieve Information Model - FIND|Implicit VR Little Endian>>
Comment: << |Study Root Query/Retrieve Information Model - MOVE|Implicit VR Little 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 Endian>>
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>>
```

### 5.3.7 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 **F:\DICOM\Dict\WorkList.DIC**. This menu option loads the contents of this file into the **VISTA** Imaging DICOM Gateway MUMPS database.

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



MSM 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 #7 (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: <<Station AE Title|Institution Name|Imaging Service|Imaging Type|Short
or Long Accession Number>>
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_I|BALTIMORE, MD|RAD|RAD|LONG>>
Comment: <<>>
Comment: << Test AE title is for exercising the local VISTA MWL provider>>
TEST -- 523 -- RAD -- RAD -- LOG
Comment: <<>>
Comment: << Place your entries below>>

```

### 5.3.8 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, the list of recognized HL7 messages, and so forth.

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 MSM Terminal icon to start a session for this menu option.



MSM 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 (Reinitialize All the DICOM Master Files).

```

Ready to build all of the DICOM Master Files? y// <Enter> yes

```

```

This system's title is "Ed's MSM Test System"
Do you wish to change it? n// 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

```

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```
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

Send text to a commercial PACS, Mitra Broker, etc.? YES// <Enter> YES

Is a PACS going to transmit IMAGES 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

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 --
```

### 5.3.9 Download Current Radiology and MAS Routines

The DICOM Gateway uses a number of routines that belong to other applications, such as Radiology, MAS and Kernel. When patches are applied to these routines on the main *VISTA* Hospital Information System, the copies of these routines must be updated on the *VISTA* Imaging DICOM Gateway computers as well.

The purpose of this menu option is make sure that the proper version of the routines that belong to these other applications is loaded on the gateway systems.

Transfer of patched routines occurs in two steps:

1. First, on the *VISTA* HIS side, a menu option must be run to copy the current versions of the routines into temporary storage
2. Then, on each *VISTA* Imaging DICOM Gateway, a menu option must be run to re-load the routines from this temporary storage.

#### Step 1: Copy routines to Temporary Storage of *VISTA* HIS

On the *VISTA* Hospital Information System, execute the menu option “**Copy Routines to DICOM Gateway**” from the Imaging System Manager menu. (This menu option requires the “MAG SYSTEM” security key).

```
Select Imaging System Manager Menu Option: ?
```

```
DS      Define Imaging Site Parameters
IW      Edit Image WRITE LOCATION only.
WF      Enter/Edit Background Processor Workstation File
NT      Enter/Edit Network Location
LS      Edit Network Location STATUS
PUR     Edit Imaging Purge Parameters
        Copy Routines to DICOM Gateway
        VistARad System Options ...
```

```
Select Imaging System Manager Menu Option:
      COP <Enter> y Routines to DICOM Gateway
```

```
Now copying:
```

```
RARIC          78 lines
RARTE2        117 lines
. . .
XUSRB1        65 lines
```

Remember to run the appropriate option on the DICOM gateway.!

## Step 2: Re-load the Routines onto the DICOM Gateway Systems from Temporary Storage

On each *VISTA* DICOM Gateway, execute the “Download Current Radiology and MAS Routines” menu option to re-loads the routines that were saved on the *VISTA* HIS.

Prerequisites:

- MSM Console
- *VISTA* Hospital Information System (data is stored on the main HIS)

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



MSM 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 (Download Current Radiology and MAS Routines).

The output should look like this:

```
RARIC          78 lines
RARTE2        117 lines
. . .
XUSRB1        65 lines
```

Please verify that each of the routines in Step 2 is copied to the DICOM gateway.

### 5.3.10 Create Shortcuts for Instruments

Whenever the INSTRUMENT.DIC is modified, the user has the option of also automatically creating the shortcuts for them in the Instrument folder on the desktop. This will create shortcuts with the mnemonic names that are used to internally identify the instruments. Alternatively, the user can manually copy an existing shortcut to create new ones, and then edit them.

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



MSM 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, the user is given the opportunity to edit the host file. See the *VISTA* Imaging Installation Guide for more details.

### 5.3.11 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 stored in FileMan table “Imaging Site Parameters” (stored in ^MAG (2006.1, ...)). The site-specific parameters that apply to the Imaging DICOM Gateways are described below. Please refer to the *VISTA* Imaging Installation Guide for additional information.

#### 5.3.11.1 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).

#### 5.3.11.2 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).

#### 5.3.11.3 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.

#### **5.3.11.4 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).

#### **5.3.11.5 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.

#### **5.3.11.6 PACS Image Write Location**

The value of this parameter is a pointer to the Network Location table (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.

### **5.4 MUMPS Utilities**

#### **5.4.1 Access MUMPS Error Log**

In order 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 about the nature of the error, the date and time when the error occurred and the internal status of the application when the error occurred is recorded.

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 MSM Terminal icon to start a session for this menu option.



MSM 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:

```
MSM - Error Report Utility
```

- ```
1 - Display errors
2 - Print errors
3 - Erase errors
4 - Summarize errors
```

```
Enter option: 4 <Enter> - Summarize
```

```
Enter date(s): ? <Enter>
```

```
Errors have been logged for the following days: T-2,T
```

```
ENTER:
```

```
'^Q' to exit this utility.
<RETURN> or '^' to return to the last question.
date as 'MM/DD/YY' or, 'T' (today) or, 'T-1' (yesterday), etc.
two dates, in either format, separated by ":", for range of dates,
example: 8/7/90:8/30/90 for period between August 7th and 30th inclusive.
```

```
Enter date(s): T-5:T <Enter>
```

```
Enter output device <0>: <Enter>
```

```
UCI 'DCM,DCM' ERRORS ON 06/07/1999
(RUN 06/09/1999 10:31 AM)
```

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```
6 ERRORS LOGGED ON 06/07/1999
```

- ```
1) $ZE=<LINER>OUTPUT1+41^MAGDDW3:::4:2:
   $H=57866,46749 JUN 7 1999 12:59 PM
2) $ZE=<LINER>OUTPUT1+41^MAGDDW3:::4:2:
   $H=57866,46752 JUN 7 1999 12:59 PM
3) $ZE=<LINER>OUTPUT1+41^MAGDDW3:::4:2:
   $H=57866,46755 JUN 7 1999 12:59 PM
4) $ZE=<LINER>OUTPUT1+41^MAGDDW3:::4:2:
   $H=57866,46764 JUN 7 1999 12:59 PM
5) $ZE=<LINER>OUTPUT1+41^MAGDDW3:::4:2:
   $H=57866,46774 JUN 7 1999 12:59 PM
6) $ZE=<LINER>OUTPUT1+41^MAGDDW3:::4:2:
   $H=57866,46784 JUN 7 1999 12:59 PM
```

```
UCI 'DCM,DCM' ERRORS ON 06/09/1999
(RUN 06/09/1999 10:31 AM)
```

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```
2 ERRORS LOGGED ON 06/09/1999
```

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- 1) \$ZE=<DSCON>SENDDATA+8^MAGDTCP2:::6:12:  
\$H=57868,28200 JUN 9 1999 7:50 AM
- 2) \$ZE=<DSCON>SENDFRAG+17^MAGDTCP2:::6:12:  
\$H=57868,29269 JUN 9 1999 8:07 AM

Enter date(s): <Enter>

- 1 - Display errors
- 2 - Print errors
- 3 - Erase errors
- 4 - Summarize errors

Enter option: 1 <Enter> - Display

Date of error: T <Enter>

2 ERRORS LOGGED ON 06/09/1999

Error #: 1 <Enter>

Symbol: ^L <Enter>

```
$ZE="<DSCON>SENDDATA+8^MAGDTCP2:::6:12:"  
$ECODE=",Z<DSCON>SENDDATA+8^MAGDTCP2:::6:12:,"  
$H="57868,28200" JUN 9 1999 7:50 AM  
$J="9"  
$I="56"  
$ZA="0"  
$ZB="64"  
$ZC="1"  
LAST GLOBAL REFERENCED="^MAGDMLOG(67343,0)"  
$S="34912"  
$ZL="0"  
Naked#1="^MAGDICOM(2006.54,4,0)"  
Naked#2="^TMP("MAG",9,"DICOM","NEGOTIATE","SOP CLASS UID","1.2.840.10008.5.1.4.3  
1")"  
Naked#3="^MAGDMLOG(67343,0)"  
%DEV="51"  
BYTE0="56"  
. . .  
X="0"  
YET2SEND="0"
```

Symbol: <Enter>

Error #: <Enter>

Date of error: <Enter>

- 1 - Display errors
- 2 - Print errors
- 3 - Erase errors
- 4 - Summarize errors

Enter option: 3 <Enter> - Erase

Enter date(s): T-2 <Enter>

Are you sure you want to delete all errors logged on 06/07/1999 ? **Y** <Enter>

ERRORS DELETED

- 1 - Display errors
- 2 - Print errors
- 3 - Erase errors
- 4 - Summarize errors

Enter option: <Enter>

## 5.4.2 Global Variable Lister

This menu-option may 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 ^%GL** 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 MSM Terminal icon to start a session for this menu option.



MSM 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:

```
MSM - Global Lister Utility
22-JUL-99  2:13 PM
```

```
Global selector: ^MAGDICOM(2006.563 <Enter>
```

```
Enter output device <0>: <Enter>
```

```
Do you want to page output? <N> <Enter>
```

```
^MAGDICOM(2006.563,0)="DICOM GATEWAY PARAMETER^2006.563^1^1"
```

```
^MAGDICOM(2006.563,1,"ASCII DICOM TEXT")="YES"
```

```
^MAGDICOM(2006.563,1,"COMMERCIAL PACS")="N/A"  
^MAGDICOM(2006.563,1,"DAILY REPORT")="58140,"  
^MAGDICOM(2006.563,1,"DATA PATH",1)="D:\DICOM\Data1"  
^MAGDICOM(2006.563,1,"DATA PATH",2)="D:\DICOM\Data2"  
^MAGDICOM(2006.563,1,"DICT PATH")="F:\DICOM\Dict"  
^MAGDICOM(2006.563,1,"FREE DISK SPACE")="15"  
^MAGDICOM(2006.563,1,"HIS/RIS")="VISTA"  
^MAGDICOM(2006.563,1,"HL7_PTR")="466632"  
^MAGDICOM(2006.563,1,"IMAGE INPUT PATH")="D:\DICOM\Image_In"  
^MAGDICOM(2006.563,1,"IMAGE OUTPUT PATH")="D:\DICOM\Image_Out"  
^MAGDICOM(2006.563,1,"INSTRUMENT PATH")="D:\DICOM\Instrument"  
^MAGDICOM(2006.563,1,"MACHINE ID")="C"  
^MAGDICOM(2006.563,1,"MESSAGE LOG")="YES"  
^MAGDICOM(2006.563,1,"MODALITY WORKLIST")="YES"  
^MAGDICOM(2006.563,1,"PACS EXAM COMPLETE")="NO"  
^MAGDICOM(2006.563,1,"POST OFFICE")="11.22.33.42"  
^MAGDICOM(2006.563,1,"SCRATCH")="C:\temp"  
^MAGDICOM(2006.563,1,"SEND CPT MODIFIERS")="YES"  
^MAGDICOM(2006.563,1,"SEND PACS TEXT")="YES"  
^MAGDICOM(2006.563,1,"SYSTEM TITLE")="Silver Spring MSM Test System"  
^MAGDICOM(2006.563,1,"TEXT GATEWAY")="YES"  
^MAGDICOM(2006.563,1,"TIME ZONE")="-500"  
^MAGDICOM(2006.563,1,"UID ROOT")="1.2.840.113754"  
^MAGDICOM(2006.563,1,"VERSION")="VA DICOM V2.5"
```

Global selector: ^

### 5.4.3 Display MUMPS System Status

When a system does not behave as expected, the first step is to verify that all expected tasks are running.

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.)

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



MSM 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).

When a system does not behave as expected, the first step is to verify that all expected tasks are running.

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:

```

MSM - System Job Status
28-SEP-00 6:14 AM

Max Partitions: 21      Current in Use: 16

JOB  UCI/VOL  ROUTINE  P-SIZE  STATUS  #-COMMANDS  DEVICES
NUM  NAME     NAME     CURR/MAX  -----  TOTAL/INCR  OWNED
-----
  1   * * *   M S M   * * *
  2   DCM,DCM  %SS     3.3/64   Running  8302/0      5pc (ISW-160
  6   MGR,IMA  MSERVER  0.7/200  TCP_IO   316/316     56c
  7   MGR,IMA  MSERVER  0.7/200  TCP_IO   324/324     56c
 10   MGR,IMA  MSERVER  1.0/40   TCP_IO   424/424     56c (127.0.0.1)
 11   MGR,IMA  MSERVER  0.7/40   TCP_IO   316/316     56c
 12   DCM,DCM  MAGDCST4 7.4/64   TermI-3   32701366/12 3pc (localhost~1041~
 13   DCM,DCM  MAGDIR1  9.6/122  Hang 110709449/483583305 4pc (127.0.0.1~104
 14   DCM,DCM  MAGDCST2 4.0/40   TCP_IO  8460012/8460012 56c
 15   DCM,DCM  MAGDCST2 8.5/40   TCP_IO  582604262/546258 56c
 16   DCM,DCM  MAGDCST2 8.5/40   TCP_IO  12070503/3513684 56c
 17   DCM,DCM  MAGDCST2 8.4/40   TCP_IO  9015589/9015589 56c
18+  MGR,IMA  DDPSRV   0.7/200  DDP      354/4
19+  MGR,IMA  DDPSRV   0.9/200  DDP      435/23
 20   DCM,DCM  MAGDHR1  12.6/64  Hang 698619857/10454162 3pc (localhost~4283~
 21   DCM,DCM  MAGDQUE1 8.5/64   Hang 1940527628/1497154 4pc (127.0.0.1~4109~
   56 (152.129.175.244)

```

p - Principal Device  
c - Current Device

Total Buffers In System: 1024, Modified#=1  
Disk Cache Efficiency:100.0%

The information displayed by this option is as follows:

| Column Heading | Description                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| JOB NUM        | The job number of the task.                                                                                                                                |
| UCI/VOL NAME   | The name of the environment in which the jobs are being processed (MGR,IMT indicates a system-related task, DCM,DCM indicates an application-related task. |
| ROUTINE NAME   | The name of the program that is currently running.                                                                                                         |
| P-SIZE         | The current amount of memory being used.                                                                                                                   |
| STATUS         | The current status of the process.                                                                                                                         |

| Column Heading                   | Description                                                                                                                                                                                                                                                         |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| # COMMANDS<br>Total<br>Increment | Two numbers, separated by a slash. The first of these numbers is the total number of MUMPS-instructions that have been executed by the process, while the second is the number of instructions that were executed since the most recent user-input from a terminal. |
| DEVICES OWNED                    | 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.                                                          |

Normally, the following tasks can be expected to be present:

```
1      * * * M S M * * *
```

Job 1 is always the MSM system server. This line is always present, and it never shows any specific status.

```
2 DCM,DCM %SS      3.3/64   Running      8302/0 5pc (ISW~160
```

Only one task will have the “running” status - the system status program itself.

```
18+ MGR,IMA DDPSRV   0.7/200   DDP          354/4
19+ MGR,IMA DDPSRV   0.9/200   DDP          435/23
```

These two tasks are the DDP servers. They should always be present. Typically, the status of these server programs will be “DDP”.

```
6 MGR,IMA MSERVER   0.7/200   TCP_IO      316/316 56c
7 MGR,IMA MSERVER   0.7/200   TCP_IO      324/324 56c
10 MGR,IMA MSERVER   1.0/40    TCP_IO      424/424 56c (127.0.0.1)
11 MGR,IMA MSERVER   0.7/40    TCP_IO      316/316 56c
```

These are TCP/IP socket listener tasks, and should always be present. Their status will typically be “TCP\_IO”. These tasks listen on specific network ports and start new programs when connections are made to them. The DICOM Gateway uses two of these MSERVER tasks, one listening on 60000 for the Storage service, and the other listening on 60010 for the Modality Worklist service. (The other two are for MSM Activate and MSM Workstation services.)

```
14 DCM,DCM MAGDCST2  4.0/40    TCP_IO      8460012/8460012 56c
15 DCM,DCM MAGDCST2  8.5/40    TCP_IO      582604262/546258 56c
16 DCM,DCM MAGDCST2  8.5/40    TCP_IO      12070503/3513684 56c
17 DCM,DCM MAGDCST2  8.4/40    TCP_IO      9015589/9015589 56c
```

These are the background MUMPS DICOM Storage Controller tasks for the foreground C-Store server processes. On a *VISTA* DICOM Image Gateway, one or more C-Store process should always be active, each with its own MUMPS DICOM Storage Controller. The status of these processes will typically be “TCP\_IO” or “DDP-wait”. (They should not be present on a *VISTA* DICOM Text Gateway.)

12 DCM,DCM MAGDCST4 7.4/64 TermI-3 32701366/12 3pc(localhost~1041~

This is the task that displays the *VISTA* DICOM Image Gateway statistics. It is usually active on an image gateway, and will typically be waiting for input from the terminal.

13 DCM,DCM MAGDIR1 9.6/122 Hang 1110709449/483583305 4pc(127.0.0.1~104

This is the task that processes DICOM images. It should always be active on an image gateway. When it is idling, the status will show as “Hang”, when it is processing images, any other status may be reported.

20 DCM,DCM MAGDHR1 12.6/64 Hang 698619857/10454162 3pc(localhost~4283~

This is the task that processes text messages. This should always be active on a *VISTA* DICOM Text Gateway. When it is idling, the status will show as “Hang”, when it is processing messages, any other status may be reported.

21 DCM,DCM MAGDQUE1 8.5/64 Hang 1940527628/1497154 4pc(127.0.0.1~4109~

This is the task that sends DICOM text messages to a commercial PACS. This task should always be active on a *VISTA* DICOM Text Gateway. When it is idling, the status will show as “Hang”, when it is transmitting messages, any other status may be reported.

#### 5.4.4 Display MUMPS System Information

This menu option displays the status of all system tasks. (This utility can also be invoked by typing **D ^%SI** at the command line in programmer mode.)

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



MSM 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 #4 (Display MUMPS System Information).

The display typically will look like:

```
MSM - System Status
28-SEP-00  6:14 AM
```

The system has been up since 21-SEP-00 at 6:12 AM (7 days,2 minutes) when it was rebooted after a crash.  
The active configuration is DICOM: Digital Imaging & Communications in Medicine

```
Maximum Users: 16           Active Users: 3           Socket Users: 1
Maximum Partitions: 21      Active Partitions: 14
Maximum Net Connections: 8  Current Net Connections: 2
Total disk buffers: 1024    Modified buffers: 0      Cache efficiency: 100.0%
```

Status of System Processes

| System Process                            | Status     | Job# | Job Status     |
|-------------------------------------------|------------|------|----------------|
| MSM                                       | system     | 1    | Running        |
| Distributed Data Processing               | active     | 18   | DDP            |
|                                           |            | 19   | DDP            |
| Telnet Service                            | Enabled    |      |                |
| Before Image Journaling                   | enabled    |      | Volume Groups: |
|                                           |            |      | DCM            |
| MSM-Activatel service (TCPIP - 1666)      | active     | 7    | TCP_IO         |
| Workstation service (TCPIP - 33086)       | active     | 6    | TCP_IO         |
| PDQweb service (TCPIP - 2001)             | not active |      |                |
| User service DICOM CSTORE (TCPIP - 60000) | active     | 10   | TCP_IO         |
| User service MOD WORKLIST (TCPIP - 60010) | active     | 11   | TCP_IO         |

In this report, the header shows the current date and time, which system configuration is running, and how long the system has been running.

The next block of information lists the maximum numbers for a number of resources and their actual usage.

The table at the bottom is the most important part of this report. This table shows which of the configured system processes are “active”. When this section of the report shows tasks that are “not active” or “crashed”, it is important to make certain that these tasks are (re)started using the appropriate system menu options.

The following system processes should be active in a DICOM Gateway that is operating normally:

|                                      |        |    |         |
|--------------------------------------|--------|----|---------|
| MSM                                  | system | 1  | Running |
| Distributed Data Processing          | active | 18 | DDP     |
|                                      |        | 19 | DDP     |
| MSM-Activatel service (TCPIP - 1666) | active | 7  | TCP_IO  |
| Workstation service (TCPIP - 33086)  | active | 6  | TCP_IO  |

In addition, Telnet and Before Image Journaling should be enabled:

|                         |         |  |                |
|-------------------------|---------|--|----------------|
| Telnet Service          | Enabled |  |                |
| Before Image Journaling | enabled |  | Volume Groups: |

DCM

The two processes, **DICOM CSTORE** and **MOD WORKLIST** are used by the **VISTA** Imaging DICOM Gateway, and should always be active:

```
User service DICOM CSTORE (TCPIP - 60000)active 10 TCP_IO
User service MOD WORKLIST (TCPIP - 60010)active 11 TCP_IO
```

The **DICOM CSTORE** must be running on the **VISTA** DICOM Image, while the Gateway **MOD WORKLIST** must be running on the **VISTA** DICOM Text Gateway. These can be re-initiated by shutting MSM down and restarting it.

The example shows **PDQweb service** as “not active”. This system service is not used by the **VISTA** Imaging DICOM Gateway, and should never be active:

```
PDQweb service (TCPIP - 2001) not active
```

#### 5.4.5 Check Available Space in MUMPS Database

MSM databases are created with a specific fixed size, and as time progresses, more space within these databases will be used.

This menu-option runs the utility program that provides information about the usage level of the active databases. (This utility can also be invoked by typing **D ^%SP** at the command line in programmer mode.)

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



MSM 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 #5 (Check Available Space in MUMPS Database).

The display typically will look like:

