Interfacing the PACS and the HIS: Results of a 5-year Implementation[1]

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An interface was created between the Department of Defense's hospital information system (HIS) and its two picture archiving and communication system (PACS)–based radiology information systems (RISs). The HIS is called the Composite Healthcare Computer System (CHCS), and the RISs are called the Medical Diagnostic Imaging System (MDIS) and the Digital Imaging Network (DIN)–PACS. Extensive mapping between dissimilar data protocols was required to translate data from the HIS into both RISs. The CHCS uses a Health Level 7 (HL7) protocol, whereas the MDIS uses the American College of Radiology–National Electrical Manufacturers Association 2.0 protocol and the DIN-PACS uses the Digital Imaging and Communications in Medicine (DICOM) 3.0 protocol. An interface engine was required to change some data formats, as well as to address some nonstandard HL7 data being output from the CHCS. In addition, there are differences in terminology between fields and segments in all three protocols. This interface is in use at 20 military facilities throughout the world. The interface reduces the amount of manual entry into more than one automated system to the smallest level possible. Data mapping during installation saved time, improved productivity, and increased user acceptance during PACS implementation. It also resulted in more standardized database entries in both the HIS (CHCS) and the RIS (PACS).

Abbreviations: CHCS = Composite Healthcare Computer System, DICOM = Digital Imaging and Communications in Medicine, DoD = Department of Defense, HIS = hospital information system, HL7 = Health Level 7, PACS = picture archiving and communication system, PC = personal computer, RIS = radiology information system

Index terms: Computers • Hospital information system (HIS) • Picture archiving and communication system (PACS) • Radiology reporting systems

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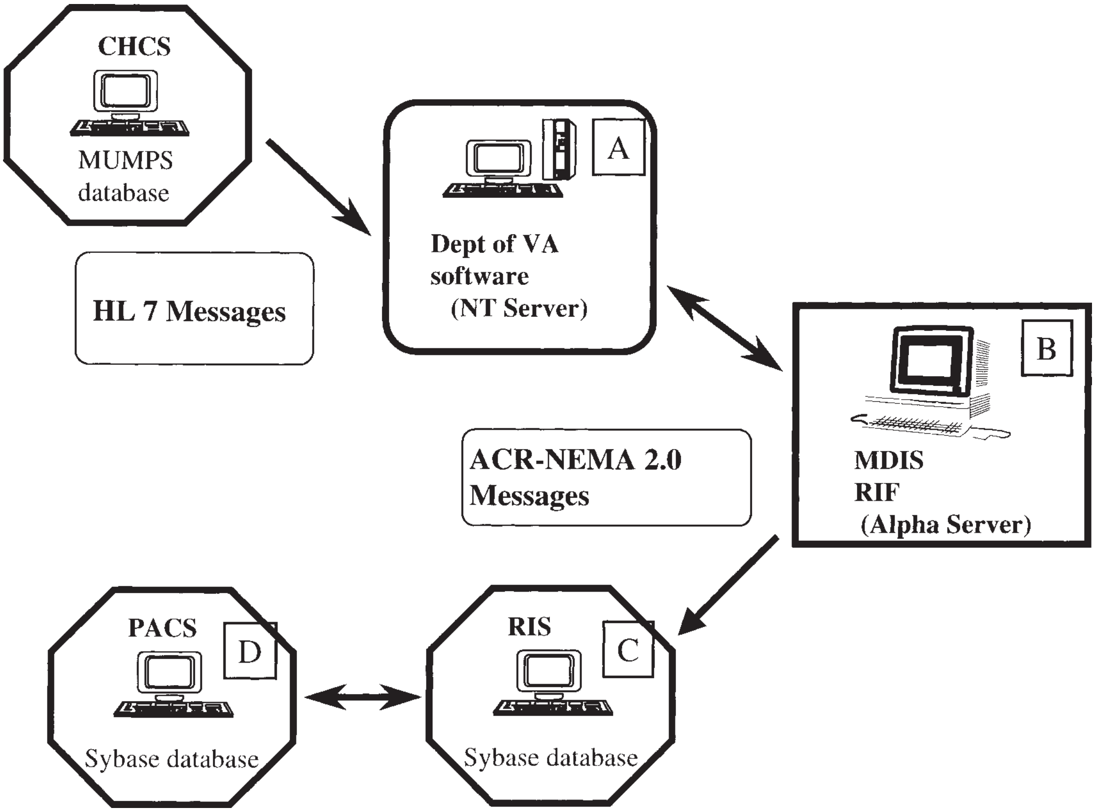

Figure 1. Diagram of the linear connection mechanism shows data flow within the Medical Diagnostic Imaging System (*MDIS*). *ACR-NEMA* = American College of Radiology–National Electrical Manufacturers Association, *MUMPS* = Massachusetts General Hospital Utility MultiProgramming System, *RIF* = Radiology InterFace, *VA* = Veterans Affairs.