```
MSM - Disk Space/Free Space Utility
18-JUN-99 8:24 AM

Select volume group to display <ALL>:

Volume Group: IMT Index: 0

Vol  Maps  Tot Blks  Free Spc  %-Free  Host File Name
---  ---  -

```

```
0      20      10240      4372      42.70      c:\msm\Database.msm
<>
```

```
Volume Group: DCM      Index: 1      DKRES reserved blocks: 200
```

| Vol | Maps | Tot Blks | Free Spc | %-Free | Host File Name   |
|-----|------|----------|----------|--------|------------------|
| 0   | 40   | 20480    | 9914     | 48.41  | c:\msm\dicom.msm |

Make sure that the system always has at least 25% free space for each database. If it gets below this value, contact the National Help Desk.

### 5.4.6 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 MSM Terminal icon to start a session for this menu option.



MSM 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 #6 (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., left click on “My Computer”, right click on the disk, and click on “Properties”).

Please keep track of disk utilization, so that there is always enough free disk space to run the gateway for an extended period of time.

### 5.5 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 Appendix A.

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



MSM 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.**

**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.**



## Chapter 6 Correcting DICOM Failed Images

When images are “acquired”, a number of checks are made to make certain that the information that is stored in the database can be linked to the correct patient and medical procedures.

On occasion, *VISTA* Imaging DICOM Gateway software may be unable to match one of the following items from a DICOM image header with an existing entry in the *VISTA* Hospital Information System:

- Patient name
- Patient ID (Social Security Number)
- Accession Number (Radiology case number or Medicine number)

When this happens, the *VISTA* Imaging DICOM Gateway will store information in VA FileMan File number 2006.575, the **DICOM FAILED IMAGES** file. Manual intervention may be used to correct any of the data items that are in error, after which another attempt may be made to add the information about the image(s) to the *VISTA* database. Note: the actual image file will remain in the directory D:\DICOM\Image\_In. Do not delete files from this directory.

The program that performs these corrections is available in the main *VISTA* Hospital Information System through the [**MAGD DICOM MENU**] menu-option **MAGD FIX DICOM FILE**. This menu-option should be assigned to responsible supervisory staff members, who should use it on a daily basis to correct all failed images as soon as possible.

In order to select an image to be fixed, three options are available:

- Select by patient
- Loop through the list of failed images
- Scan the list of failed images by date-range

When a failed image has been selected, the user can identify the correct patient and case-number for the image. This causes the correct patient and study to be assigned to the image. After this, the DICOM Image Gateway will be able to process the image correctly. Images that can not be identified can be deleted.

Below, a sample session is shown for each of the three selection options.

## 6.1 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:

|                         |                                    |
|-------------------------|------------------------------------|
| ADAC FLOOD,             | D:\DICOM\Image_In\A0002791.DCM     |
| CASE#: 031298-<unknown> | DATE: Feb 24, 1999 MODALITY: CR1   |
| BOWLES, SAMUEL          | D:\DICOM\Image_In\A0014799.DCM     |
| CASE#: 062398-<unknown> | DATE: Feb 24, 1999 MODALITY: CR1   |
| BRIGHT, GOLDENROD       | D:\DICOM\Image_In\F0000001.DCM     |
| CASE#: 021097-4666      | DATE: Apr 28, 1999 MODALITY: WALSH |
| CT HILIGHT ADV, 01SHFO  | D:\DICOM\Image_In\A0000034.DCM     |
| CASE#: 091798-<unknown> | DATE: Sep 23, 1999 MODALITY: CR1   |
| DAMAZO, MILTON          | D:\DICOM\Image_In\A0014810.DCM     |
| CASE#: 062498-<unknown> | DATE: Feb 24, 1999 MODALITY: CR1   |
| GIDDINGS, TYRONE        | D:\DICOM\Image_In\A0014816.DCM     |
| CASE#: 062498-<unknown> | DATE: Feb 24, 1999 MODALITY: CR1   |
| JONES, WILLIAM          | D:\DICOM\Image_In\A0014803.DCM     |
| CASE#: 061898-<unknown> | DATE: Feb 24, 1999 MODALITY: CR1   |

Select DICOM Failed Images: **JONES, WILLIAM** <Enter> D:\DICOM\Image\_In\A0014803.DCM  
CASE#: 061898-<unknown> DATE: Feb 24, 1999 MODALITY: CR1

\*\*\*\*\*Processing entry\*\*\*\*\*

|                                    |                       |
|------------------------------------|-----------------------|
| PATIENT: JONES, WILLIAM            | SSN: 228302197        |
| 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: **TEST,SIX** <Enter>

Select RAD/NUC MED PATIENT: TEST,SIX// TEST,SIX 01-06-44 111223333  
 NO NON-VETERAN (OTHER)

\*\*\* WARNING \*\*\*  
 Case Lookup by Patient

Patient's Name: TEST,SIX 111223333

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 |
|---------------|---------------|------------------|----------|
| JONES,WILLIAM | FEB 24,1999   | 061898-<unknown> | NM       |

Type '^' to STOP, or

\*\*\*\*Please review the following: \*\*\*\*

Previous name: JONES,WILLIAM

New name: TEST,SIX

Previous ssn: 228302197

New ssn: 111223333

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: JONES,WILLIAM

New name: TEST,SIX

Previous ssn: 228302197

New ssn: 111223333

Previous case #: 061898-<unknown>

New case #: 106

Are you sure you want to correct this entry? ? No// <Enter> (No)

## 6.2 Looping through the list of failed images

Select OPTION NAME: **MAGD FIX DICOM FILE** <Enter>

Correct RAD-DICOM File Entries

## Chapter 6 – Correcting DICOM Failed Images

Select one of the following:

```

P      Patient
L      Loop thru file
D      Specify a Date Range
  
```

Update entries by: **L <Enter>** oop thru file  
 \*\*\*\*\*Processing entry\*\*\*\*\*

```

PATIENT: WILD,RASBERRY                      SSN: 202-52-4439
RADIOLOGY CASE #: 051299-105
Equipment: CR1                               Model: CT
Date Processed: SEP 15,1999                 Problem with: PATIENT
Comment: 051299-105
  
```

Correcting file on server ID: A  
 D:\DICOM\Image\_In\A0000012.DCM  
 Do you want to Correct this entry? (Y/N/D/Q)// **<Enter>**  
 \*\*\*\*\*Processing entry\*\*\*\*\*

```

PATIENT: CT HILIGHT ADV,01SHFO              SSN: PHANTOM
RADIOLOGY CASE #: 091798-<unknown>
Equipment: CR1                               Model: CT
Date Processed: SEP 23,1999                 Problem with: PATIENT
Comment: 091798-<unknown>
  
```

Correcting file on server ID: A  
 D:\DICOM\Image\_In\A0000034.DCM  
 Do you want to Correct this entry? (Y/N/D/Q/P)// **Y <Enter>**  
 Lookup by case number or patient name

Enter Case Number or Patient Name: **TEST,SIX <Enter>**  
 Select RAD/NUC MED PATIENT: TEST,SIX// TEST,SIX 01-06-44 111223333  
 NO NON-VETERAN (OTHER)

\*\*\* WARNING \*\*\*  
 Case Lookup by Patient

Patient's Name: TEST,SIX 111223333 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  
 CT HILIGHT ADV,01SHFO SEP 23,1999 091798-<unknown>CT

Type '^' to STOP, or

\*\*\*\*Please review the following: \*\*\*\*  
 Previous name: CT HILIGHT ADV,01SHFO

```

New name: TEST,SIX
Previous ssn: PHANTOM
New ssn: 111223333
Previous case #: 091798-<unknown>
New case #: 080498-70
Social Security numbers do not match. Update? (Y/N/D/Q/P)// D <Enter>

*****
*** Will log in error log (file 2006.599). ***
Please enter a reason for deleting.
For example: TEST PATIENT
Reason for deletion: <Enter>
This is a required response. Enter '^' to exit
Please enter a reason for deleting.
For example: TEST PATIENT
Reason for deletion: ^ <Enter>
Can not delete if a reason is not provided.
*****Processing entry*****

PATIENT: GORE,A                      SSN: 202-52-4439
RADIOLOGY CASE #: 5528
Equipment: CR1                       Model: CT
Date Processed: OCT 8,1999           Problem with: PATIENT
Comment: 5528                        \F/U

\
\
Correcting file on server ID: A
D:\DICOM\Image_In\A0000192.DCM
Do you want to Correct this entry? (Y/N/D/Q/P)// Q <Enter>

```

### 6.3 Scanning the list of failed images by date-range

```

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: D <Enter> Specify a Date Range
Enter start date: T-20 <Enter>
Enter stop date: T-10 <Enter>
*****Processing entry*****

PATIENT: GORE,A                      SSN: 202-52-4439
RADIOLOGY CASE #: 5528
Equipment: CR1                       Model: CT
Date Processed: OCT 8,1999           Problem with: PATIENT
Comment: 5528                        \F/U

\
\
Correcting file on server ID: A
D:\DICOM\Image_In\A0000192.DCM
Do you want to Correct this entry? (Y/N/D/Q)//
. . .

```

In any of the cases that the question “**Are you sure you want to Update?**” is asked, responding with a “**D**” will cause deletion of the image file on the server and will record the deletion in a log file.

The FileMan DICOM FAILED IMAGES (File 2006.575) file may have many entries. Sometimes, however, this option will only loop through a few studies, because a single study, like a CT scan, can have a large number of image files associated with it.

## Appendix A Re-Define Access and Verify Codes

The procedure to modify access and verify codes is not directly available from any of the menus in order 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 5.5).

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.

```
[DCM,DCM]>Do INIT^MAGDLOGN <Enter>
```

```
Enter new ACCESS CODE: password <Enter>
```

```
Re-enter ACCESS CODE (to make sure I got it right): password <Enter>
```

```
Enter new VERIFY CODE: password <Enter>
```

```
Re-enter VERIFY CODE (to make sure I got it right): password <Enter>
```

```
Enter new PROGRAMMER ACCESS CODE: password <Enter>
```

```
Re-enter PROGRAMMER ACCESS CODE (to make sure I got it right): password <Enter>
```

```
Enter new PRINT/VIEW ONLY CODE: password <Enter>
```

```
Re-enter PRINT/VIEW ONLY CODE (to make sure I got it right): password <Enter>
```

```
[DCM,DCM]>
```

The system requires that the “**password**” be a combination of six or more letters and numbers. It is not case-sensitive, however.

**Note:** When a user logs 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).



## Appendix B Text Gateway File Modes of Operation

### B.1 Overview

The *VISTA* 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.

### B.2 DIRECT Mode of Operation

In some applications, like responding to Modality Worklist queries, where the *VISTA* 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 3-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 B.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 B.2**

### B.3 FIFO QUEUE Mode of Operation

In other applications, like the PACS text interface, where the *VISTA* 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, while 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 B.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                           |
| <b>VISTA</b>       | 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 B.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 Lnnnnnn.DCM, where “L” is the queue letter, “nnnnnn” is a sequentially assigned 7-digit number, and DCM is the message extension. (Depending on a configuration parameter, there may also be a Lnnnnnn.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 thirty-two 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.

### B.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 ("0000000"). 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 ("000027"), 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=000027

W0000028.DCM

W0000029.DCM                    W\_WRITE.PTR=000029

Note: there may also be thirty W00000nn.TXT files as well.

### B.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<sup>3</sup>. 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.

### B.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**

---

<sup>3</sup>The numbers are in the inclusive range of 0-9999999. The increment step must reset the counter at the end of the range.

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).

#### **B.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.



## Appendix C Image Acquisition Devices - Modalities

This appendix describes the steps to be undertaken 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 of the image acquisition devices and mapping them to the *VISTA* DICOM Image Gateways. Such an inventory should include the information shown in tables C.1 and C.2. Then register each instrument with the *VISTA* Modality Worklist Provider on the *VISTA* DICOM Text Gateway. Section C.3 presents the details on how to do this. Finally, setup the image processing parameters for each different instrument modality. This is described below in Section C.4.

### C.1 Image producing equipment

Table C.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 upon the scheme described in the *VISTA* Imaging DICOM Installation Guide.

| Instrument Name          | VA Network Name | IP Address      | Port Assigned | Mnemonic | Location | Imaging Service |
|--------------------------|-----------------|-----------------|---------------|----------|----------|-----------------|
| DeJarnette ImageShare    | VHAXXIMG1       | 111.222.333.229 | 60100         | CR1      | 2D-130   | RAD             |
| DeJarnette ImageShare    | VHAXXIMG2       | 111.222.333.230 | 60101         | CR2      | C2-72    | RAD             |
| DeJarnette ImageShare    | VHAXXIMG3       | 111.222.333.231 | 60102         | CR3      | OPC      | RAD             |
| GE CT/i CT Scanner       | VHAXXCTS1       | 111.222.333.111 | 60120         | CT1      | 2D-124   | RAD             |
| OEC C-Arm 9400           | VHAXXOEC1       | 111.222.333.120 | 60140         | DRS1     | Portable | RAD             |
| OEC C-Arm 9700           | VHAXXOEC2       | 111.222.333.121 | 60141         | DRS2     | Portable | RAD             |
| Acuson 128 Ultrasound    | VHAXXACU1       | 111.222.333.117 | 60160         | US1      | Portable | RAD             |
| Acuson 128 Ultrasound    | VHAXXACU2       | 111.222.333.118 | 60161         | US2      | Portable | RAD             |
| Acuson 128 Ultrasound    | VHAXXACU3       | 111.222.333.119 | 60162         | US3      | Portable | RAD             |
| ADAC Vertex              | VHAXXADAC1      | 111.222.333.178 | 60170         | NM1      | 2D-166   | RAD             |
| ADAC Solus               | VHAXXADAC2      | 111.222.333.184 | 60171         | NM2      | 2D-163   | RAD             |
| ADAC Siemens Basicam     | VHAXXADAC3      | 111.222.333.185 | 60172         | NM3      | 2D-162   | RAD             |
| ADAC Siemens Orbiter     | VHAXXADAC4      | 111.222.333.177 | 60173         | NM4      | 2D-158   | RAD             |
| Lumisys 75               | VHAXXLUM1       | 111.222.333.150 | 60190         | LUMISYS  | 2D-116   | RAD             |
| GE Advantage Workstation | VHAXXAWS1       | 111.111.333.113 | 60200         | ADW1     | 2D-135   | RAD             |

| Instrument Name    | VA Network Name | IP Address      | Port Assigned | Mnemonic | Location | Imaging Service |
|--------------------|-----------------|-----------------|---------------|----------|----------|-----------------|
| Philips EasyVision | VHAXXE1         | 111.222.333.130 | 60201         | EV1      | 2D-155   | RAD             |
| Philips MRI        | VHAXXMRI1       | 111.222.333.131 | 60300         | MRI1     | 2D-155   | RAD             |
| Olympus EndoWorks  | VHAXXENDO1      | 111.222.333.140 | 60400         | ENDO1    | 4E-124   | MED-ENDO        |

**Table C.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.

## C.2 Distribute Modalities over Processors

Table C.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            | VHAXXDIG1       | VHAXXDIG2       | VHAXXDIG3       | VHAXXDIG4       | VHAXXDIG5       |
|--------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| <b>IP Address:</b> | 111.222.333.238 | 111.222.333.239 | 111.222.333.240 | 111.222.333.241 | 111.222.333.242 |
| <b>Allocation</b>  | CT1             | MRI1            | CR1             | CR2             | CR3             |
| <b>Mnemonic</b>    | DRS1            | DRS2            | US1             | US2             | US3             |
|                    | NM1             | NM2             | NM3             | NM4             | ENDO1           |
|                    | LUMISYS         |                 | ADW1            | EV1             |                 |

**Table C.2**

## C.3 Image Acquisition

### C.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 NT 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. (The full name of this file is typically `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

```

### C.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 C.3.

| Storage SCP           |                 | Required Values                               |
|-----------------------|-----------------|-----------------------------------------------|
|                       | IP Address      | <b>VISTA</b> DICOM Image Gateway's IP Address |
|                       | Port Number     | Port number assigned for the Instrument       |
|                       | Called AE Title | <b>VISTA_STORAGE</b>                          |
| Modality Worklist SCP |                 |                                               |
|                       | IP Address      | <b>VISTA</b> DICOM Text Gateway's IP Address  |
|                       | Port Number     | <b>60010</b>                                  |
|                       | Called AE Title | <b>VISTA_WORKLIST</b>                         |

Table C.3

### C.3.3 Registering the Instrument with **VISTA** Modality Worklist SCP

In order for the instrument to utilize the **VISTA** Modality Worklist service, the instrument must first be properly registered with the **VISTA** DICOM Gateway. The DICOM Application Entity Title of the image acquisition device, its location, imaging service, the accession number format (Short or Long), and a description of the instrument must be entered in the **F:\DICOM\Dict\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|MED-ENDO||LONG|Endoscopy
```

**Note:** The column in this file that reads “*sitename*” in this 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 above in Section 7.3.7.

### C.3.4 Registering the Instrument with VISTA Storage Provider SCP

The parameters that are shown in the shaded columns in table C.1 will be entered in the **F:\DICOM\Dict\Instrument.DIC** master file (see also the **VISTA** Imaging DICOM Gateway Installation Guide, Chapter 8). For the above site, the contents of this file would look like:

```
# 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|MED-ENDO|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 5.3.3.

Once the **F:\DICOM\Dict\Instrument.DIC** master file has been created (or each time it is updated), the “Create Shortcuts for Instruments” menu option can be run to create the shortcuts for the various instruments (see Section 5.3.10).

## C.4 Setting up DICOM Image Processing

### C.4.1 Registering the Type of Modality with VistA

After an entry has been added to **F:\DICOM\Dict\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.

Before images can be processed correctly, however, the image acquisition device must have a corresponding entry in the **F:\DICOM\Dict\Modality.DIC** master 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 **F:\DICOM\Dict\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, 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).

```
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
```

## Appendix C – Image Acquisition Devices - Modalities

| t                       | n         | h           | Attribute                        | Value                         |
|-------------------------|-----------|-------------|----------------------------------|-------------------------------|
| t                       | 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" |
| 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"           |
| 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" |
| 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>"                   |
| <b>000212:0008,0070</b> | <b>LO</b> | <b>0014</b> | <b>Manufacturer</b>              | <b>"G.E. Medical Systems"</b> |
| 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"                      |
| <b>00025E:0008,1090</b> | <b>LO</b> | <b>000A</b> | <b>Manufacturer's Model Name</b> | <b>"LOGIQ 700"</b>            |
| 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                   | "ULTRASOUND^GE^^"             |
| 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)"                  |

## Appendix C – Image Acquisition Devices - Modalities

```

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"

```

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```
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)

In the above print-out, a number of lines are highlighted. The information from these lines is used for the parameters that need to be entered into **d:\DICOM\Modality.DIC**.

| DICOM Element | Name         |
|---------------|--------------|
| (0008,0070)   | Manufacturer |
| (0008,1090)   | Model        |
| (0008,0060)   | Modality     |

**Table B.4**

### **C.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.

The parameters in the line to be constructed are:

1. Manufacturer
2. Model
3. Modality
4. DCMtoTGA.exe parameters
5. Case# lookup code
6. Data extraction code
7. Data extraction file

**C.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|
```

**C.4.2.2 Parameter Number 4, Image Processing**

The value of this parameter is a string of codes that are used as parameters for the program that converts DICOM files to TARGA™ format.

See the *VISTA* Imaging DICOM Installation Guide, Appendix B for appropriate values.

**C.4.2.3 Parameter Number 5, Accession Number Lookup Routine**

This parameter specifies the name of the routine that is invoked to extract the Accession Number from the data in the header of the image file.

See the *VISTA* Imaging DICOM Installation Guide, Appendix B for appropriate values.

**C.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*.

See the *VISTA* Imaging DICOM Installation Guide, Appendix B for appropriate values.

**C.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.

See the *VISTA* DICOM Installation Guide, Chapter 8 for appropriate values

**C.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 above in Section 5.3.4.



## Appendix D Diagnostic Tests

This appendix 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.)

### D.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
```

```
Pinging FORUM [11.22.33.44] with 32 bytes of data:
```

```
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. Four “impc requests” were issued by PING and four (or zero) “impc responses” were received.

A system should always be able to ping its 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 a phony PING function by attempting to establish a FTP session with the destination system. This does not work with the **VISTA** DICOM system, since Windows NT workstation does not normally provide an FTP server.

### D.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.

### D.3 Sending a Test Image

Normally, images are sent by the “instruments”. 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>
```

## Appendix D – Diagnostic Tests

```
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:>
```

# Appendix E Image Transfer from Commercial PACS - DICOM Exam Complete

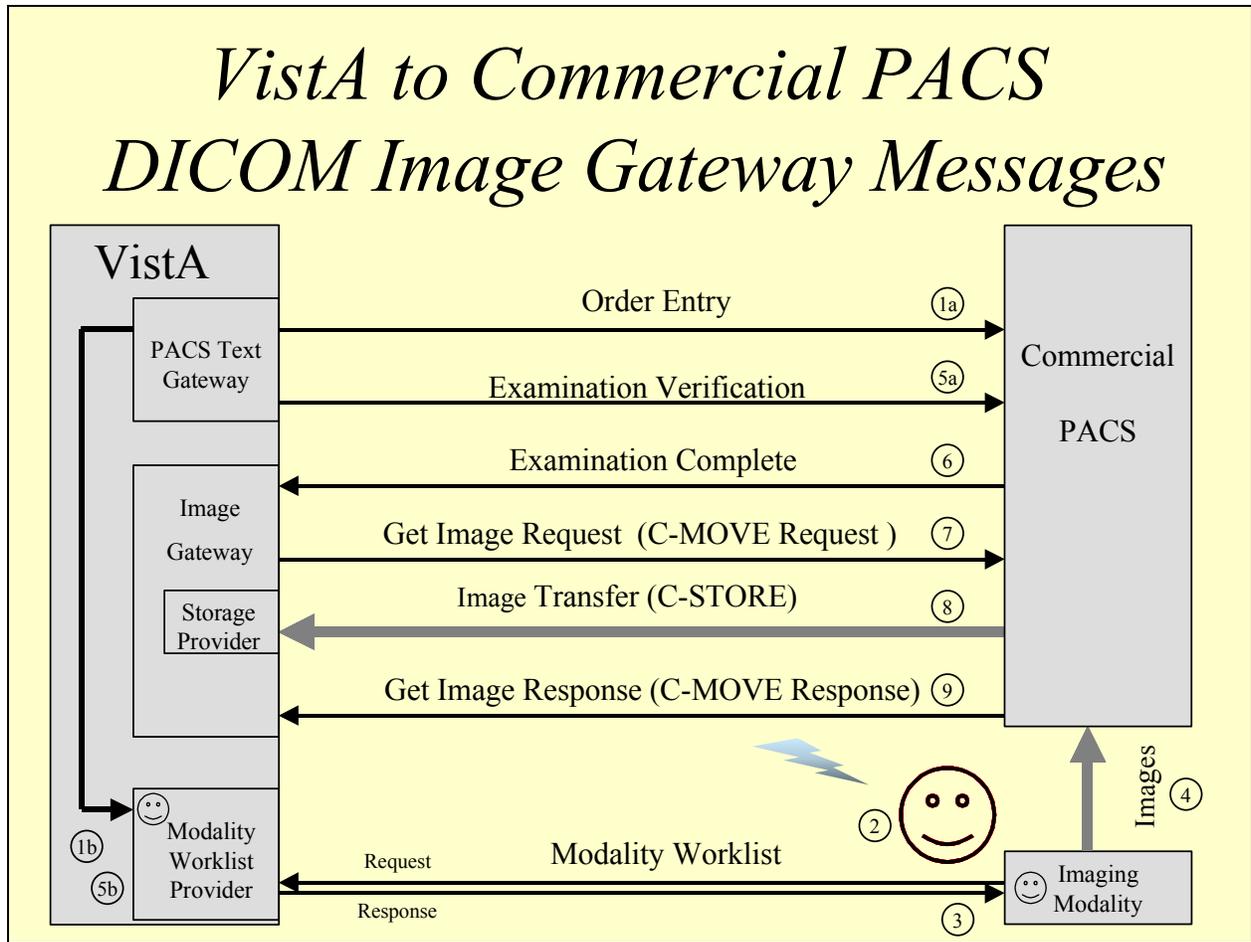
This is the method used by the GEMS PACS when configured with the Mitra PACS Broker and by the EMED PACS.

## E.1 Overview

The following sequence of messages and events are used in the commercial PACS interface (see Figure E.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. When this occurs it depends on the commercial PACS implementation. The Exam Complete message contains the Study Instance UID (0020,000D) which 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 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 are presented in the sections below.



**Figure E.1**

## E.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** Request a set of images to be transferred from one DICOM Application Entity to a DICOM Storage Application Entity.
- C-STORE** Transfer 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 **C-STORE**.

### E.3 *VISTA* DICOM Image Gateway Processes

Five window processes need to run on a *VISTA* DICOM Image Gateway in order 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. 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

### E.4 Configuration Preparation for PACS Interface

#### E.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.

#### E.4.2 Receive Exam Complete Messages

Create an entry in the **F:\DICOM\Dict\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**

### **E.4.3 C-STORE Provider**

Create an entry for the PACS in the **F:\DICOM\Dict\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 `c-store.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**)

### **E.4.4 Send PACS Request Image Transfer Messages**

Create an entry for the PACS in the **F:\DICOM\Dict\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.)

#### E.4.5 Process DICOM Images

No additional setup required.

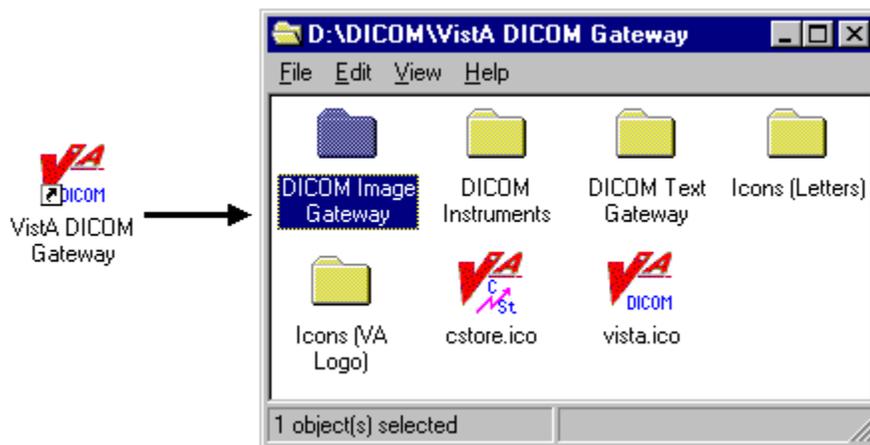
#### E.4.6 Display Real-Time Storage Server Statistics

No additional setup required.

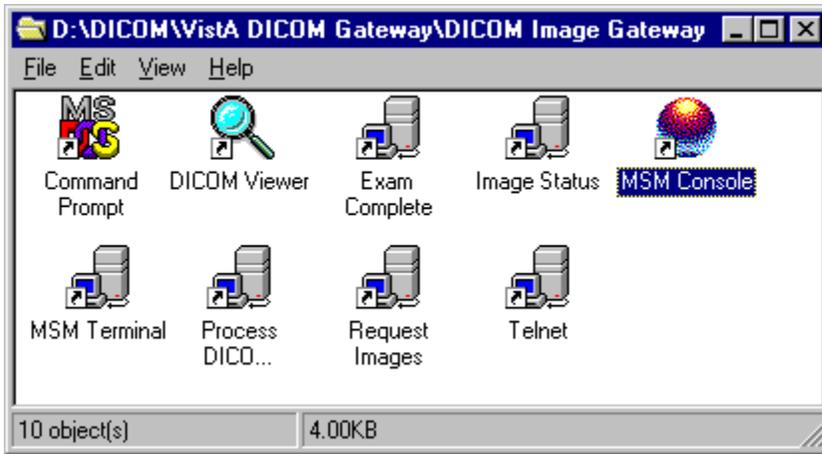
### E.5 Startup Sequence for commercial PACS Interface

Use the following sequence of steps to start the *VISTA* DICOM Image Gateway for the commercial PACS:

1. Open the folder labeled “**DICOM Image Gateway**”

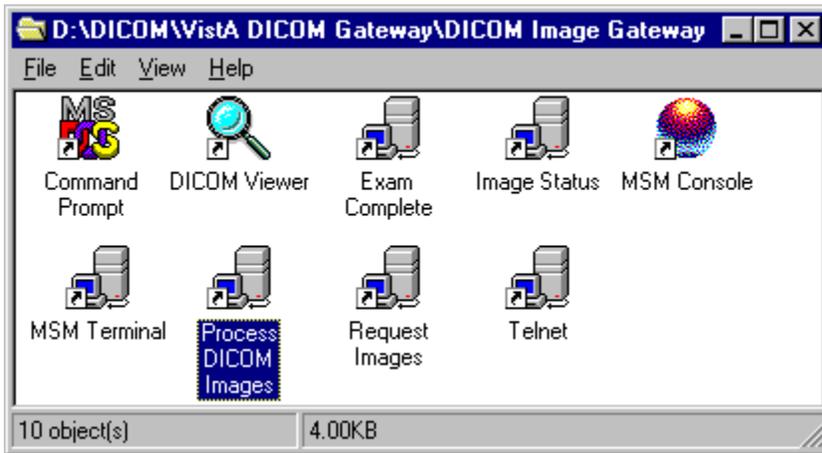


2. Start the MSM Console

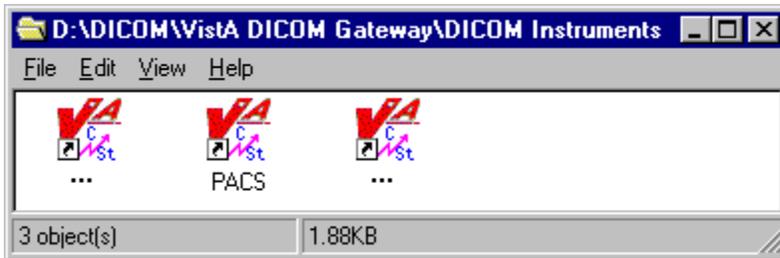


This shortcut should automatically select the startup configuration “**DICOM**”. If not, press <Enter> to accept this default configuration. Next, when the startup procedure asks for a “**UCI**”, press <Enter> again. The MSM Server should respond by displaying the text “Exit”.

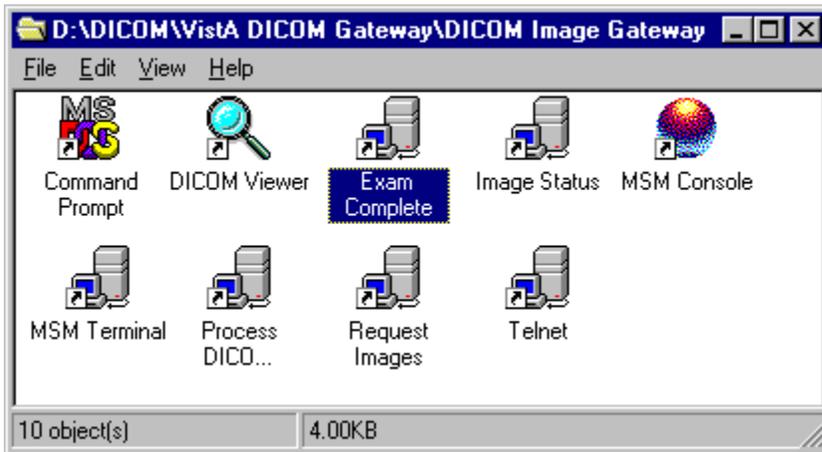
3. Open the folder labeled “**DICOM Instruments**”



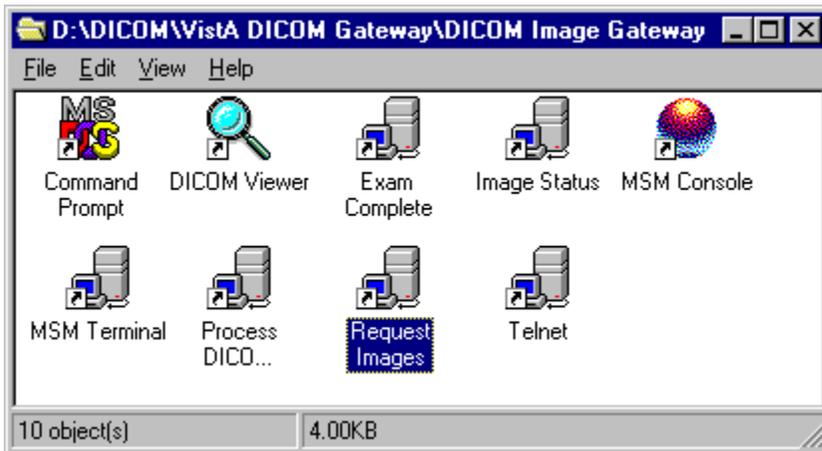
4. Double-click on the **PACS** icon to launch the C-Store program. There should be some activity in the **MSM Console** window when this program starts up.



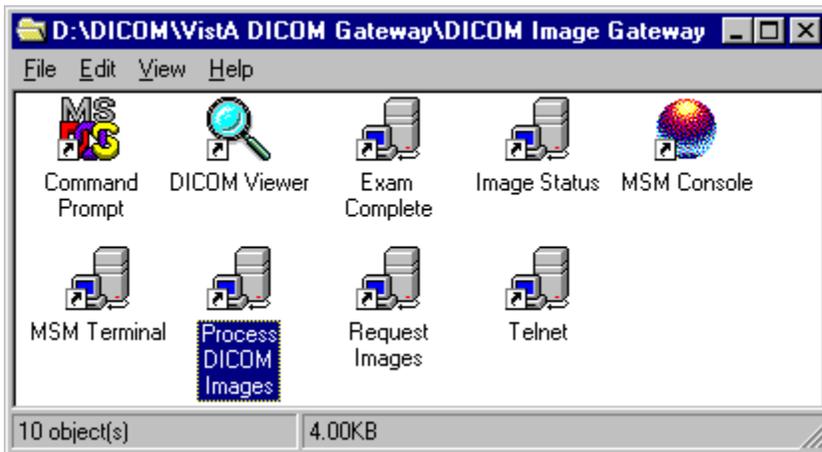
- Return to the “DICOM Image Gateway” window and double-click on the shortcut labeled “**Exam Complete**” and select the menu items listed in the shortcut title (options 2 and 1).



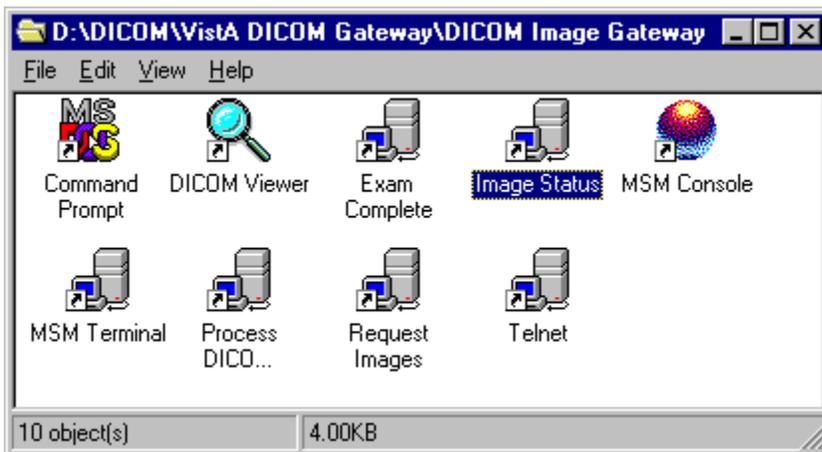
- Double-click on the shortcut labeled “**Request Images**” and select the menu items listed in the shortcut title (options 2 and 2).



7. Double-click on the shortcut labeled “**Process DICOM Images**” and select the menu items listed in the shortcut title (options 2 and 3).



8. Double-click on the shortcut labeled “**Image Status**” and select the menu items listed in the shortcut title (options 2 and 4).



## Appendix F 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 Appendix E.

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.

### F.1 Configuration Preparation for PACS Interface

#### F.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.

#### F.1.2 C-STORE Provider

Create an entry for the PACS in the **F:\DICOM\Dict\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 `c-store.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**)

### F.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.



# Appendix G Troubleshooting

This chapter contains a number of hints for resolving problems.

## G.1 License Limits

The MUMPS database server used by the *VISTA* Imaging DICOM Gateway requires a large enough license to allow all users, background tasks, and network connections to operate simultaneously. Of course, the larger the license, the higher the fee. In the *VISTA* Imaging DICOM Gateway Installation Guide, a minimum license size is specified as **16 users** and **8 network connections**. This size system will allow for 25 simultaneous job partitions, one for the MSM System itself, a maximum of 16 that run in the foreground, and the rest in the background<sup>4</sup> (see Sections 5.4.3 and 5.4.4.). When the MUMPS engine on a *VISTA* Imaging DICOM Gateway has a smaller license, it may not function adequately, and the error messages shown in this section may appear.

An error message may appear when an attempt is made to start an additional task on the database server, while all license slots are being utilized. There are a number of situations where such a message can show up.

- DDP connection
- C-Store connection
- Telnet connection

The discussion below provides more details about each of these.

As the actual usage of the database server increases, the first action should be to rethink the allocation of tasks over the various DICOM Gateway processors. Only when additional tasks are needed, and all of the available processors have been “maxed out”, should an additional processor be acquired, or the license count on at least one processor be increased.

Contact the vendor of the MUMPS Database server (InterSystems Corporation) or a designated reseller to acquire licenses, or to increase license limits.

### G.1.1 Limit on DDP Connections

In order to create operational DDP connections, several different quotas need to be kept in mind:

- The *VISTA* Imaging DICOM Gateway needs to have two DDP server tasks running (these tasks count against the partition count).

---

<sup>4</sup> The total number of simultaneous jobs is 1.5 times the number of users specified by the license.

- For each active DDP connection, one network connection is charged to the network connection quota.

When the maximum number of allowable partitions is not high enough, the MSM startup log will contain a message like:

```
Can't start 2 servers, only nn servers have been started
```

When this message appears, first check which tasks are automatically started when MSM is restarted (^SYSGEN, option 3, 3)<sup>5</sup>. First validate that all these tasks are really needed. If there are unnecessary background tasks, delete them. If all tasks are needed, consider obtaining a license with a higher user” quota.

When the maximum number of network connections is not high enough, the MSM startup log will contain a message like:

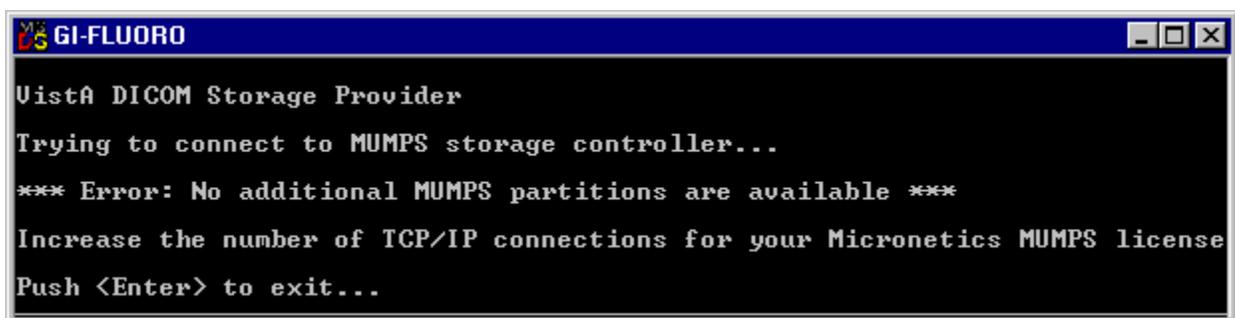
```
DDP #4: Circuit to node SAA via link #1 with DSMV2 protocol  
cannot be created; exceed Net license limit.
```

When this message appears, it is usually beneficial to turn off “automatic network configuration” (^SYSGEN, 3, 15, 1)<sup>5</sup> and then “manually” define only the circuits for the essential DDP connections (see the *VISTA* Imaging DICOM Gateway Installation Guide). If this error persists after minimizing the active network connections in this way, consider obtaining a license with a higher network connection quota.

### G.1.2 Limit on Number of C-Store Processors

For each C-Store processor, a background task will be started on the *VISTA* Imaging DICOM Gateway. The license quota for number of users needs to be high enough to support all C-Store processors that are assigned to a single Image Gateway.

When the quota for “users” is not high enough to start all C-Store processors, the start up log of the failing C-Store processors will contain this error message:



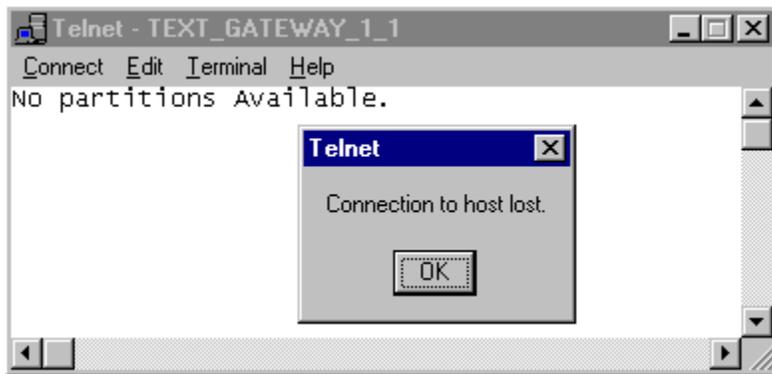
---

<sup>5</sup> See the **MSM System Manager’s Guide** for a more detailed description of the program ^SYSGEN.

If this error message occurs, first try to re-distribute the various C-Store providers over the **VISTA** DICOM Image Gateways. If all Image Gateways are maxed out, consider obtaining a license with a higher “user” quota.

### G.1.3 Limit on Number of Telnet Sessions

Each telnet session counts as one user. When the “user” quota is not high enough to accommodate all needed interactive sessions, the attempt to launch a telnet session will produce this error message:



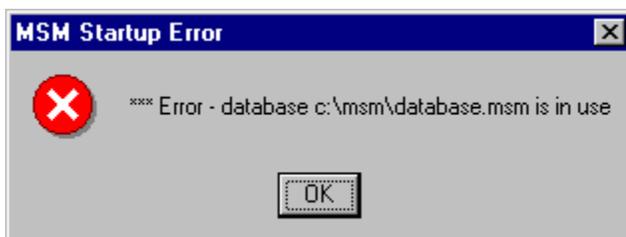
When this error occurs, local system manager should use the MSM Console window, or any of the other open telnet sessions to run an MSM System Status (see Section 5.4.3), and terminate any non-essential telnet sessions (Do ^KILLJOB).

When all running telnet sessions are essential, consider obtaining a license with a higher user quota.

## G.2 MSM Startup Error Messages

### G.2.1 MSM is Already running

When MSM is already running, and an attempt is made to start a second copy of the MSM Console, the following error message will be displayed.



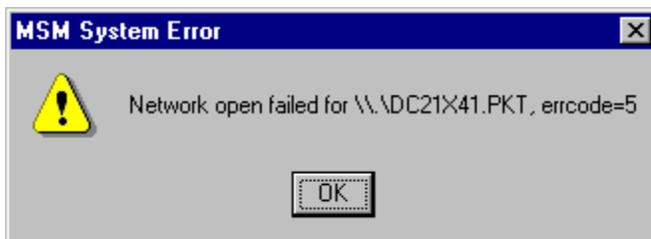
This message can be ignored (just click on the “**OK**” button).