Introduction

One of the greatest challenges encountered with the installation of a picture archiving and communication system (PACS) is sharing electronic data with other information systems within the health care enterprise. These data could be the demographic data that identify patients, historical records of these patients' encounters, historical listings of diagnostic imaging studies, and reports of those studies. The purpose of an interface would be to eliminate or reduce the amount of keyboard interaction clerks, technologists, and radiologists have with the PACS. The benefits of tightly integrating the disparate computer systems within the health care enterprise include (*a*) the ability to combine a variety of data sources into an integrated database, (*b*) the ability to interrelate applications with linkages through an organizational database, (*c*) the ability to accommodate physicians' requirements with a full range of medical data for different stages of the treatment, and (*d*) the ability to shift among applications as a user choice (1). With this tight level of integration, some authors propose that the lines between the hospital information system (HIS), the radiology information system (RIS), and the PACS become so blurred that the result begins to approach the current technology of distributed databases (2).

The Department of Defense (DoD) has been using its own HIS since 1988. This system is called the Composite Healthcare Computer System (CHCS) (Science Applications International, La Jolla, Calif) and is operational at every DoD medical facility and on some larger naval vessels. PACS have also been installed at some of these sites beginning in 1994 and continue to be installed today. Both the HIS and the PACS have components that represent a RIS.

In this article, we describe the primary schemes for PACS-HIS interfacing used by the DoD and discuss mapping data between the different protocols.

Schemes for PACS-HIS Interfacing

The DoD uses two primary schemes to connect the CHCS to its PACS: a linear connection mechanism and a parallel connection mechanism. The oldest PACS use the linear mecha-

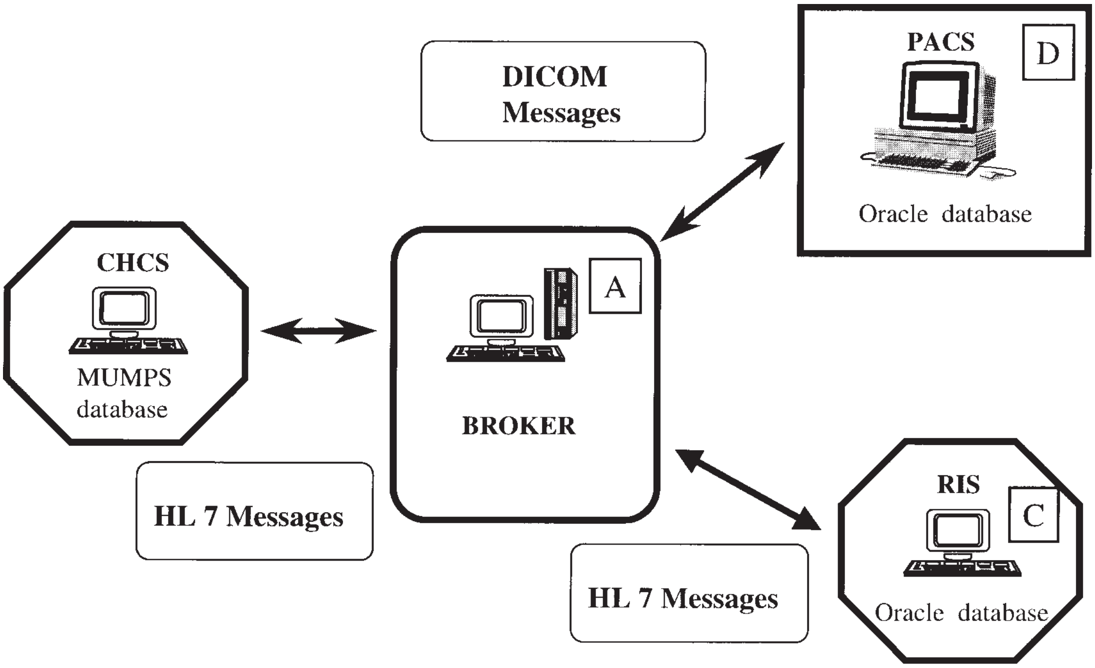

Figure 2. Diagram of the parallel connection mechanism shows data flow within the Digital Imaging Network (DIN)–PACS. *A* is the broker PC, which communicates with the CHCS via a transmission control protocol/Internet protocol (TCP/IP) link and an HL7 protocol. These messages are then translated into DICOM 3.0 and transmitted to both the RIS and the PACS. The broker can send HL7 or DICOM messages to the RIS and DICOM messages to the PACS. The broker thus becomes the single interface between the HIS (CHCS), the RIS, and the PACS. *MUMPS* = Massachusetts General Hospital Utility MultiProgramming System.