### G.2.2 A Different Configuration of MSM is Already running

When a different configuration of MSM is already running, and an attempt is made to start an instance of the MSM Console, the following error messages will be displayed.



and

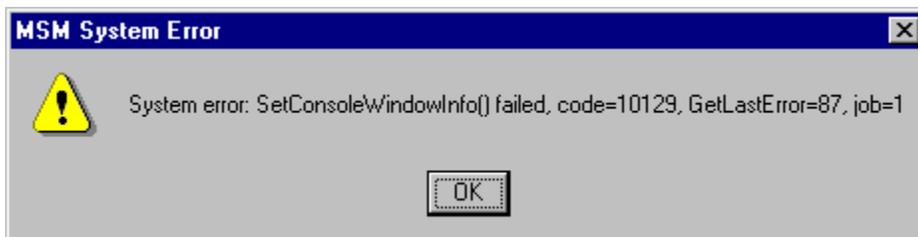


These messages indicate that the network connection is already in use by another configuration. (In the second error message, the name of the actual Ethernet card will appear.) Click on "OK" in both error messages, and shut down the newly started MSM configuration.

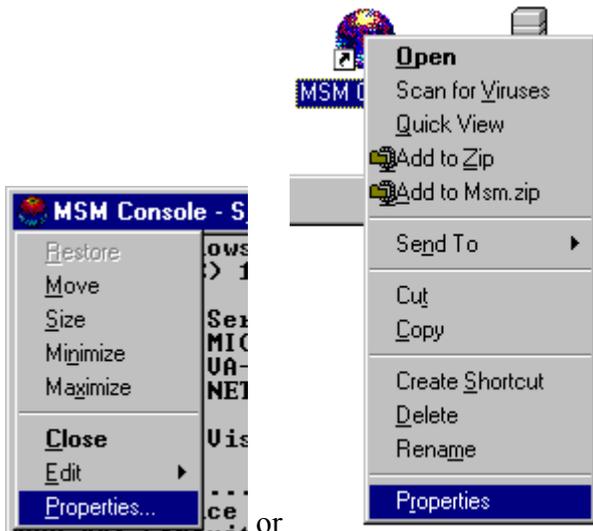
If the newly started should be running, rather than the one that is already using the network connection, shut down both MSM environments, and only start the one that is needed to be running.

### G.2.3 Invalid Window Settings

Sometimes, when MSM is started, the following error message will pop up that indicates that the console window could not be started:

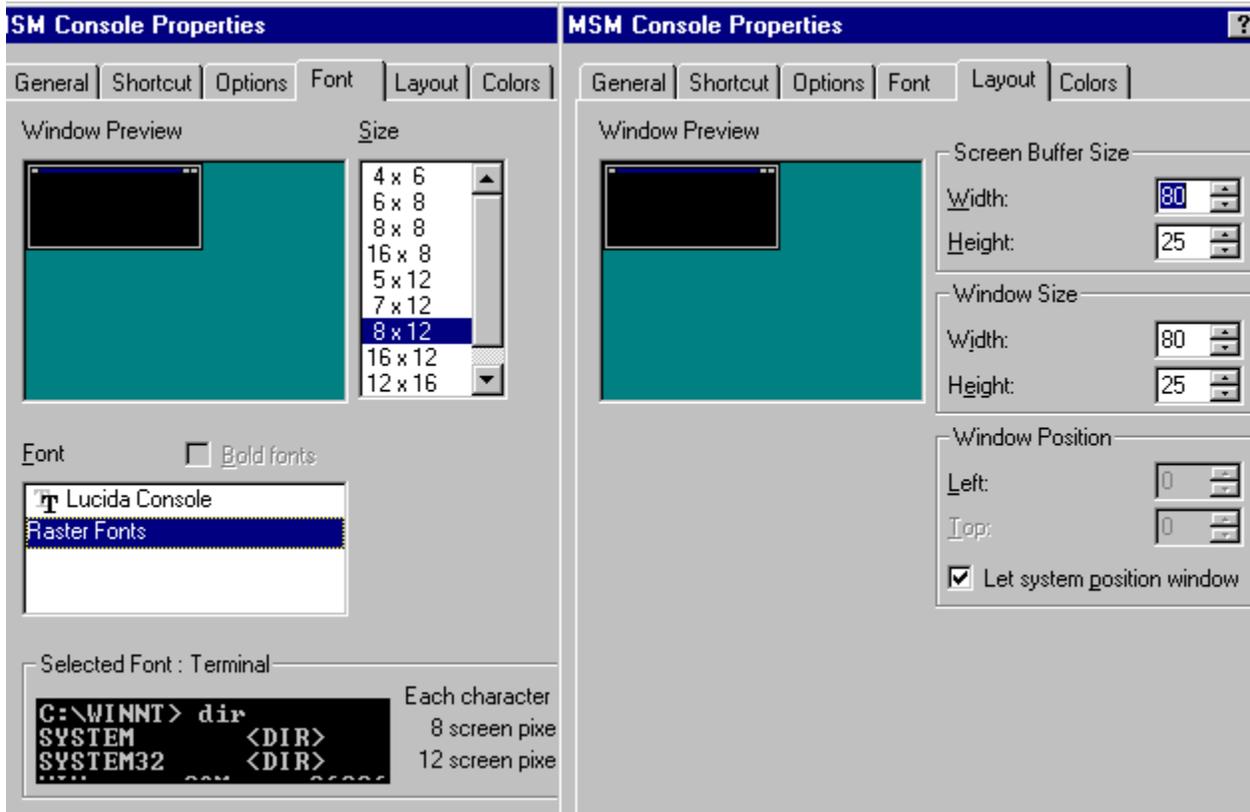


The meaning of this message is that the current settings for the console window are invalid. To recover from this condition, either click on the icon in the left upper corner of the MSM Console window or right-click on the icon for the MSM Console itself.



In either case, select “**Properties**” from the pop-up menu.

In the properties dialog, make sure that the font-size is set small enough that the complete console window fits on one screen full, and make sure that the window size is 80 columns by 25 lines.

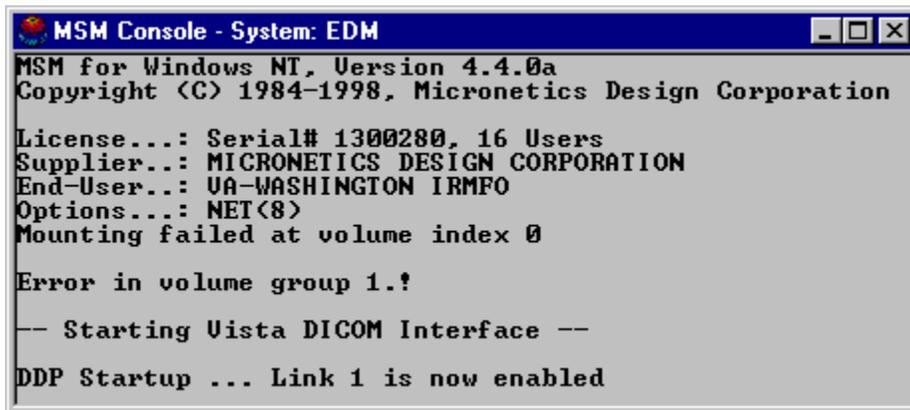


When saving any modified settings, be certain to update the settings for the “shortcut” that started the MSM Console.



## G.2.4 DICOM Database Cannot be Mounted

When a system is restarted after a power failure, the database may be in a state that does not allow automatic mounting of the database. In such a case, an error message will appear during system start-up. Typically, the message will indicate that the database could not be mounted, or that Before Image Journaling could not be started.

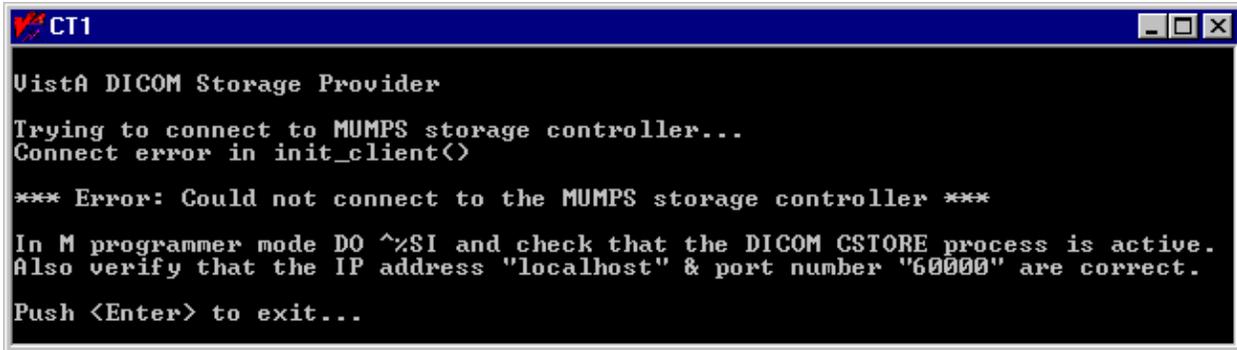


When such a message appears, call Customer Support to repair the database.

## G.3 Improper Start-Up Sequence

### G.3.1 Start C-Store Program before MSM Server is Running

When an attempt is made to start a C-Store program before the MSM Server has been started, an error message like the following will appear:



```

CT1
UistA DICOM Storage Provider
Trying to connect to MUMPS storage controller...
Connect error in init_client()

*** Error: Could not connect to the MUMPS storage controller ***

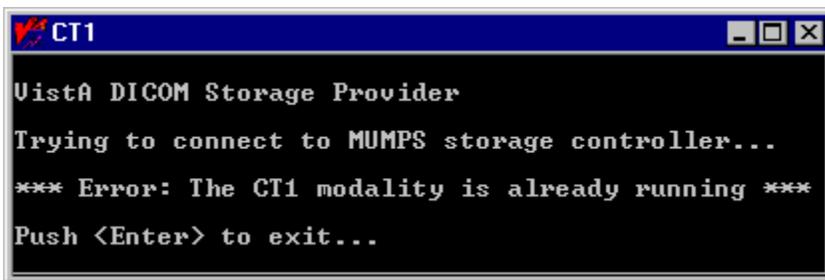
In M programmer mode DO ^%SI and check that the DICOM CSTORE process is active.
Also verify that the IP address "localhost" & port number "60000" are correct.
Push <Enter> to exit...

```

In order to resolve this problem, first start the MSM Server and then start the C-Store program.

### G.3.2 Start C-Store Program while it is already Running

When an attempt is made to start an instance of a C-Store program, while a copy of that program for that instrument is already running, the following error message will be reported:



```

CT1
UistA DICOM Storage Provider
Trying to connect to MUMPS storage controller...

*** Error: The CT1 modality is already running ***

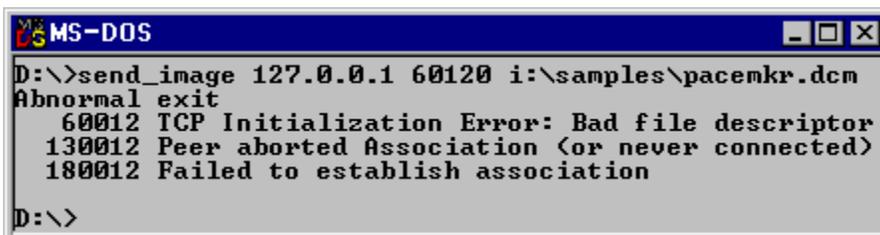
Push <Enter> to exit...

```

In order to resolve this problem, simply press <Enter> to terminate the second instance of the program.

### G.3.3 Transmit Image before C-Store Program is Running

When an attempt is made to store an image while the *VISTA* C-Store program for the instrument is not running, an error message is likely to appear. The actual error message is instrument-specific. The following one is produced by the Mallinckrodt Send\_Image program and is used as an example.



```

MS-DOS
D:\>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:\>

```

In order to resolve this problem, first start the *VISTA* C-Store program by double-clicking on its icon, and then transmit the image.

### G.3.4 Too many Instruments for one Image Gateway

Each instrument that transmits images to an Image Gateway uses one MUMPS background partition. When too many instruments are assigned to one single Image Gateway exceeding the maximum partition count, the following error message will appear:



```

GI-FLUORO
Vista DICOM Storage Provider
Trying to connect to MUMPS storage controller...
*** Error: No additional MUMPS partitions are available ***
Increase the number of TCP/IP connections for your Micronetics MUMPS license
Push <Enter> to exit...

```

When this happens, first try to re-distribute the various instruments over the available Image Gateways. If that isn't possible, consider acquiring a license for more "users" for the processor.

### G.3.5 Images are acquired, but are not moved to the NT File Server

When images are being acquired successfully, but are not being transported to the NT File Server, this is most likely due to the fact that the "Process DICOM Images" task is not running. Check to make sure that it is running. (See Section 4.11 for information on how to start the task.)

If "Process DICOM Images" is running, and images are still not moving to the NT File Server, one of the following six problems might be happening:

- The patient/study information in the image header is incorrect and the association cannot be properly made.
- The network connection from the DICOM Image Gateway to the NT File Server may be down.
- There may not be an entry in the Modality.DIC for the manufacturer-model-modality defined in the image header.
- There may be a run-away job on the *VISTA* Imaging DICOM Gateway, either in MUMPS or elsewhere, that is preventing the image-processing task from having the necessary CPU resources. (Use NT Task Manager and ^%SS to further identify this problem.)
- There may be a problem with a run-away job on the *VISTA* main HIS preventing DDP from having the necessary CPU resources.
- There may be other DDP problems.

## G.4 Privileges and Permissions

By the nature of the information that is stored and manipulated in a hospital environment, many aspects of the DICOM Gateway are subject to access restrictions. It is important to keep track of the various user-accounts that have to be created and utilized to ensure proper access for the various parts of the system.

When any part of the software reports an access restriction type of error, the most common causes are that...

- The current user is logged in using a user-account that does not have the privileges needed to perform the action at hand
- A password has been changed, and the current user has not yet updated the registered copy of that password to the current value.

It is also important to be aware that...

- Some access restrictions apply to the current user
- Some access restrictions apply to the file at hand
- Some access restrictions apply to the disk-share where a file is stored
- Different access privileges may apply for reading an existing file and for creating a new file

Typical error messages that may appear are “Image file subdirectory creation error”, “Cannot create the image subdirectory: -5”, “Cannot find file xxxx” and “Access Denied”.

## G.5 DDP Problems

The protocol that is being used for the communication between the *VISTA* Imaging DICOM Gateway processors and the main *VISTA* Hospital Information System is called **DDP (Distributed Data Processing)**. The *VISTA* Imaging DICOM Gateway Installation Guide describes the process to configure the Gateway processors so that DDP connectivity can be established.

A menu-option is available to validate that DDP connectivity is working properly (see Section 5.2.1).

Under normal circumstances, the *VISTA* Imaging DICOM Gateway software is resilient enough to recover from common disruptions in network connectivity.

However, when changes in system configuration occur on either the main *VISTA* system, or on one of the *VISTA* Imaging DICOM Gateway processors, the automatic restart may fail, as the configuration of the *VISTA* Imaging DICOM Gateway processor needs to remain synchronized with the configuration of the main *VISTA* system.

When many disruptions occur, it may be necessary to purge error messages with <NOSYS>, <DSTDB>, <DSCON> and <DDPER> from the MUMPS error log (see Sections 5.4.1 and G.13.6). If there are so many error reports that the database overflows, see the section about a full database (Section G.6.1).

The sections below describe some typical changes in configuration that may affect DDP connectivity.

### G.5.1 Changes in Passwords

The use of a password for DDP-based access to a system is optional. If a password for DDP access is added, removed, or changed on the main *VISTA* system, the passwords stored on the *VISTA* Imaging DICOM Gateway processors must be modified accordingly.

In order to modify a DDP password on a gateway processor, login into the MGR environment, and run the following program:

```
[MGR,EDM]>Do ^SYSGEN <Enter>

      MSM - System Generation Utility

Select SYSGEN Option:

    1 - Display Configuration Parameters
    . . .
    14 - Journaling Management

Select Option: 3 <Enter> - Edit Configuration Parameters

Select Configuration <DICOM>: <Enter> DICOM

Select SYSGEN Option:

    1 - SYSGEN (step through full SYSGEN)
    . . .
    20 - Mode Flags

Select Option: 15 <Enter> - Network Configuration

Available Functions:

    1 - DDP System Parameters
    . . .
    5 - Network Security
    . . .
    15 - PDQWeb Service Configuration

Select Option: 5 <Enter> - Network Security

Network Security Options:

    1 - Network Password
    2 - Security Challenge
```

Select Option: **1** <Enter> - Network Password

Enter Network Password: **xxxxx** <Enter>  
or

Enter Network Password <xxxxx>: - <Enter> Deleted.  
Security Challenge disabled.

Network Security Options:

- 1 - Network Password
- 2 - Security Challenge

Select Option: <Enter>

Available Functions:

- 1 - DDP System Parameters
- . . .
- 15 - PDQWeb Service Configuration

Select Option: <Enter>

Select SYSGEN Option:

- 1 - SYSGEN (step through full SYSGEN)
- . . .
- 20 - Mode Flags

Select Option: <Enter>

Select SYSGEN Option:

- 1 - Display Configuration Parameters
- . . .
- 14 - Journaling Management

Select Option: <Enter>

[MGR,EDM]>

### G.5.2 Network Card Replaced on main VISTA System

When “Automatic Network Configuration” is turned off in the DDP setup on the VISTA Imaging DICOM Gateway, the Gateway will be sensitive to situations where the physical network card on the main VISTA system is replaced.

In such cases, turn on “Automatic Network Configuration” (**Do ^SYSGEN**, option **3**, configuration **DICOM**, option **15**, option **1**), and restart MSM. After this, either modify the definition for the “manually defined circuit” for the main VISTA system to reflect the new “MAC address” and turn off “Automatic Network Configuration” again, or continue to run with “Automatic Network Configuration” turned on.

When “Automatic Network Configuration” is always turned on, replaced network cards will never be an issue, however, the system may exceed its DDP connection limit before establishing the necessary circuits.

When “Automatic Network Configuration” is always turned off, the gateway processor will never be bothered by DDP messages from sources that are not “manually” defined and enabled.

### G.5.3 DDP Group Allocation

DDP communication can be separated out into 16 distinct groups (numbered 0 through 15). Each processor on a local area network needs to be configured to be a member of one or more of these groups. A *VISTA* Imaging DICOM Gateway processor should only be a member of the group that provides access to the main *VISTA* system.

If the main *VISTA* system is a Caché system, this group number is always **0**.

If the main *VISTA* system is a DSM system, this group number is usually **0**, and occasionally **15**.

If the group number is changed on the main *VISTA* system, it will also need to be changed on all *VISTA* Imaging DICOM Gateway processors (**Do ^SYSGEN**, option **3**, configuration **DICOM**, option **15**, option **4**).

### G.5.4 License Limit

DDP communication requires that 2 background tasks are constantly active on each *VISTA* Imaging DICOM Gateway processor. These processes both run the program DDPSRV, and will typically be in a status of “DDP”.

One can check whether or not these processes are active by examining a system status report (see Section 5.4.3).

```

MSM - System Job Status
18-AUG-99 9:21 AM

Max Partitions: 21      Current in Use: 10

JOB   UCI/VOL  ROUTINE  P-SIZE  STATUS  #-COMMANDS  DEVICES
NUM   NAME    NAME     CURR/MAX  -----  TOTAL/INCR  OWNED
-----
1     * * *    M S M    * * *
2     MGR,EDM  MSMSHELL 1.1/200  TermI-1  23058/43    1pc
3+    MGR,EDM  DDPSRV   0.8/200  DDP      372/22
4+    MGR,EDM  DDPSRV   0.8/200  DDP      372/22
6     MGR,EDM  MSERVER  0.7/200  TCP_IO   316/316    56c
7     MGR,EDM  MSERVER  0.7/200  TCP_IO   324/324    56c
8     MGR,EDM  MSERVER  0.9/256  TCP_IO   370/370    56c (127.0.0.1)
13    MGR,EDM  MSERVER  1.0/40   TCP_IO   370/370    56c (127.0.0.1)
14    MGR,EDM  MSERVER  0.7/40   TCP_IO   316/316    56c
17    MGR,EDM  %SS      2.4/200  Running  27936/182  3pc (localhost~1153~

p - Principal Device
c - Current Device

Total Buffers In System: 1024, Modified#=0

```

Disk Cache Efficiency: 95.4%

When a gateway processor is running too many tasks, one or both of the DDP processes may not be able to be restarted during an error recovery. When this happens, the local system manager should use the MSM Console window, or any of the other open telnet sessions to run an MSM System Status (see Section 5.4.3), terminate any non-essential tasks (D<sub>O</sub> ^KILLJOB), and then manually restart the DDP servers (D<sub>O</sub> ^DDP).

It may be possible to distribute the workload better among the Imaging DICOM Gateways to avoid this problem.

If everything else fails to reduce the number of concurrent processes, a license with a higher allowance for the number of simultaneous users will have to be acquired.

## G.6 Disk Full

In the course of doing their work, the various processes create temporary data files which are later removed. On occasion, it may be necessary to manually remove data files that have been inadvertently left behind, perhaps by a run-away task (for example, one that is trying to read an incorrectly constructed DICOM image file). The sections below describe several utility functions that may be of help in removing this old computer litter.

There are two major groups of problems that result in “disk full” error messages:

- Situations where all space within a MUMPS database has been used up.
- Situations where all space on a physical medium has been used up.

### G.6.1 Full MUMPS Databases

#### G.6.1.1 Data Stored in Wrong Database

The *VISTA* Imaging DICOM Gateway locally *only* stores and maintains data in *its own* database (volume group DCM). Any error messages that indicate issues with storage in other databases (e.g. MGR or IMx) would indicate that data has been stored in a wrong place. When this happens, the spurious data should be removed from the database where it should not have been stored. (Of course, the *VISTA* Imaging DICOM Gateway remotely stores data in ^MAG(2005) and other translated globals.)

#### G.6.1.2 Purge MUMPS Error Log

When a database “fills up”, **DO NOT** increase the size of the database container file. Under normal circumstances, 15MB is more than enough to hold the DICOM database. As a safety margin, the database is sized at 20MB. When the database becomes “full”, this indicates an error by itself. First, the root-cause of this error should be determined, then the extraneous data should be removed, and after this normal processing can continue with plenty of space in the 20MB database.

The most likely cause for a “database full” situation is that a burst of similar errors caused the error log to overflow the database.

When this type of error occurs, execute the following steps (preferably, call customer support for help in executing these steps):

1. Login in programming mode as MGR using the MSM console window.
2. Terminate all telnet processes.
3. Shut down DDP. (Do ^DDP, option 2)
4. Verify that your task is the ONLY active MUMPS process on the system (Do ^%SS)
5. Terminate all remaining background server processes (Do ^KILLJOB, option 3).
6. Verify that the database is not corrupted (Do ^VALIDATE, do **not** turn on TRACE, scan all volumes).
7. If the database is corrupted, first resolve all issues that are reported by ^VALIDATE, using ^DBFIX.  
(Learning to use ^DBFIX requires a multi-day class from the database vendor. Most of the information learned in this class is “under non-disclosure restrictions”. Call customer support if a database repair is needed.)
8. A special case is global variable ^MAGDMLLOG. When this global variable has become corrupted, it’s not worth the time to try and fix it. Use ^DBFIX to remove the global variable from the Global Directory, and use ^RECOVER to remove the actual data.
9. Once it is established that it is safe to use the database, login in programming mode in DCM.
10. Check the error log (Do ^%ER) to see which errors happened over the past few days. If the bulk of the errors are DDP related, just erase them. If the error log indicates a persistent software problem, be sure to save a copy of that error report for the developer.
11. Clean out the error log
12. Remove temporary data (Kill ^TMP).
13. Check how much space is now available in the database (Do ^%SP). If it’s more than 15%, the system can be put back into operation (Shut down MSM and restart it, so that all background processes are running again.)

Once the system is back up and running, execute routine purge functions.

Purging the files and HL7 pointers to 30 days should clear sufficient disk space. (Options 10, 11, and 12 on the menu)

The U-V/W-X queue pointers should be checked.

MUMPS error logs reside in the MUMPS databases on each *VISTA* Imaging DICOM Gateways in global variable ^UTILITY.

Old entries in the MUMPS error log can be purged using a menu-option. See Section 5.4.1.

### **G.6.1.3 Purge Old Modality Worklist Entries**

The Modality Worklist database resides in the MUMPS database on the DICOM Text Gateway in global variable ^MAGDWLST.

Old entries in the Modality Worklist database can be purged using a menu-option. See Section 3.14.

### **G.6.1.4 Purge Old HL7 Transaction Global Nodes**

The HL7 transactions are stored in the main hospital *VISTA* MUMPS database in global variable ^MAGDHL7.

Old nodes in that global variable can be purged using a menu-option. See Section 3.16.

### **G.6.1.5 Purge Old Audit Records**

Audit records that pertain to the whole system are stored in the main hospital *VISTA* MUMPS database in global variable ^MAGDAUDT.

Old audit records can be purged using a menu-option. See Section 3.17. This allows the global space to be recovered for other use.

### **G.6.1.6 Purge DICOM Image Processing Error Logs**

There are four DICOM log files that hold images that fail to be properly processed:

- DICOM Failed Images – wrong patient/study id – ^MAGD(2006.575)
- DICOM Undefined Modalities – unknown modalities - ^MAGD(2006.592)
- DICOM Incomplete Image – incomplete image files - ^MAGD(2006.593)
- DICOM Error Log – holds deleted images – ^MAGD(2006.599)

Use of the DICOM Failed Image Correction procedure (see Appendix B) automatically deletes entries from the first three. No purging is currently available for the DICOM Error Log, however.

## **G.6.2 Full Physical Media**

### **G.6.2.1 Purge Old DICOM Message Files**

On the DICCOM Text Gateway, the DICOM message files reside in directories with names like **D:\DICOMDATAn**, where *n* is an integer number, typically 1 and usually not higher than 2.

Old DICOM message files are purged automatically by the message generating application. They can also be purged using a menu-option. See Section 3.15.

The entire subdirectory tree can be purged by running **INIT\_DICOM.BAT** in the **DATAn** directory from the command line. (This has to run on a “quiet system” – be sure to stop all MUMPS processes before doing this.)

### **G.6.2.2 Purge DICOM Image Files**

On the DICOM Image Gateway, the DICOM image files are stored in the **D:\DICOMIMAGE\_IN** and **D:\DICOM\IMAGE\_OUT** directories for incoming and outgoing images respectively.

Normally, all image deletion from these two directories is under automatic program control. Incoming images are deleted from the **D:\DICOMIMAGE\_IN** directory as they are processed. Incoming images that cannot be processed remain in the directory until they are resolved using the DICOM Failed Image Correction application. Incomplete image files will remain in this directory for at least an hour before they are renamed by appending “\_incomplete” to the filename. These files (\*.dcm\_incomplete) will remain in the **D:\DICOMIMAGE\_IN** directory for further research by site personnel and will require manual deletion.

Outgoing images are automatically deleted from the **D:\DICOMIMAGE\_OUT** directory as they are sent. However, they may remain if there is a problem with the transmission. Old \*.dcm files in this directory can be manually deleted.

In either case, on a need-basis, use MS Explorer to delete the old image files.

### **G.6.2.3 Other Possible Issues**

In addition to the possibility that a disk is physically full, there are a number of other reasons why an error message like “Insufficient disk space to store images. Waiting 10 minutes.” might appear:

- Images are not processed due to lost connection with server
- Images are not processed due to incorrect information in headers.
- Images are not processed due to failure of the “Process Image” process.

Such error messages are usually displayed in the telnet window for the session labeled **PACS Request Image Transfer (2\_2)**.

Make sure that the session labeled **Process DICOM Images (2\_3)** is running.

It is very likely that the directory `x:\DICOM\Image_In` contains files for images that require corrections. See the window for the session labeled **Image Status (2\_5)** for details. The latter window will also contain information on how badly backed up the system may be (number of files to be processed). Disk space will become available as images are processed. Just keep an eye on the status window to make sure the image count is *decreasing*.

Some image files may be as large as 7MB. When a site needs to store a large number of these files, it is imperative to ensure that sufficient disk space is available.

It may be possible to use the DICOM FIX utility to correct images with demographic information that does not match the HIS information.

The DICOM Gateway uses a site parameter that establishes the percentage of disk space that should remain free. If this percentage is too high, the system will start producing error messages about insufficient disk space when there still is a lot of disk space. To ensure that this parameter is set to a reasonable value, use VA-FileMan (Enter/Edit, file 2006.1):

```
PCT FREE SPACE DICOM MSGS: 10//
```

Typically, this value should not be larger than 15%.

## **G.7 Extremely Slow Performance**

### **G.7.1 Issues at the Network and Operating System Level**

When a normally operating system begins to run very slowly, the first question to ask is “what changed?”

If a specific system is extremely slow and others are fine, then launch NT Task Manager to determine what is running on the system. Is there a run-away task? (The problem might be as simple as a user who inadvertently clicked too many times on an icon and launched multiple tasks!)

The problem might be with the main Hospital Information System. There could be a “run-away” job on it or a situation where DDP is not functioning properly.

A slow DICOM Image Gateway may be related to the NT file server problem. Is there adequate free disk space on the server for new images?

The problem could also be with the network. Check whether the PC network interface is properly set up, especially the speed and duplex settings. The settings should be the same on the DICOM Gateway as on the hubs and routers. In a wide-area network situation, check that the WAN is operating properly.

If you suspect that the amount of work for the system might be exceeding the available resources, check the following possible causes:

- If bad performance mainly occurs during peak times, there may be a network bandwidth issue. All devices used for *VISTA* Imaging must be placed on a switched rather than a shared connection. This will reduce delays due to contention and collisions on the device's Ethernet segment. If the device is already on switched Ethernet, one could try upgrading the network for a higher throughput capacity.
- There could be a bottleneck on the Imaging Storage Server. This could be the case when the Storage Server has a shared Ethernet connection or is connected via a 10 Mbps or a 100 Mbps Ethernet. In that case, an upgrade to 1000 Mbps (Gigabit Ethernet) could resolve the problem.
- There could be an IP routing bottleneck. If the device is on a different TCP/IP subnet than the Imaging Storage Server, the router might be the bottleneck. It is recommended that all *VISTA* Imaging devices be on the same subnet, so that there will be no need for any routing. The *VISTA* Imaging DICOM Gateways and Background Processors must be on the same subnet as the Imaging Storage Server. It may be possible to “collapse” multiple subnets into a single one by migrating to a wider subnet mask.
- If the site uses VLANs, routing bottlenecks may not be completely eliminated. Double-check the definitions of the VLANs and the assignment of processors to subnets. Review the routing set-up.
- Check the Network Interface Card (NIC) and the network switch or hub to make sure that none of the components is using “automatic sensing” of speed. If one component is set to “auto” or “auto-detect”, and another component is expecting to use a specific speed, time may be lost in unnecessary negotiations. This feature can sometimes fail.

### G.7.2 Issues at the MSM Level

Sometimes it happens that an MSM system causes the CPU to be busy for 100%, while apparently, the MSM system is not doing anything.

A likely cause for this is that the “**SPX Workstation Server**” is running (this is a service that should **not ever** be running in the context of a *VISTA* Imaging DICOM Gateway). Such a server will look for a connection until it finds one, and uses all available CPU time, effectively doing nothing.

In the distributed system, this server is disabled, but it can become enabled inadvertently, typically when one carelessly "carriage-returns" through the system management program ^SYSGEN.

The option that turns it “off” is:

```
>D ^SYSGEN <Enter>
Select Option: 3 <Enter> - Edit Configuration Parameters
Select Configuration <DICOM>: <Enter>
Select Option: 15 <Enter> - Network Configuration
Select Option: 11 <Enter> - Workstation Server Configuration
```

Enter IP Port for Workstation TCP/IP Connect <33086>: **33086** <Enter>

Enter IP Port for Workstation SPX Connect <33085>: - <Enter>

Enter Password <DICOM>: <Enter>

When, at the question for the SPX Connect, a “carriage return” is entered, the service will be enabled the next time that the system is restarted. At this question, the answer must **always** be a **minus sign**, so that the service will remain disabled.

The easiest way to tell whether or not a system is performing slowly because of this issue is to run the system utility program ^%SI (system information, see the menu option described in Section 5.4.4). When the report produced by this program includes the highlighted line, the SPX service is active and should be turned off using the system management program ^SYSGEN.

System Process	Status	Job#	Job Status
MSM	system	1	Running
Distributed Data Processing	active	3	DDP
		4	DDP
Telnet Service	Enabled		
Before Image Journaling	enabled		Volume Groups:
			DCE
MSM-Activatel service (TCPIP - 1666)	active	8	TCP_IO
<b>Workstation service (SPX - 33085)</b>	<b>active</b>	<b>7</b>	<b>WaitQ2a</b>
Workstation service (TCPIP - 33086)	active	6	TCP_IO
PDQweb service (TCPIP - 2001)	active	9	TCP_IO
User service DICOM CSTORE (TCPIP - 60000)	active	12	TCP_IO
User service MOD WORKLIST (TCPIP - 60010)	active	13	TCP_IO

**Note:** The SPX option is automatically turned off by the Version 2.5 *VISTA* Imaging DICOM Gateway software.

## G.8 Network Connectivity Problems

Connectivity problems can exhibit themselves in a number of ways:

- Users are unable to login. They see messages like “Domain Controller Unavailable” when they attempt to login into the system.
- The window “**Network Neighborhood**” does not show any other computers
- There are error messages while booting up the computer, or when attempting to start a program.
- There are error messages related to TCP/IP, NetBIOS name resolution or NIC hardware in the system’s “**Event Viewer**”.
- There may be errors in configuration information.

If any of the above situations occurs, the following steps usually lead to a quick assessment of the actual problem.

### **G.8.1 A DICOM Gateway is not yet properly configured**

When an installation procedure is not yet complete, typically, the following error messages will appear:

- Network service open failed for MSMPKT, errcode=1060
- Network startup failed for link 1
- The MSMPKT service failed to start due to...

In those cases, verify the following steps:

1. If the system has two NICs (Network Interface Card), make sure that the correct one is specified in the system configuration as the one to be used for DDP.
2. To specify an interface card, Do `^ SYSGEN` and then select options: 3, [Enter], 15 and 2.
3. Don't forget to check that the **VISTA** system is up and running.

For the error message “The MSMPKT service failed to start due to the following error: The system cannot find the file specified.”, double-check that the “packet driver” is installed. If necessary, copy the file `x:\msm\msmpkt.sys` to `C:\WINNT\SYSTEM32\DRIVERS`

### **G.8.2 Only one DICOM Gateway (that used to work) is affected**

Check first whether the problem is localized in one computer, or shared by multiple ones. If the problem occurs only in one computer, check the following:

1. Check that all cables are properly connected.
2. Check that the information in the appropriate configuration file is correct (Instrument.DIC and PortList.DIC contain port numbers, SCU\_List.DIC contains IP addresses and port numbers and AE Titles).
3. Try to “ping” the affected computer from itself (first try “**ping 127.0.0.1**” and then try “**ping assigned\_IP\_address**”). If either of these attempts fails, the IP settings are miss-configured.
4. Check the computer's IP configuration (utility program `ipconfig.exe`). Make sure that the computer has a usable IP address, subnet mask and gateway address. Attempt to reach a server or network resource that is known to be operational. Use the “ping” utility to see if network traffic is being routed correctly to the ailing system. Use `tracert.exe` to further verify the network pathway.

5. Try to “ping” the default gateway from the affected computer. If this fails, either the address for the default gateway is not entered, or it is wrong.
6. Make sure that no other system has the DICOM Gateway’s IP address. This can be easily checked by disconnecting the ailing system, and then trying to “ping” its IP address from another location.
7. Make sure that no other MUMPS system has the same 3-character system name.
8. Make sure that Microsoft’s DHCP is not being used, check that the affected computer has correct WINS and DNS information. Make sure that IP address any incoming clients are in the Gateway’s HOSTS table. This will prevent excessive name lookup.
9. Double-check the values for the subnet mask and the default gateway. If either of these is wrong, the processor may not be able to “see outside” its subnet. As a result, Image Gateways and Workstations may be unable to access either the modalities or the **VISTA** Hospital Information System.
10. Double-check that the TCP/IP protocol is configured properly on the system in question by looking at the network properties. Confirm that TCP/IP is in the list of protocols and verify that it is configured with an IP address and an address for a default gateway. The default gateway must have an address that is on the same subnet as the system itself.
11. Use a utility program like `netperf.exe` (combined with `netserver.exe`) to measure the effective speed of the network connection.

### G.8.3 Several processors are affected

When multiple computers are having problems, check the following:

1. Look for problems with the network or with the router. To see if network traffic is being routed correctly, use the “ping” utility on an affected computer to attempt to reach a server or network resource that is known to be operational.
2. Check the server(s). Is the domain controller up and running? Is it reachable from the network? Can the server be reached via the network? Are the network interface cards and protocols configured properly?
3. If it is possible to login into the Windows NT Domain, but not into **VISTA**, check whether **VISTA** is running and “reachable” via the network.
4. On the server, use “**Server Manager**” to check “**Services**” to make sure that the appropriate services are running.
5. Check that the information in the appropriate configuration file is correct (Instrument.DIC and PortList.DIC contain port numbers, SCU\_List.DIC contains IP addresses and port numbers and AE Titles).

6. Try to “ping” the server from any of the affected processors. If this attempt fails, try to “**ping 127.0.0.1**” on the server to make sure that the server’s IP address and settings are correct. From the server, try to “ping” its default gateway. From one of the affected stations, try to “ping” the server’s gateway.

7. Use the utility program `tracert.exe` to trace the access route to the server. E.g.

```
D:\>ipconfig <Enter>

Windows NT IP Configuration

Ethernet adapter DC21X41:

    IP Address. . . . . : 11.22.33.43
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 11.22.33.45

D:\>tracert 11.22.33.45 <Enter>

Tracing route to wciofo-reglwan.eth100.net.va.gov [11.22.33.45]
over a maximum of 30 hops:

    1  <10 ms  <10 ms  <10 ms  wciofo-reglwan.eth100.net.va.gov [11.22.33.45]

Trace complete.

D:\>
```

8. If `tracert` is not successful, there is most likely a routing problem. Links that are probably down are indicated by asterisks in the report from `tracert`.
9. Try using **Windows NT Explorer** to see if it is possible to browse to the server. Users with Administrator privileges on the server have access to the “administrative shares”. They could attempt to map a drive to one of these “shares”. If such attempts fail, it is likely that the WINS/DNS setup is incorrect.

#### **G.8.4 One or more windows show an error message**

One error message that may show up on occasion is “MUMPS length network\_read() error: -1”. There are several possible causes for this error message:

- Network error
- MSM console is closed or crashed
- Disk is Full

When this error message appears, follow the steps below to find the root-cause of the problem:

- Verify connectivity by PINGing in both directions
- Verify connectivity by executing a DICOM echo

- Check that the MSM Console window is still up-and-running.
- Verify that there is sufficient disk space on the disk that contains the directories x:\DICOM\Data1 and x:\DICOM\Image\_In
- Check that there is sufficient space in the MUMPS database for normal processing

### **G.8.5 PACS isn't Sending an Image Complete Message**

This situation typically comes about when the TCP link with the PACS is broken.

Before attempting to restart any processes, examine the log files to ascertain that the exam complete message is being received from the PACS. The correct C-Move request should be issued by **VISTA**, but response may not be returned from the PACS. Restarting the gateway process for the PACS (1-2-x) usually restores normal functionality

## **G.9 Other Configuration Issues**

### **G.9.1 Loading Master Files**

After (re)loading the Master Files, the error message “nnn error(s) encountered while building master files” may appear. When this message appears, it indicates that some error(s) have been found in one or more of the Master Files. The site-modifiable master files are:

- Instrument.DIC
- Modality.DIC
- PortList.DIC
- SCU\_List.DIC
- WorkList.DIC

Check the contents of these files to repair any reported issues.

Most commonly, the “Institution Name” is not set in WorkList.DIC. The default value that is specified in the distributed file is: “<add local name here>”. It should be either the facility number or the name, e.g.:

```
AE_Title|523| ... or
```

```
AE_Title|BOSTON, MA| ...
```

See the **VISTA** Imaging DICOM Gateway Installation Guide for more information about properly formatted specifications in Master Files.

### **G.9.2 Incomplete Master Files**

It may happen that not all modalities that are transmitting images to an image gateway are described in the master file named `Modality.DIC`. When this happens, the error message “The following images have undefined modalities” will appear.

In such a case, use the information about the modality that is presented in the error message to add the missing modalities to the master file.

(Don’t forget to re-load the master file.)

### **G.9.3 Multiple Instruments are Configured to Use the Same Port Number**

The DICOM Gateways should be configured such that each instrument has its own unique port number assigned for communication. When multiple instruments share a port number, only the one that happens to connect first will be able to communicate with its gateway. Any other instrument attempting to use the same port number will cause an error message “Cannot listen to DICOM port because it is already being used”.

When this happens, verify that there are no conflicts in the master file `Instrument.DIC`. Reload the master file after it has been corrected.

When the configuration has been corrected, restart the DICOM gateway. Just closing and restarting the modality windows will not have the effect that any ports are released. The MSM system must be restarted to release all ports.

### **G.9.4 Digitized Images Appear Small on the Diagnostic Workstation**

The master file `Modality.dic` contains a parameter that provides a number of settings that influence the conversion from the original file format to TARGA™ format. See the **VISTA** Imaging DICOM Gateway Installation Guide for a complete description of these parameters.

Pay special attention to the (sub)parameters **R1**, **R2**, **R4** and **R8** that may be used to create a “small” thumbnail version of the image (also known as “abstract” or “icon”). When one of these parameters is applied to the conversion of the “full” image, a severe loss of resolution may be the result.

### **G.9.5 Digitized Images Appear Dark**

The master file `Modality.dic` contains a parameter that provides a number of settings that influence the conversion from the original file format to TARGA™ format. See the **VISTA** Imaging DICOM Gateway Installation Guide for a complete description of these parameters.

Pay special attention to the (sub)parameter **Bnnn**. When the number of bits specified by this parameter is incorrect, the resulting images may appear with a severely reduced number of gray-values, typically showing extremely dark colors.

### G.9.6 Modality Worklist Find Failure

The registration of a modality's AE Title in the master file `Worklist.DIC` must be an exact match with the string that the modality transmits. This value is case-sensitive.

After the master file `Worklist.DIC` has been corrected, verify that the values in the master files `Instrument.DIC` and `Modality.DIC` are also correct, and be sure to re-load any modified master files into the database.

### G.10 Failover Procedure

It is possible to allow a gateway processor to take over the tasks of another, in case one of the gateways should fail. In order to allow for a smooth “fail-over”, take the following steps:

1. Add the TCP/IP address of the *failed* gateway to the substitute gateway processor. This will be the *second* IP address on the substitute gateway's Network Interface Card (NIC).
2. On the substitute gateway, open the folder that contains the instruments for the failing gateway and click on the modality icons within that folder to begin listening for the modalities on their respective ports. The substitute gateway can continue to work with its “regular” icons for the modalities that already were assigned to that processor.

Nothing will have to change on the modality configuration. It will be completely “transparent” to the modality. There might be a small performance degradation, however, and the screen will certainly be more busy.

### G.11 Error Messages from DICOM Gateway Executable Programs

#### G.11.1 Error Messages from CSTORE.exe

The program `CSTORE.exe` maintains a TCP socket connection with an image acquisition device on one side and with a MUMPS Server on the other side. It processes bi-directional data streams that are encoded according the DICOM standard and causes image files to be stored on its host-PC. It is called with the following parameters:

```
cstore <IP address> <port> <modality> [<debug level>]
```

Parameter	Meaning
IP address	For the <i>VISTA</i> DICOM Gateway, this value is always “ <b>localhost</b> ”.
Port	For the <i>VISTA</i> DICOM Gateway, the port number for the on which the MUMPS Server listens, which is always <b>60000</b> .
Modality	An abbreviation for the name of the instrument that is sending the images, typically a code like “ <b>CR1</b> ”, “ <b>CT3</b> ”, ...
Debug Level	A code that indicates the verbosity of debug messages:

**0**=none, **1**=some, **2**=lots

The program `CSTORE.exe` can produce the following error codes:

Error: Could not connect to the MUMPS storage controller

Error in reading PDU header -- connection dropped

Error in reading dataset -- connection dropped

Error in writing echo response -- connection dropped

Error in reading control dataset -- connection dropped

The WinSock initialization has failed

Error writing control PDU to disk

Error writing control PDU to DICOM socket

Error reading PDV header

Error reading PDV data, *nnn* bytes input

Disk read error in `net_write_data()`

Unknown disk read error in `net_write_data()`

Error writing PDU hdr to socket

Error writing PDV hdr to socket

Error writing DATA PDU to socket

`select()` error in `network_read()`

Error in `network_read()`, total read: *nnn*, `errno=nnn`

MS NT Socket Error *#nnn*

`select()` error in `network_write()`

Error in `network_write()`, Error Number: *nnn*

Socket initialization error in `init_client()`

Connect error in `init_client()`

`ioctlsocket()` (non-block) error in `init_client()`

ioctl() (non-block) error in init\_client()  
 setsockopt(SO\_LINGER) error in init\_client()  
 socket() error in init\_server()  
 gethostid() error in init\_server()  
 bind() error in init\_server  
 Could not listen on the DICOM port because it is already in use  
 listen() error in init\_server()  
 ioctlsocket() (non-block) error in init\_server()  
 ioctl() (non-block) error in init\_server()  
 select() error in init\_server()  
 accept() error in init\_server()  
 setsockopt(SO\_LINGER) error in init\_server()  
 MUMPS length network\_read() error: *nnn*  
 MUMPS message network\_read() error: *nnn*  
 Disk Read error  
 Unknown read error  
 Write error: number\_written= *nnn* count= *nnn*  
 Unknown write error  
 Error: Incorrect Message *xxx* It should have been *xxx*  
 Error: No additional MUMPS partitions are available  
 Error Reading PDU Header

### G.11.2 Error Messages from DCMTOTGA.exe

The program `DCMTOTGA.exe` reads files that are encoded according to the DICOM standard and produces files in TARGA™ format. It is called with the following parameters:

```
dcmtotga {input filename} {output filename} {parameter(s)}
```

#### Parameter    Meaning

<b>A</b> <i>nnn</i>	Add <i>nnn</i> to each pixel (before min/max check)
<b>B</b> <i>nnn</i> ☛	Number of bits in a pixel (stored in the TARGA™ header)
<b>C</b> <i>nnn</i>	Ceiling (maximum) pixel value (any value > <i>nnn</i> becomes <i>nnn</i> )
<b>F</b> <i>nnn</i>	Floor (minimum) pixel value (any value < <i>nnn</i> becomes <i>nnn</i> )
<b>I</b>	Invert each pixel
<b>O</b> <i>nnn</i> ☛	Byte offset in DICOM file to image
<b>R1</b>	Reduce the size of the image file a factor of two (a two-byte 8-bit pixel is stored in one byte, loss-less)
<b>R2</b>	Reduce the size of the image file a factor of two (a two-byte 16-bit pixel is stored as one byte, usually not loss-less)
<b>R4</b>	Reduce the size of the image file a factor of four (a square of four 16-bit pixels is averaged and stored in two bytes (16 bits) as one pixel, definitely not loss-less)
<b>R8</b>	Reduce the size of the image file a factor of eight (a square of four 16-bit pixels is averaged and stored in one byte as one pixel, definitely not loss-less)
<b>S</b> <i>nnn</i>	Subtract <i>nnn</i> from each pixel (unsigned arithmetic -- before add)
<b>X</b> <i>nnn</i> ☛	X-dimension of image (horizontal width or number of columns)
<b>Y</b> <i>nnn</i> ☛	Y-dimension of image (vertical height or number of rows)

☛ - Required *nnn* represents an unsigned integer number

The environment variable `DCMTOTGA_VERBOSE` may be used to override the default settings:

`DCMTOTGA_VERBOSE=1` Selects brief verbose mode

`DCMTOTGA_VERBOSE=2` Selects total verbose mode

`DCMTOTGA_VERBOSE=3` Turns on density histogram

The program `DCMTOTGA.exe` can produce any of the following error codes:

- 1 End of Input File
- 2 Read Error detected by `ferror()`
- 3 End of Output File
- 4 Write Error detected by `ferror()`

- 5 Maximum number of columns exceeded
- 999 Unknown Error

### G.11.3 Error Messages from ABSTRTGA.exe

The program `ABSTRTGA.exe` reads files that are encoded in Targa™ format and produces reduced resolution (thumbnail, abstract) copies of these files. It is called with the following parameters:

```
abstrtga.c {input filename} {output filename} [/s:x,y] [/8]
```

#### Parameter Meaning

`/s:x,y` (Optional) Modify the maximum X and Y dimensions.

`/8` (Optional) Force all black & white (monochrome) pixels to be 8-bits

The following environment variables can override the default settings

```
ABSTR_VERBOSE=1      Select verbose mode
ABSTR_MAX_X=nnn     Maximum X dimension is nnn
ABSTR_MAX_Y=nnn     Maximum Y dimension is nnn
```

The program `ABSTRTGA.exe` can produce any of the following error codes:

- 1 End of Input File
- 2 Read Error detected by `ferror()`
- 3 End of Output File
- 4 Write Error detected by `ferror()`
- 5 Maximum number of columns exceeded
- 999 Unknown Error

### G.11.4 Error Messages from DCM\_COPY.exe

The program `DCM_COPY.exe` is typically called when the DICOM header is being updated either to change from Explicit VR to Implicit VR or when the values of the attributes are being changed. It is called with the following parameters:

```
dcm_copy {input file} {output file} {input offset} {number of bytes to copy}
```

<b>Parameter</b>	<b>Meaning</b>
Offset	The byte address where the copy program starts reading
Number of Bytes	The number of bytes to be copied to the output file. (Any information to be copied is appended to the output file.)

The program `DCM_COPY.exe` can produce any of the following error codes:

- 1 End of Input File
- 2 Read Error detected by `ferror()`
- 3 End of Output File
- 4 Write Error detected by `ferror()`
- 999 Unknown Error

### **G.11.5 Error Messages from TGATODCM.exe**

The program `DCMTOTGA.exe` reads files in TARGA™ format and produces files that are encoded according to the DICOM standard. It is with the following parameters:

```
tgatodcm {input filename} {output filename} {number of bytes to  
copy}
```

The program `TGATODCM.exe` can produce any of the following error codes:

- 1 End of Input File
- 2 Read Error detected by `ferror()`
- 3 End of Output File
- 4 Write Error detected by `ferror()`
- 999 Unknown Error

### **G.12 Run Time Errors Reported by the DICOM Gateway**

For ease of use, all of these errors are alphabetically listed in the Index under the heading “Run Time Error”.

## G.12.1 DICOM Association Errors

These errors are non-recoverable protocol violations on the part of the peer DICOM application entity. They cause both the association and the communications task to be terminated.

### G.12.1.1 Unexpected “DATA” PDU

```
*****
*** DICOM GATEWAY ERROR ***
*** ***
*** PDU is out of sequence. ***
*** PDU Type is 04, data. ***
*** ***
*** Routine: ^MAGDACR1 Please Call Support Personnel ***
*****
```

This error occurs when an unexpected DICOM message is encountered during the lower-level communication “handshaking” with a peer application entity. (A PDU is a **Protocol Data Unit**.)

### G.12.1.2 Peer application entity Requests “Abort Association”

```
*****
*** DICOM GATEWAY ERROR ***
*** ***
*** PDU Type is 07, abort association. ***
*** ***
*** Routine: ^MAGDACR1 Please Call Support Personnel ***
*****
```

The peer application entity is requesting to terminate the communication. **VISTA** terminates the communications task.

### G.12.1.3 DICOM Association – Invalid Protocol Identifier

```
*****
*** DICOM GATEWAY ERROR ***
*** ***
*** Expected protocol version 1. ***
*** Found "xxxxxxxxxx". ***
*** ***
*** Routine: ^MAGDACR1 Please Call Support Personnel ***
*****
```

The DICOM protocol version is exchanged during the initial negotiation of the association. The only legal DICOM protocol is “Version 1”.

### G.12.1.4 Opcode for Unsupported Operation

```
*****
*** DICOM GATEWAY ERROR ***
*** ***
*** No subroutine for opcode: "xxxxxxxxxx". ***
*** ***
*** Routine: ^MAGDACR1/3 Please Call Support Personnel ***
*****
```

This error occurs when an unexpected association sub-item field is presented by a calling application entity negotiating an association with *VISTA*. This is possibly a violation of the DICOM standard. It is a problem that a user cannot resolve and that must be reported to the *VISTA* Imaging Project Team.

The error message will include the offending opcode code.

### G.12.1.5 DICOM Association – Invalid DICOM Standard UID

```
*****
*** DICOM GATEWAY ERROR ***
***
*** Expected UID for "DICOM Application Context Name", ***
*** which is "1.2.840.10008.3.1.1.1". ***
*** Found "xxxxxxxxxx". ***
***
*** Routine: ^MAGDACR3 Please Call Support Personnel ***
*****
```

The DICOM Standard UID is exchanged during the initial negotiation of the association. The only legal value for DICOM is “1.2.840.10008.3.1.1.1”.

### G.12.1.6 Invalid Context Identifier

```
*****
*** DICOM GATEWAY ERROR ***
***
*** Context ID should be an odd number. ***
*** The number encountered is "xxxxxxxxxx". ***
***
*** Routine: ^MAGDACR3 Please Call Support Personnel ***
*****
```

DICOM Presentation Context IDs are odd numbers in the range 1:255. If an even number is presented, it is an error.

The error message will include the number specified.

### G.12.1.7 Invalid Sub-Type

```
*****
*** DICOM GATEWAY ERROR ***
***
*** Expected sub-type 51(hex) is missing. ***
*** Found "xxxxxxxxxx" instead. ***
***
*** Routine: ^MAGDACR1 Please Call Support Personnel ***
*****
```

The *VISTA* Imaging DICOM Gateway found a “User Information Item Field (Item-type 50H)” in an association request. The user data field of must contain Item-type 51H, and did not.

The error message will include the incorrect hexadecimal value specified.

### G.12.1.8 Illegal Unique Identifier (UID)

```
*****
*** ERROR IN DICOM UNIQUE IDENTIFIER DICTIONARY ***
***
*** The UID Dictionary is not properly setup! ***
*** There is no entry in the UID dictionary for "xxxxxxxxxx" ***
***
***
*** Routine: ^MAGDUID1 Please Call Support Personnel ***
*****
```

The UID dictionary must contain the proper entries in order for the gateway applications to operate properly. This error is probably caused by an old version of the dictionary being loaded. Load the current version (see Section 5.3.8).

### G.12.2 Storage Provider Error – Unexpected Response

```
*****
*** ERROR IN STORAGE SERVICE ***
***
*** Expected return value "STORAGE COMPLETE", ***
*** Received "xxxxxxxxxx". ***
***
*** Routine: ^MAGDCST1 Please Call Support Personnel ***
*****
```

The C-Store task running in the foreground sent an unexpected message to the MUMPS Storage Controller. It should have sent “STORAGE COMPLETE”. The erroneous text is displayed in the error message.

This error is fatal and causes the DICOM Storage Provider to terminate.

### G.12.3 Errors Encountered in Reading/Writing DICOM Messages

#### G.12.3.1 Unsupported Value Representation (Input)

```
*****
*** DICOM GATEWAY ERROR ***
***
*** Undefined value representation: "xxxxxxxxxx". ***
***
*** Routine: ^MAGDDR3 Please Call Support Personnel ***
*****
```

This error may occur during the reading of a DICOM message. This error occurs when a data element is encountered to have a “value representation” that is not recognized by the *VISTA* Imaging DICOM Gateway software (All legal DICOM value representations are handled by *VISTA* Imaging DICOM Gateway software).

The error message will contain the code for the offending value representation. The erroneous message will have to be skipped.

### G.12.3.2 Value Representation Mismatch

```
*****
*** DICOM TEXT GATEWAY ERROR -- WRITING DICOM FILE ***
***
*** VR Mismatch ***
*** Requested Value Representation="xxxxxxxx", Dictionary="xxxxxxxx". ***
*** Group: xxxxxxxx, Group Owner: xxxxxxxx Element: xxxxxxxx (xxxxxxxx) ***
***
*** Routine: ^MAGDDW3 Please Call Support Personnel ***
*****
```

This error may occur when trying to re-generate an Explicit VR image header where the VR specified for an element by a vendor is not in agreement with the DICOM Standard.

The error message will contain the offending value representation, as well as the list of value representations that is specified in the DICOM Data Dictionary. The error message will include identify the offending element.

### G.12.3.3 Required Type 1 Data Item Missing

```
*****
*** DICOM TEXT GATEWAY ERROR -- WRITING DICOM FILE ***
***
*** REQUIRED TYPE 1 DATA MISSING ***
*** Group: xxxxxxxx, Group Owner: xxxxxxxx Element: xxxxxxxx (xxxxxxxx) ***
***
*** Routine: ^MAGDDW3 Please Call Support Personnel ***
*****
```

This error occurs when a required element’s value is not provided, while formatting a DICOM message. The error message will include identify the offending element.

This is usually a caused by a programming error that an user cannot resolve and that must be reported to the **VISTA** Imaging Project Team.

### G.12.3.4 Unsupported Value Representation (Output)

```
*****
*** DICOM TEXT GATEWAY ERROR -- WRITING DICOM FILE ***
***
*** ERROR -- Undefined value representation: xxxxxxxxxx ***
***
*** Routine: ^MAGDDW4 Please Call Support Personnel ***
*****
```

This error may occur during the writing of a DICOM message. This error occurs when a data element is encountered to have a “value representation” that is not recognized by the **VISTA** Imaging DICOM Gateway software. (All legal DICOM value representations are handled by **VISTA** Imaging DICOM Gateway software.)

This is usually a caused by a dictionary file or programming error that an user cannot resolve and that must be reported to the *VISTA* Imaging Project Team.

The error message will contain the offending value representation.

**G.12.4 Modality Worklist – Invalid SOP Class (C-Find)**

```
*****
*** ERROR IN C-FIND ***
*** ***
*** Expected SOP Class "Modality Worklist Information Model - FIND". ***
*** Found "xxxxxxxxxx". ***
*** ***
*** Routine: ^MAGDFND1 Please Call Support Personnel ***
*****
```

This error may occur while processing a C-Find request. As part of the message, the client specifies the name of the SOP class, which defines the context for the entire transaction. This error occurs when the name of this SOP class is not recognized. (Currently, only the SOP class “Modality Worklist Information Model – FIND” is recognized.) This is an error on the part of the application entity that issued the C-Find request.

The error message will include the name of the class that is specified by the client. This is a fatal error that terminates the association.

**G.12.5 HL7 Error Messages**

HL7 messages are generated on the main *VISTA* hospital system in the ^MAGDHL7 global. They are read by the Text Gateway and used to update the Modality Worklist database ^MAGDWLST global and to create the DICOM messages that are sent to commercial PACS.

All of these errors are detected while reading and processing them. Bad HL7 message can be bypassed by incrementing the HL7 pointer (see Section 4.10.)

**G.12.5.1 Bad HL7 Message Header**

```
*****
*** DICOM TEXT GATEWAY -- HL7 DATA ERROR ***
*** ***
*** Error: BAD HL7 MESSAGE HEADER ***
*** ***
*** Routine: ^MAGDHR1 Please Call Support Personnel ***
*****
```

```

*****
*** BAD HL7 MESSAGE HEADER ***
***
*** HL7 message header should start with "MSH", ***
*** starts with "xxxxxxxxxx". ***
***
*** Routine: ^MAGDHRP Please Call Support Personnel ***
*****

```

Each HL7 message should start with the prefix “MSH”. These errors will occur when the DICOM Text Gateway detects a message that does not start with this prefix. It indicates a badly garbled message that can not be further processed.

### G.12.5.2 Incomplete HL7 Message

```

*****
*** DICOM TEXT GATEWAY -- HL7 DATA ERROR ***
***
*** Incomplete copy of HL7 message encountered. ***
*** In message number "nnn", ***
*** segment number "mmm" is missing. ***
***
*** Routine: ^MAGDHR2 Please Call Support Personnel ***
*****

```

A portion of the HL7 message is missing, due to a problem on the main hospital system. The incomplete message will have to be bypassed manually. See Section 3.12 for instructions on how to modify the HL7 message pointer.

### G.12.5.3 Invalid Text ID in OBX Segment

```

*****
*** DICOM TEXT GATEWAY -- HL7 DATA ERROR ***
***
*** Expected ID="A", "H", "I", "M" or "R" ***
*** Found ID="xxxxxxxxxx". ***
***
*** Routine: ^MAGDHR5 Please Call Support Personnel ***
*****

```

When a data field in an OBX segment (order) is identified as a “text” value, its meaning can be either “allergy” (“A”), “history” (“H”), “impression” (“I”), “modifier” (“M”) or “report” (“R”). Any other value is erroneous, and triggers this message.

The error message will include the value that is incorrect.

### G.12.5.4 Invalid Coded Entry ID in OBX Segment

```

*****
*** DICOM TEXT GATEWAY -- HL7 DATA ERROR ***
***                                     ***
*** Expected ID="P" or "C4", found ID="xxxxxxxxxx". ***
***                                     ***
*** Routine: ^MAGDHR5                      Please Call Support Personnel ***
*****

```

When a data element in an OBX segment (order) is identified as a “coded entry” value, it must be a “procedure code” (“P”). Any other value is erroneous.

The error message will include the value that is incorrect.

### G.12.5.5 Invalid Status ID in OBX Segment

```

*****
*** DICOM TEXT GATEWAY -- HL7 DATA ERROR ***
***                                     ***
*** Expected ID="D", found ID="xxxxxxxxxx". ***
***                                     ***
*** Routine: ^MAGDHR5                      Please Call Support Personnel ***
*****

```

When a data element in an OBX segment (order) is identified as a “status” value, it must be a “diagnostic code” (“D”). Any other value is erroneous.

The error message will include the value that is incorrect.

### G.12.5.6 Invalid Data Type in OBX Segment

```

*****
*** DICOM TEXT GATEWAY -- HL7 DATA ERROR ***
***                                     ***
*** Expected TYPE="TX", "CE" or "ST", found TYPE="xxxxxxxxxx". ***
***                                     ***
*** Routine: ^MAGDHR5                      Please Call Support Personnel ***
*****

```

The data type of a data element in an OBX segment (order) may be either “text” (“TX”), “coded entry” (“CE”) or “status” (“ST”). When the code that identifies the data type is anything else, this error will occur.

The error message will include the value of the code for the data type.

## G.12.6 DICOM Image Processing Errors During Input

These errors in processing a DICOM image may indicate database corruption and may require manual intervention. Maybe the image processing pointer can be incremented to bypass offending images until the problem can be resolved.

When this type of error occurs, it usually indicates a serious database inconsistency. Report it immediately to the **VISTA** Imaging Project Team.

**G.12.6.1 File 2005 Corruption Problem**

```

*****
*** Wed 12:09 DICOM IMAGE PROCESSING ERROR - FILE 2005 CORRUPTION ***
***
*** The ^MAG(2005) file has been corrupted so that new images will ***
*** overwrite old ones and general image database inconsistency ***
*** will result. ***
***
*** Latest internal entry number processed: 102158 Wed SEP 20, at 11:40 ***
*** Bad ^MAG(2005,0) internal entry number: 102146 ***
***
*** Image Gateway: "Vista DICOM Gateway Development System" ***
***
*** This is a VERY SERIOUS ERROR. Image processing ***
*** will be halted until it is resolved. ***
***
*** Call IRM and the National VISTA Support Help Desk (888) 596-HELP ***
***
*** Routine: MAGDIR1B ***
*****

```

The image processing task has determined that the most recent internal entry number contained in the ^MAG(2005,0) node has been decremented. This could have been caused by restoring previously saved copy of the ^MAG global without applying the journal files. This is a **VERY SERIOUS ERROR** since it would allow new images to overwrite old ones, resulting in general corruption of the **VISTA** Imaging database. Please contact IRM and the National Help Desk immediately.

**G.12.6.2 Radiology Report File Corruption Problem**

```

*****
*** Wed 07:02 DICOM IMAGE PROCESSING ERROR - ^RARPT FILE CORRUPTION ***
***
*** The RAD REPORT file has been corrupted so that new reports will ***
*** overwrite old ones and general image/report database inconsistency ***
*** will result. ***
***
*** Latest internal entry number processed: 77710 SEP 11 at 09:51:39 ***
*** Bad ^RARPT(0) internal entry number: 77643 ***
*** Image Gateway: "Vista DICOM Gateway Development System" ***
***
*** This is a VERY SERIOUS ERROR. Image processing ***
*** will be halted until it is resolved. ***
***
*** Call IRM and the National Vista Support Help Desk (888) 596-HELP ***
***

```

```
*** Routine: ^MAGDIR1B ***
*****
```

The image processing task has determined that the most recent internal entry number contained in the ^RARPT(0) node has been decremented. This could have been caused by restoring a previously saved copy of the ^RARPT global without applying the journal files. This is a VERY SERIOUS ERROR since it would allow new images to overwrite old ones, resulting in general corruption of the VISTA Imaging database. Please contact IRM and the National Help Desk immediately.

### G.12.6.3 Group Entry Number Problem

```
*****
*** Wed 13:07 DICOM IMAGE PROCESSING ERROR - GROUP ENTRY NUMBER PROBLEM ***
***
*** The internal entry number for this group is less than that of the ***
*** last processed image. This will cause new images to overwrite ***
*** old ones and general image database inconsistency will result. ***
***
*** Latest internal entry number processed: 102158 Wed SEP 20, at 11:40 ***
*** Bad internal entry number of new group: 102100 ***
***
*** Image Gateway: "VistA DICOM Gateway Development System" ***
***
*** This is a VERY SERIOUS ERROR. Image processing ***
*** will be halted until it is resolved. ***
***
*** Call IRM and the National VISTA Support Help Desk (888) 596-HELP ***
***
*** Routine: MAGDIR2A or MAGDMED3 ***
*****
```

The image-processing task has determined that the internal entry number of the new group is less than the most recently created entry. This could have been caused by restoring a previously saved copy of the ^MAG global without applying the journal files. This is a VERY SERIOUS ERROR since it would allow new images to overwrite old ones, resulting in general corruption of the VISTA Imaging database. Please contact IRM and the National Help Desk immediately.

### G.12.6.4 Image Entry Number Problem

```
*****
*** Wed 12:38 DICOM IMAGE PROCESSING ERROR - IMAGE ENTRY NUMBER PROBLEM ***
***
*** The internal entry number for this image is less than that of the ***
*** last processed image. This will cause new images to overwrite ***
*** old ones and general image database inconsistency will result. ***
***
*** Latest internal entry number processed: 102158 Wed SEP 20, at 11:40 ***
*** Bad internal entry number of new image: 102100 ***
***
*** Image Gateway: "VistA DICOM Gateway Development System" ***
```

## Appendix G – Trouble Shooting

```
***
***           This is a VERY SERIOUS ERROR.  Image processing
***           will be halted until it is resolved.
***
*** Call IRM and the National VISTA Support Help Desk (888) 596-HELP
***
*** Routine: MAGDIR2B
*****
```

The image-processing task has determined that the internal entry number of the new image is less than the most recently created entry. This could have been caused by restoring a previously saved copy of the ^MAG global without applying the journal files. This is a VERY SERIOUS ERROR since it would allow new images to overwrite old ones, resulting in general corruption of the **VISTA** Imaging database. Please contact IRM and the National Help Desk immediately.

### G.12.6.5 Wrong Group Object Type

```
*****
*** Wed 12:42 DICOM IMAGE PROCESSING ERROR - WRONG GROUP OBJECT TYPE ***
***
*** The group entry in ^MAG(2005) does not have the proper group
*** object type.
***
*** The expected value is 11. The value in the group entry is 3.
***
*** Internal entry number of incorrect group: 102139
***
*** Image Gateway: "Vista DICOM Gateway Development System"
***
***           This is a VERY SERIOUS ERROR.  Image processing
***           will be halted until it is resolved.
***
*** Call IRM and the National VISTA Support Help Desk (888) 596-HELP
***
*** Routine: MAGDIR2B
*****
```

The image-processing task has determined that the object type of the group entry is wrong. An unknown software problem or manual modification of the data could have caused this to occur. This is a VERY SERIOUS ERROR since it might lead to a corrupted **VISTA** Imaging database. Please contact IRM and the National Help Desk immediately.

### G.12.6.6 Imaging Patient Mismatch Problem

```
*****
*** Wed 12:53 DICOM IMAGE PROCESSING ERROR - PATIENT MISMATCH PROBLEM ***
***
*** The image and the group point to different patients.
***
*** The image points to #100 ----- SMITH,ADAM^M^2440404
*** The group points to #90271 --- BAKER,JOSEPHINE^F^2020202
***
```

```

*** Internal entry number of group: 102138 ***
*** Image Gateway: "VistA DICOM Gateway Development System" ***
***                                     ***
***           This is a VERY SERIOUS ERROR.  Image processing ***
***           will be halted until it is resolved. ***
***                                     ***
*** Call IRM and the National VISTA Support Help Desk (888) 596-HELP ***
***                                     ***
*** Routine: MAGDIR2B ***
*****

```

The image-processing task has determined that the image and the group entries would point to different patients. An unknown software problem or manual modification of the data could have caused this to occur. This is a **VERY SERIOUS ERROR** since it might lead to a corrupted **VISTA** Imaging database. Please contact IRM and the National Help Desk immediately.

### G.12.6.7 Radiology Patient Mismatch Problem

```

*****
*** Mon 06:50 DICOM IMAGE PROCESSING ERROR - RAD PATIENT/REPORT MISMATCH ***
***                                     ***
*** The image and the radiology report point to different patients. ***
***                                     ***
*** The image points to #90263 --- DEMO,JANE^F^2170328 ***
*** The report points to #17 ----- FRED,CONNERS^M^2110208 ***
***                                     ***
*** Internal entry number of report: ^RARPT(1) ***
*** Image Gateway: " VistA DICOM Gateway Development System" ***
***                                     ***
***           This is a VERY SERIOUS ERROR.  Image processing ***
***           will be halted until it is resolved. ***
***                                     ***
*** Call IRM and the National VistA Support Help Desk (888) 596-HELP ***
***                                     ***
*****

```

The image-processing task has determined that the image and the radiology report entries would point to different patients. An unknown software problem or manual modification of the data could have caused this to occur. This is a **VERY SERIOUS ERROR** since it might lead to a corrupted **VISTA** Imaging and/or Radiology database. Please contact IRM and the National Help Desk immediately.

### G.12.6.8 No Radiology Case Number

```

*****
***                                     ***
***           DICOM           IMAGE           PROCESSING           ERROR ***
***                                     ***
*** No radiology case number specified for patient xxxxxxxxxxxx ***
***                                     ***

```

```

*** Routine: ^MAGDIR2A                               Please Call Support Personnel
***
*****
***

```

A database inconsistency may exist in the Radiology package. There should be a radiology case number specified for this patient. Perhaps the case has been deleted. The DICOM Image Input pointer can be incremented to temporarily get around this problem.

### G.12.6.9 Radiology Case Not in ^RADPT

```

*****
***
***          DICOM          IMAGE          PROCESSING          ERROR
***
***   Radiology   case   xxxxx   is   not   in   ^RADPT (yyyyyyyy)
***
*** Routine: ^MAGDIR2A                               Please Call Support Personnel
***
*****
***

```

The entry in the Radiology Patient File (^RADPT) for this case number appears to be missing. This may be due to a database inconsistency in the Radiology package. Perhaps the case has been deleted. The DICOM Image Input pointer can be incremented to temporarily get around this problem.

### G.12.6.10 Cannot Create Group for Old Radiology Images

```

*****
*** DICOM IMAGE PROCESSING ERROR                               ***
***
*** IMAGE GROUP CREATION ERROR:                               ***
*** Radiology Report has been archived and purged.          ***
*** Patient xxxxxxxxxxx, Date xxxxxxxxxxx, Case xxxxxxxxxxx  ***
***
*** Routine: ^MAGDIR2A                               Please Call Support Personnel ***
*****

```

This error may occur while attempting to enter information into the **VISTA** database to establish a group of images. This error happens when the image files are for a Radiology study whose reports already have been archived and purged, as may happen when films are scanned in for 'old' studies.

**G.12.6.11 Cannot Create Group for New Radiology Images**

```
*****
*** DICOM IMAGE PROCESSING ERROR ***
*** ***
*** IMAGE GROUP CREATION ERROR: ***
*** xxxxxxxxxxxx ***
*** ***
*** Routine: ^MAGDIR2A Please Call Support Personnel ***
*****
```

This error may occur while attempting to create a radiology image group in the *VISTA* database.

**G.12.6.12 Cannot Find Image Group Pointer in Radiology Report**

```
*****
*** DICOM IMAGE PROCESSING ERROR ***
*** ***
*** IMAGE GROUP LOOKUP ERROR: ***
*** Looking for 2005 cross reference in ^RARPT(xxxxxxxxxx) ***
*** ***
*** Routine: ^MAGDIR2A Please Call Support Personnel ***
*****
```

This error may occur while attempting to access a radiology image group in the *VISTA* database.

**G.12.6.13 Cannot Create Image File Entry in VistA Database**

```
*****
*** DICOM IMAGE PROCESSING ERROR ***
*** ***
*** IMAGE FILE CREATION ERROR: ***
*** xxxxxxxxxxxx ***
*** ***
*** Routine: ^MAGDIR2B Please Call Support Personnel ***
*****
```

This error may occur while attempting to create the image entry in the *VISTA* database.

**G.12.6.14 G.12.6.14 Cannot Create Subdirectory to Store Image File**

```
*****
*** DICOM IMAGE PROCESSING ERROR ***
*** ***
*** IMAGE FILE SUBDIRECTORY CREATION ERROR ***
*** Can not create the image subdirectory "xxxxxxxxxx" ***
*** xxxxxxxxxxxx ***
*** ***
*** Routine: ^MAGDIR2B Please Call Support Personnel ***
*****
```

Images are stored in a hierarchy of subdirectories. This error may occur when the creation of a new subdirectory. The error message will contain the name of the directory that failed to be

created. Check that the network file server is still “reachable”. Try to map a network drive to it and manually create the subdirectory using the command prompt.

### G.12.6.15 Cannot Write Image File

```
*****
*** DICOM IMAGE PROCESSING ERROR ***
***
*** The writing of image file "xxxxxxxxxx" failed ***
*** The error message was "xxxxxxxxxx" ***
***
*** Routine: ^MAGDIR2B Please Call Support Personnel ***
*****
```

When an image is stored on the network file server, the software checks whether the size of the created file is greater than zero. This error message is reported if the newly created file is either not created or has a zero size. Check that the network file server is still “reachable”. Try to map a network drive to it and manually copy a file using the command prompt.

Try the following steps to correct this problem:

- From a DOS session copy a small file to the share using the UNC path and file name for the destination. If the write fails it is usually caused by permission problems. Fix the permission problem using the NT user administration tools (if necessary, find a System Administrator who has the appropriate privileges).
- Check the available disk space on the share. If the disk space is low, run a purge on the background processor to free up space on the magnetic shares.

### G.12.6.16 Cannot Find Table with Additional Data Items

```
*****
*** DICOM GATEWAY ERROR ***
***
*** Data transfer dictionary <<xxxxxxxxxx>> is missing ***
***
*** Routine: ^MAGDIR4 Please Call Support Personnel ***
*****
```

The error message will include the name of the missing table.

This error may occur when the designated data transfer dictionary can not be found. This is probably either a configuration or an installation problem.

The data transfer dictionaries are **DataGECT.DIC**, **Data\_CR.DIC**, and **DataMisc.DIC**, all of which should be in the **f:\DICOM\Dict** subdirectory. The **Modality.DIC** file should contain the names of the data transfer dictionaries.

The missing data transfer dictionary will be created when the information from master file **F:\DICOM\Dict\Modality.DIC** is reloaded into the database of the **VISTA** Imaging DICOM Gateway (use menu option 4, 2, 3, **Install MODALITY.DIC**, see Section 5.3.4.

If the file(s) in directory **F:\DICOM\Dict** are also missing, these can be re-copied from the distribution CD-ROM.

### G.12.6.17 DICOM Element has Too Many Values

```
*****
*** DICOM GATEWAY ERROR ***
***
*** Processing "xxxxxxxx", tag is "xxxxxxxx". ***
*** Multiplicity is "xxxxxxxx". ***
***
*** Routine: ^MAGDIR4 Please Call Support Personnel ***
*****
```

This error may occur while building the set of data elements that is to be displayed on a diagnostic workstation. Within the DICOM protocol, each data item may have 0 (zero) or more values. How many values a specific data item may have is defined in the DICOM Data Dictionary. When a data item is encountered that has more actual values than the maximum defined in the DICOM Data Dictionary, this error will occur.

The error message will identify the data stream being processed, the “tag” for the data item in question, and the actual number of values.

### G.12.7 DICOM Image Processing Errors During Output

Images are internally stored in TARGA™ file format with an “about image text file,” which contains an ASCII version of the DICOM Header. When DICOM images are to be sent to another application entity, the DICOM images are “reconstituted” from the TARGA™ image files and the text files, and are then sent.

Like the **VISTA** DICOM Storage Provider architecture, two processes are used to send a DICOM image, the MUMPS Transmission Controller and the C executable **Vista\_Send\_Image.exe**.

The MUMPS Transmission Controller has managerial responsibilities for the effort and spawns the **Vista\_Send\_Image.exe** program to transmit the actual image files. The two processes communicate with each other via TCP/IP, with the MUMPS routine instructing the C program with what to do.

### G.12.7.1 Bad TARGA™ File

```
*****
*** DICOM GATEWAY ERROR ***
***
*** Bad Targa File -- xxxxxxxxxx ***
*** Neither RGB color, nor gray scale. ***
*** Image Type is "xxxxxxx". ***
***
*** Routine: ^MAGDIW2 Please Call Support Personnel ***
*****
```

This error may occur while re-constituting a DICOM file from a TARGA™ file and a Text file. In the TARGA™ file, a code occurs that indicates the internal “image type”. Currently, only image types “gray scale” and “RGB color” are supported. When a file with a different image type is encountered, this error will occur.

### G.12.7.2 Cannot Establish Connection with VistA\_Send\_Image

```
*****
*** ERROR IN VISTA SEND IMAGE ***
***
*** Expected return value "Connection established to MUMPS". ***
*** Received "xxxxxxx". ***
***
*** Routine: ^MAGDIW5 Please Call Support Personnel ***
*****
```

When the **Vista\_Send\_Image.exe** program is spawn by the MUMPS Transmission Controller (^MAGDIW5), it tries to establish a TCP/IP connection back to the MUMPS controller task. This error message denotes that this communications failed.

### G.12.7.3 Connection to Destination Storage Provider Failed

```
*****
*** ERROR IN VISTA SEND IMAGE ***
***
*** Expected return value "CONNECTION SUCCESSFUL". ***
*** Received "xxxxxxx". ***
***
*** Routine: ^MAGDIW5 Please Call Support Personnel ***
*****
```

The **Vista\_Send\_Image.exe** program to attempts to create a TCP/IP connection to the destination Storage Provider application entity. This connection could not be created.

### G.12.7.4 Could Not Establish Association with Destination SCP

```

*****
*** ERROR IN VISTA SEND IMAGE ***
*** ***
*** Expected return value "ASSOCIATION ACKNOWLEDGE". ***
*** Received "xxxxxxxxxx". ***
*** ***
*** Routine: ^MAGDIW6 Please Call Support Personnel ***
*****

```

The MUMPS Transmission Controller created an Association Request and had the Vista\_Send\_Image.exe program send it to the destination Storage SCP. The destination did not send back an Association Response.

### G.12.7.5 DICOM Network Error

```

*****
*** ERROR IN VISTA SEND IMAGE ***
*** ***
*** Job terminated due to Network Error #n ***
*** ***
*** Routine: ^MAGDIW5 Please Call Support Personnel ***
*****

```

This error occurs while sending a DICOM message when one of the following conditions arises:

- 1 Connection/association dropped/aborted by peer application entity
- 2 Unknown PDU (Protocol Data Unit) type received
- 3 Garbled transmission

These are errors caused by the DICOM system receiving images from VISTA.

### G.12.7.6 Image Transmission Acknowledgement Failed

```

*****
*** ERROR IN VISTA SEND IMAGE ***
*** ***
*** Unexpected Response ***
*** Expected "IMAGE SENT", received "xxxxxxxxxx". ***
*** ***
*** Routine: ^MAGDIW5 Please Call Support Personnel ***
*****

```

The MUMPS Transmission Controller instructed the Vista\_Send\_Image.exe program to send an image to the destination Storage SCP. An error on the Storage SCP prevented successful transmission of the image.

### G.12.7.7 Image Transmission Failed

```

*****
*** ERROR IN VISTA SEND IMAGE: DESTINATION STORAGE FAILURE ***
*** Status=XXXXX Error ID: YYYYYY ***
*** Comment: ZZZZZ ***
*** Offending Element: (gggg,eeee) <name of element> ***
*** ***
*** Routine: ^MAGDIW5 ***
*****
    
```

The destination Storage SCP was not able to properly handle an image transmitted to it by the VistA\_Send\_Image.exe program. The complete reason for the error is given in the message.

### G.12.7.8 Cannot Acknowledge Release of Association

```

*****
*** ERROR IN VISTA SEND IMAGE ***
*** ***
*** Unexpected response ***
*** Expected "ASSOCIATION ENDED", Received "xxxxxxxxxx". ***
*** ***
*** Routine: ^MAGDIW6 Please Call Support Personnel ***
*****
    
```

The MUMPS Transmission Controller had the VistA\_Send\_Image.exe program send an Association Release Request to the destination Storage SCP. The error is that the Storage SCP did not respond with a proper Association Release Response.

## G.12.8 Error Messages from the DICOM Correction Application

### G.12.8.1 Cannot link failed image to currently defined modality

```

*****
*** CORRECT FAILED IMAGE ***
*** ***
*** Cannot link failed image to currently defined modality. ***
*** Manufacturer = "xxxxxxxxxx". ***
*** Model = "xxxxxxxxxx". ***
*** Modality = "xxxxxxxxxx". ***
*** Instrument = "xxxxxxxxxx". ***
*** ***
*** Routine: ^MAGDLB1A Please Call Support Personnel ***
*****
    
```

This error may occur while attempting to move “failed” image entries for which no matching radiology case number can be found.

Typically, this error indicates that the list of known modalities has been rebuilt between the time that the image “failed” and the time that the recovery was attempted.

The error message will include all identifying information that could help linking the image to one of the currently defined modalities.

### G.12.8.2 Cannot Create Group of Images (Medicine)

```

*****
*** DICOM IMAGE PROCESSING ERROR ***
***
*** IMAGE GROUP CREATION ERROR: ***
*** xxxxxxxxxxxx ***
***
*** Routine: ^MAGDMED3 Please Call Support Personnel ***
*****

```

This error may occur while attempting to enter information into the *VISTA* database that establishes a group of images. When it is not possible to enter a group of values into the database as a unit, this error will occur. Entering such information into the database happens when a Medicine File entry has to be added to the database in the context of the acquisition of an image file.

The error message will contain a detailed description of the problem.

### G.12.8.3 Cannot Find Image Group Pointer in Medicine Data

```

*****
*** DICOM IMAGE PROCESSING ERROR ***
***
*** IMAGE GROUP LOOKUP ERROR: ***
*** updating 2005 x-reference in ^MCAR(xxxxxxxxxx,xxxxxxxxxx) ***
***
*** Routine: ^MAGDMED3 Please Call Support Personnel ***
*****

```

This error may occur while attempting to link information about a group of images to an entry in a Medicine File. Such linking happens when an entry is added to a Medicine File in the context of the acquisition of an image file.

The error message will include the internal number of the Medicine File in question and the internal entry number of the entry in that file.

## G.12.9 Error Messages Report by DICOM Message Queuing Software

Between the message processing and transmission steps, all DICOM messages are stored in intermediate files (\*.DCM) on the local system. For the sake of flexibility four different mechanism are provided:

1. First-In-First-Out (FIFO) queues for PACS messages for the Text Gateway
2. Direct mode for queries (e.g., Modality Worklist) for the Text Gateway
3. FIFO queue for image acquisition (**D:\dicom\image\_in\...**)

#### 4. FIFO queue for image transmission (D:\dicom\image\_out\...

The error messages in this section pertain to the intermediate file processing for the Text Gateway.

##### G.12.9.1 Error in Directory Lookup of FIFO Queue Subdirectory

```
*****
*** DICOM TEXT GATEWAY ERROR ***
***
*** Cannot locate directory xxxxxxxxxx ***
*** Host File System Error xxxxxxxxxx ***
***
*** Routine: ^MAGDQUE0 Please Call Support Personnel ***
*****
```

This error occurs when the Text Gateway is doing a directory lookup of a FIFO queue subdirectory (typically **D:\dicom\data1 \ANNNNN**) for writing a new file. This is a catastrophic error that prevents the application from even creating the new file's subdirectory, if it did not already exist.

The error message include the name of the subdirectory that got the error and the error code from the directory lookup operation. The most likely problem is that the path is pointing to a non-existent **D:\dicom\data1** directory.

##### G.12.9.2 Cannot Create FIFO Queue Subdirectory

```
*****
*** DICOM TEXT GATEWAY ERROR ***
***
*** Cannot create directory xxxxxxxxxx ***
*** Host File System Error: xxxxxxxxxx ***
***
*** Routine: ^MAGDQUE0 Please Call Support Personnel ***
*****
```

This error occurs when the Text Gateway is creating a new FIFO queue subdirectory (typically **D:\dicom\data1 \ANNNNN**).

The error message includes the name of the subdirectory that got the error and the error code from the **MKDIR** operation. The most likely problems are either that the permissions prevent the subdirectory from being created or the disk drive is out of space.

### G.12.9.3 Invalid Data in Queue Pointer File

```

*****
*** DICOM TEXT GATEWAY ERROR -- WRITING DICOM FILE      ***
***                                                    ***
*** Bad File Pointer:                                    ***
*** "xxxxxxxxxx" = "xxxxxxxxxx".                          ***
*** Value of pointer should be 7 digits.                  ***
***                                                    ***
*** Routine: ^MAGDQUE0                                     Please Call Support Personnel ***
*****

```

This error occurs when the Text Gateway finds Queue processor invalid data in one of the FIFO queue pointer files. (The “pointer files” are named **x\_READ.PTR** and **x\_WRITE.PTR**, where **x** is A, B, C, D, E, F, G, H, S, T, U, V, W, X, Y, or Z.) The values in these files must be 7-digit integer numbers with leading zeroes. When any other value is encountered in one of these files, this error will occur.

The error message will include the name of the offending file and the value that is encountered in that file.

Typically, this error occurs when a queue pointer file was modified manually, not through the software in the *VISTA* Imaging DICOM Gateway. When the displayed value indicates that a “strange” character appears leading or trailing the queue entry number, use the *NOTEPAD* editor to correct the offending file and enter the appropriate value. When the value contains an embedded control character, it may be necessary to erase the complete line, and re-enter it.

For example, suppose the **X\_READ.PTR** is null (zero bytes long), and should really contain 12345. Use *NOTEPAD* and type the value **0012345<Enter>**.

### G.12.9.4 Cannot Create a FIFO Queue Text File

```

*****
*** DICOM TEXT GATEWAY ERROR -- WRITING DICOM FILE      ***
***                                                    ***
*** Renaming xxxxxxxxxxxx to xxxxxxxxxxxx failed          ***
*** Please delete the file "xxxxxxxxxx" and restart.      ***
***                                                    ***
*** Routine: ^MAGDQUE0                                     Please Call Support Personnel ***
*****

```

This error occurs when the DICOM Text Gateway is not able to create a file in a FIFO Queue. When writing a DICOM file, the file is first created with a temporary name (typically **ANNNNNNN.tmp**), and then is renamed to its permanent name (in this case, **ANNNNNNN.dcm**). The error occurs whenever the temporary file cannot be renamed to its permanent name. This may occur when there is already a file present with that same name present, with permissions set so that it can't be deleted. Manually deleting the file will allow the processing to continue.

The error message will include the temporary file name and the permanent file name.

### G.12.9.5 Unrecognized Command Code in DICOM Message

```
*****  
*** DICOM GATEWAY ERROR ***  
*** ***  
*** Unexpected command value processing "xxxxxxxxxx". ***  
*** Expected an integer numeric value, received "xxxxxxxxxx". ***  
*** ***  
*** Routine: ^MAGDQUE4 Please Call Support Personnel ***  
*****
```

This error occurs when the DICOM Gateway encounters an unrecognized command code in an incoming DICOM message.

The error message will include the name of the data stream being processed and the offending command code.

This is probably an error on the configuration of the peer application entity.

### G.12.9.6 Unsupported Command in DICOM Message

```
*****  
*** DICOM GATEWAY ERROR ***  
*** ***  
*** Unexpected command value processing "xxxxxxxxxx". ***  
*** Cannot find label "xxxxxxxxxx" in routine ^MAGDQUE4. ***  
*** ***  
*** Routine: ^MAGDQUE4 Please Call Support Personnel ***  
*****
```

This error occurs when the DICOM Gateway encounters an unsupported command in an incoming DICOM message.

The error message will include the name of the data stream being processed and the offending command code.

This is probably an error on the configuration of the peer application entity.

## G.12.10 TCP/IP Communications Errors

### G.12.10.1 Cannot Connect to TCP/IP Socket (Set-Up Error)

```
*****  
*** TCP not setup correctly ***  
*** ***  
*** Connecting to IP Address "xxxxxxxxxx", port "xxxxxxxxxx". ***  
*** Cannot open Socket ***  
*** ***  
*** Routine: ^MAGDTCP1 Please Call Support Personnel ***  
*****
```

This error occurs when the DICOM Gateway attempts to connect to a TCP/IP socket, and no connection can be established.

The error message will include the values of the IP Address and the port number that were used in the attempt to open the socket.

Typically, the cause of this error is that either the IP Address or the Port Number is incorrectly specified in the **F:\DICOM\Dict\SCU\_List.DIC** master file. The **NOTEPAD** editor can be used to correct this file. Please see Section 7.3.6 for additional details.

**G.12.10.2 Cannot Find DICOM Message File to Send**

```
*****
*** DICOM GATEWAY ERROR ***
*** ***
*** Cannot find file "xxxxxxxxxxxx". ***
*** ***
*** Routine: ^MAGDTCP2 Please Call Support Personnel ***
*****
```

This error occurs when the file containing the DICOM message file to be transmitted cannot be located.

**G.12.10.3 Invalid First 8-bytes in DICOM Message**

```
*****
*** DICOM GATEWAY ERROR ***
*** ***
*** Incorrect DICOM Message -- first 8 bytes are wrong ***
*** Group=xxxxxxxxxx, Element=xxxxxxxxxx, Length=xxxxxxxxxx ***
*** ***
*** Routine: ^MAGDTCP2 Please Call Support Personnel ***
*****
```

The first eight bytes of a DICOM message file should be “0 0 0 0 4 0 0 0” hexadecimal. This represents element (0000,0000) with a length of 4. This data must always be correct.

This error most likely occurs when the system is trying to send a zero-length DICOM file that was created due to running out of disk space.

**G.12.10.4 Length-to-End Missing in DICOM Message**

```
*****
*** DICOM GATEWAY ERROR ***
*** ***
*** Incorrect DICOM Message -- Length to End not present ***
*** Group=xxxxxxxxxx, Element=xxxxxxxxxx, Length=xxxxxxxxxx ***
*** ***
*** Routine: ^MAGDTCP2 Please Call Support Personnel ***
*****
```

The second required element in a **VISTA** DICOM message is (0000,0001) which specifies the length to the end of the message. This is used by the TCP routine for performance to concatenate several messages into a single file (typically for Modality Worklist responses).

If this element is missing, it probably represents a programming error.

### G.12.10.5 SOP Class UID Missing in DICOM Message

```
*****  
*** DICOM GATEWAY ERROR ***  
*** ***  
*** Incorrect DICOM Message -- SOP Class UID not present ***  
*** Group=xxxxxxxxxx, Element=xxxxxxxxxx, Length=xxxxxxxxxx ***  
*** ***  
*** Routine: ^MAGDTCP2 Please Call Support Personnel ***  
*****
```

The third required element in a *VISTA* DICOM message (0000,0002) specifies the SOP Class UID for the message. This is needed to determine the Presentation Contact ID for the message.

If this element is missing, it probably represents a programming error.

### G.12.10.6 Invalid SOP Class UID in DICOM Message

```
*****  
*** DICOM GATEWAY ERROR ***  
*** ***  
*** Incorrect SOP Class UID format <<xxxxxxxxxx>> ***  
*** ***  
*** Routine: ^MAGDTCP2 Please Call Support Personnel ***  
*****
```

If the SOP Class UID for the message, element (0000,0002), has the wrong format (i.e., doesn't begin with a numeric), this error will occur.

This probably represents a programming error.

### G.12.10.7 Unknown Presentation Context ID

```
*****  
*** DICOM GATEWAY ERROR ***  
*** ***  
*** Unknown Presentation Context ID for <<xxxxxxxxxx>> ***  
*** ***  
*** Routine: ^MAGDTCP2 Please Call Support Personnel ***  
*****
```

If the SOP Class UID for the message, element (0000,0002), has the wrong value this error will occur.

This is most likely caused by trying to send a message for a SOP Class that was not negotiated for the association. It is typically seen during “trial and error” configuration of vendor systems.

### G.12.10.8 Unexpected PDU (expected 04 = P-Data)

```

*****
*** DICOM GATEWAY ERROR ***
*** ***
*** Expected PDU type 04(hex), ***
*** found "xxxxxxxxxx". ***
*** ***
*** Routine: ^MAGDTCP3 Please Call Support Personnel ***
*****

```

This error occurs when the DICOM Gateway attempts to receive data from a peer application entity and the code for the PDU Type is not equal to 04 (hex), which is the code for P-Data. (A PDU is a **Protocol Data Unit**.)

This is caused by a DICOM implementation problem with a vendor system.

## G.13 Run Time MUMPS Error Messages

### G.13.1 The system error log

The system error log contains a list of any errors that have occurred within the MSM system. It is good practice to review this log on a regular basis and to report important errors.

Some entries in the error log are the result of the normal operation of the system and can be ignored. Entries that fall in this category are itemized below.

Some error codes may occur under multiple circumstances, and hence may appear in more than one of the sections below.

### G.13.2 Errors <INRPT> and <KLJOB>

A user interrupted a program by typing “Control-C” (<INRPT>), or a system manager terminated a job (<KLJOB>).

While it may be useful for statistical purposes to keep track of such events, these error messages can be ignored while scanning the error log for serious problems.

### G.13.3 Errors <DKRES>, <DKFUL>, <DKSER> and <DBDGD>

Databases, like many other resources, have a tendency to fill up. The DICOM database (stored in **c:\msm\dicom.msm**) is created as a file of 20 MB, and should never become completely full.

When the database completely fills up, it is usually because some internal “clean up” process did not function properly and did not remove redundant information.

<DKRES> is the “early” warning that a database is “almost full”. It is important to call for support when this error is reported.

When the error message <DKFUL> appears, this means that the database is physically full, and that there is information that could not be written to the database. As a result, later attempts to read from the database may find corrupted information.

Error messages like <DKSER> and <DBDGD> indicate that the database has become physically damaged, and the system cannot be used until after it has been repaired properly.

#### **G.13.4 Error <DKHER>**

This message indicates that there is a hardware problem with the disk that holds the database.

A typical cause for this error is that a cable that connects the disk drive to other components of the computer has become detached. Re-attaching the cable would resolve the problem in such cases.

On occasion, this error message means that the physical magnetic platter in the disk drive is damaged. When this occurs, only a physical replacement of the disk drive can resolve the problem. Data will have to be restored from a backup in such cases.

#### **G.13.5 Error <SYSTM>**

This error indicates that an internal error has occurred within the MSM system. Errors of this type need to be reported to the vendor of the MSM product.

Contact the support organization, so that enough information about the circumstances can be collected to allow the support organization to report the problem.

#### **G.13.6 Errors <ASYNC>, <DSCON>, <DSTDB>, <NOSYS>, and <DDPER>**

In a networked system, connections are created, terminated and recreated continually. When a connection is temporarily lost, any of these error messages may be added to the error log.

Although it would be “better” if these error messages would never appear, these messages do not indicate intrinsic problems with the software.

#### **G.13.7 Errors <NOPGM> and <PLDER>**

This error indicates that a program was invoked that is not loaded into the application database (<NOPGM>) or improperly loaded (<PLDER>).

Typically, this error means that a software component was not installed completely. In such cases, it is useful to contact the support organization, so that they may assist in the proper installation of the defective software component.

In other cases, this error may indicate a spelling error in the name of a program, and the problem resolution would require a “bug fix”.

### G.13.8 Errors <NOUCI> and <NOSYS>

These errors indicate that a reference is made to a database resource that is not currently available. Typically, this means that a “global variable translation” is not set up properly (see the section about setting up “**global variable translation tables**” in the Installation Guide).

### G.13.9 Error <PROT>

This error indicates that the application software attempted an action for which no permission was granted.

Typically, this means that one of the steps involving the installation of a system component was not completed successfully. In such cases, contact the support organization, so that they may assist in the proper installation of the software component in question.

In some cases, this error message may appear after a system was shutdown improperly (a power-off, no emergency shutdown), causing corruption in the BIJ (Before Image Journaling) file.

If there are no errors in the error file (D<sub>o</sub> ^%ER) and the BIJ file is not corrupt, try restarting the MSM console and then the gateway functions. Sometimes it’s just a momentary network failure.

If the Before Image Journal file is corrupt, it will need to be rebuilt. Use the following steps to rebuild the file:

1. Login in programming mode as MGR using the MSM console window.
2. Terminate all telnet processes.
3. Shut down DDP. (D<sub>o</sub> ^DDP, option 2)
4. Verify that your task is the ONLY active MUMPS process on the system (D<sub>o</sub> ^%SS)
5. Terminate all remaining background server processes (D<sub>o</sub> ^KILLJOB, option 3).
6. Dismount the DICOM database (D<sub>o</sub> ^DBMAINT, option 5)
7. Turn off journaling temporarily (D<sub>o</sub> ^BIJ, option 2, file name is x:\msm\dicom.msm)
8. Mount the DICOM database (D<sub>o</sub> ^DBMAINT, option 4)
9. Turn on journaling (D<sub>o</sub> ^BIJ, option 1, database is DCM).

When these steps are done, the program will report that journaling will be re-activated the next time that the database is mounted. At this point, shut down MSM and restart it, so that all background processes will be running again.

### **G.13.10 Errors <PGMOV>, <STKOV> and <ZSAVE>**

These errors indicate that a resource in the MSM configuration is exhausted.

<PGMOV> and <ZSAVE> occur when the partition size is not large enough (see the Installation Guide for instructions to establish the proper partition size).

<STKOV> occurs when one of the internal memory stacks is exhausted (see the Installation Guide for instructions to establish the proper stack size).

### **G.13.11 Errors <BKERR>, <CLOBR>, <ISYNT>**

These errors may occur as a side-effect of programmers modifying code in an operational environment and do not indicate any errors in the software.

### **G.13.12 Error <MODER>**

This error indicates that an attempt was made to access a file in a manner other than requested when the file was opened. Typically, this means that an attempt was made to write to a “read-only” file, or to read from an “output” file.

Often, however, this error indicates that an attempt was made to read from a non-existent file.

### **G.13.13 Error <MTERR>**

This error indicates that an error occurred with a magnetic tape device. Such errors are typically hardware related errors (tape full, parity error, unit went off-line, ...).

Contact the support organization for a proper analysis and resolution of the problem.

### **G.13.14 Error <ZSVGP>**

This error indicates that the database was not created properly, and does not allow for any programs to be stored in it. See the Installation Guide for instructions on creating a database.

### **G.13.15 Errors <NMSPC>, <NOJRN>, <SPOOL> and <XCALL>**

These errors indicate that a system component is not set up properly.

In the current release of the DICOM Gateway, these components are not used.

### **G.13.16 Any other code like <XXXXX>**

Any other code that is spelled as 4 or 5 upper case characters between two angle brackets typically indicates that there is an error in one of the application programs.

Currently defined codes of this type are <BADCH>, <CMMND>, <DIVER>, <DPARM>, <ECODE>, <EXPER>, <FUNCT>, <INDER>, <LINER>, <MERGE>, <MINUS>, <INHIB>, <LCNSE>, <MAPER>, <MODER>, <MWAPI>, <MXMEM>, <MXNUM>, <MXSTR>.

<NAKED>, <NOPEN>, <NOPGM>, <OBJECT>, <PCERR>, <SBSCR>, <SYNTAX>, <TXPER>, <UNDEF>, <VWERR>, <XCALL> and <Zxxxx>.

Contact the support organization. They will typically ask for more detailed information, so that a “bug fix” may be prepared.

## G.14 DICOM error messages

### G.14.1 Error message: \$ZE=<STKOV>BTXT+2^DIALOG:::6:6:

**Problem:** This error may occur while attempting to correct images, and while trying to input data into a field that does not exist in the FileMan Data Dictionary on the *VISTA* side. Specifically, this may happen while attempting to update the fields **DICOM SERIES NUM** and **DICOM IMAGE NUM**, which are part of versions DICOM39 or later.

**Solution:** Have site install the latest MAGD2\_xxx.xxx KID application and restart the process images procedure.

**Note:** This error will only occur during the process of corrected images because the exclusive kill does not take place during this process.

### G.14.2 Error message “Port in Use” or “Port Unavailable”

This message indicates that multiple processes are contending for the same socket. The resolution of this problem is usually fairly simple.

First try to simply close the C-Store window that displays the error message. Check that there is no other C-Store session active that is attempting to run the same program for the same instrument. If there is, that other session is probably successfully using the port that the former one could not obtain. If there is no other session attempting to run the same task, try to start it by double-clicking on its icon. This usually resolves the problem.

If the problem persists, wait until the Image Gateway is not actively processing images (all active windows show the “idle” indicator). Close the windows that display the “idle” indicator one by one. When no more telnet sessions are active, shut down MSM and restart MSM. Once MSM is running again, restart all telnet sessions.

If, after this, the problem still persists, wait until the Image Gateway is not actively processing images (all active windows show the “idle” indicator). Close the windows that display the “idle” indicator one by one. When no more telnet sessions are active, shut down MSM. Once MSM is shut down, shut down Windows NT as well. Power down the PC, wait 20 seconds, and power it up again, Restart Windows NT, login using the appropriate username and password and restart MSM. Once MSM is running again, restart all telnet sessions.

If, after this, the problem still persists, log a NOIS call.

### G.15 Signing on to the GUI

When a user signs on into the GUI version of the **VISTA** Imaging software and the user has a Radiology classification as a resident and/or staff, the Kernel Broker login software will execute a Radiology routine that counts the number of “unverified reports”. In hospitals where it is not common practice that all staff members verify their radiology reports, the number of reports with a status of “waiting for action” can grow extremely large. Such a count may keep the user waiting for a successful login for several minutes. Routine ^RAUTL3 is the called routine that counts the number of radiology reports requiring action by the user who is currently logging on. Some sites have modified this routine to quit for GUI sign-on. Consult the Radiology developers if this problem exists or have user verify all outstanding reports, which is the standard procedure.

### G.16 Dumping Files that Cannot be Processed by the Gateway Application

Occasionally, input files cannot be processed properly. The distribution kit contains an “octal dump” utility program (**OD.EXE**), that may be of help in diagnosing such problems. This utility program is intended to be started from the DOS-prompt, and will accept the following parameters:

```
> od -b -A {doxn} -N number -j number -t {acdfoux} filename
```

The meaning of the various parameters is described below.

#### **-b**

This parameter means that the content of the file is to be displayed in “bytes” rather than in “words” (default, when this parameter is omitted).

#### **-A {d,o,x,n}**

This parameter indicates how the counter in the left-most column is to be displayed. Only one of the four possible sub-options may be specified:

-A d means: display the counter in decimal representation

-A o means: display the counter in octal representation (default)

-A x means: display the counter in hexadecimal representation

-A n means: do not display the counter

#### **-N number**

This parameter indicates how many bytes need to be displayed. Only the first “so many” bytes of the file will be displayed, where “so many” is the number indicated by this parameter. Note: The value of this parameter is written in decimal representation.

#### **-j number**

This parameter indicates where in the input file, the program is to start displaying characters. The program will start at the character indicated by the value of “number” in this parameter. Note: the value of this parameter is written in decimal representation.

**-t {a,c,d,f,o,u,x}**

When this parameter is omitted, the utility program will only display the numeric values of the various characters in the file. When additional information is desired, this parameter may be used to indicate which additional information should be displayed:

- t a means: display all ASCII characters
- t c means: display only printable ASCII characters
- t d means: display decimal representation
- t f means: display floating point representation
- t o means: display octal representation
- t u means: display unsigned decimal representation
- t x means: display hexadecimal representation

Example:

```
C:\DICOM\DICT>od -N 80 -j 50 -b -A d -t c instrument.dic <Enter>
0000000050    162 151 160 164 151 157 156 174 111 156 163 164 151 164 165 164
              r  i  p  t  i  o  n  |  I  n  s  t  i  t  u  t
0000000066    151 157 156 040 116 141 155 145 174 111 155 141 147 151 156 147
              i  o  n      N  a  m  e  |  I  m  a  g  i  n  g
0000000082    040 123 145 162 166 151 143 145 174 120 157 162 164 174 015 012
              S  e  r  v  i  c  e  |  P  o  r  t  |  \r  \n
0000000098    043 040 111 155 141 147 151 156 147 040 163 145 162 166 151 143
              #      I  m  a  g  i  n  g      s  e  r  v  i  c
0000000114    145 163 040 141 162 145 040 144 145 146 151 156 145 144 040 141
              e  s      a  r  e      d  e  f  i  n  e  d      a
0000000130

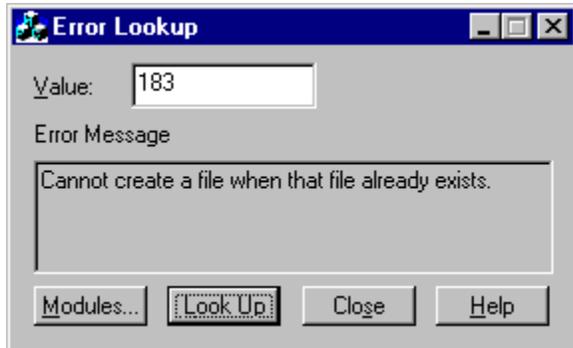
C:\DICOM\DICT>
```

## G.17 Microsoft Windows Error Code

In some cases, the system reports an error number. Such error numbers are typically returned by platform-specific system calls. Usually, the software will display both the error code and the meaning. If a code, but no meaning is displayed, the program “**ErrLook**” may be of help to find out the meaning of the code.

The program “ErrLook.exe” is stored in the directory \Program Files\Vista\Imaging DICOM, so that is always in an accessible “execution path”.

When this program is started, it asks for an error code number. When a number is entered, click on the button labeled “**Look Up**” to display the meaning of the code.



# 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 <b>VISTA</b> .
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.

## Glossary

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.
Mouse	Hand driven input and pointing device.
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.
<b>VISTA</b>	<u>V</u> eterans Health <u>I</u> nformation <u>S</u> ystem <u>T</u> echnology <u>A</u> rchitecture. <b>VISTA</b> 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.
WYSIWYG	“What you see is what you get.” The feature of seeing images and text exactly as they will look when printed or transmitted.

Glossary

Zoom

To enlarge an image or a portion of an image.

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