nism, in which a succession of personal computers (PCs) are used to translate and transfer data. These old PACS use the American College of Radiology–National Electrical Manufacturers Association (ACR-NEMA) 2.0 communication protocol and are being upgraded to the Digital Imaging and Communications in Medicine (DICOM) 3.0 standard. The CHCS uses Health Level 7 (HL7) 2.2 as its primary communication protocol (Fig 1).

The most important aspects of this type of interface are the three limitations it imposes. First, the multiple PCs introduce several failure points into the interface process. If any one of these PCs fails, the interface stops working. The DoD experiences several such failures each year, particularly now that the PCs are more than 2 years old.

Another problem encountered is the extensive system of pointers needed to keep all the PCs synchronized. There are pointers in the CHCS, pointers in the Windows NT server (Microsoft, Redmond, Wash), pointers in the Alpha server (Digital Equipment, Maynard, Mass), and pointers in the PACS. Any one of these sets of pointers that loses its place affects the performance of the interface. This is far and away the largest problem encountered with these interfaces, accounting for almost 75% of the interface problems requiring intervention. Each interface experienced these problems at least once each year, some more often.

The last problem encountered is "orphaned" data on the two intermediary PCs, the NT and Alpha servers. Very often, when the pointers lose their synchronization, the only way to fix the problem is to reset all the pointers, except those of the CHCS, to zero. This process allows data to become "trapped" in one of the two middle PCs, in a lost directory. Since HL7 is a trigger-based protocol, those messages are not transmitted again and are thus "lost" to the receiving system. This problem is most acute with completed reports and results in images on the PACS with no attached reports. Special procedures have been developed to recover these lost messages, but they are cumbersome and time-consuming.

Parallel interface connections allow multiple, simultaneous connections to several devices at once. This mechanism reduces the number of PC "boxes" necessary to the smallest number possible. These parallel connections use devices called brokers to transfer the data from one system to another (Fig 2). Brokers are provided by companies such as Mitra Imaging (Waterloo,

Table 1
Partial List of HL7 Elements for Patient Identification (PID)

Sequence	Element Name	Description	Usage
1	Set ID - Patient ID	Sets repeating segments	Set repeating segments
2	External ID (Patient ID)	Patient ID from another institution	. . .
3	Internal ID (Patient ID)	Primary Patient ID	. . .
4	Alternate Patient ID	Other forms	Family Member Prefix or Social Security number of sponsor
5	Patient Name	Name in standard format	Patient name
6	Mother's Maiden Name	Mother's family name	. . .
7	Date of Birth	Patient's date of birth	Patient birth date
8	Sex	Patient sex	Code (M or F)
9	Patient Alias	Other patient names	. . .
10	Race	Race classification	Code
11	Patient Address	Mailing address of patient	Street, city, state, zip code
12	Country Code	Patient country code	Country code

Ontario, Canada) and Dejarnette Research Systems (Towson, Md) and are capable of performing the translation and the transfer of data together on the same PC.

These multiple connections between the broker and other components allow data to be replicated between systems much more quickly and efficiently than with the linear model. Although the broker cannot actually transfer data between two (or more) locations at the exact same instant, the transfer happens so quickly due to the processing speed of the computer that the user is not able to see the time delays. There are other advantages as well. Since the broker is a single PC, it can be replicated and stored as a "cold spare" or integrated into the configuration as a "hot spare," thus reducing the effects of machine failure. With a single PC, the likelihood of orphaned data is also reduced. When the broker fails, data are held in the HIS; when the PACS fails, the broker has the ability to hold data until the PACS comes back online. With these types of interfaces just now being deployed within the DoD, there have been no hardware failures within the past year. The broker also allows the use of DICOM Modality Worklist rather than an HL7 interface to the individual modalities (3).

One of the most significant differences in the DoD between these strategies is the support mechanism for each. Since the NT server in the linear model is third-party software, neither the CHCS nor the PACS vendor supports it. Thus, the facility has a support role for this piece of equipment, providing maintenance, coordinating upgrades, and repairing problems as they arise. In the broker model, the PACS vendor supplies the broker and the software, with all maintenance, upgrades, and repairs performed by the vendor rather than the local facility.

Mapping Data between Protocols

In addition to the hardware challenges, there are challenges in maintaining the data consistency between the HIS (CHCS) and the PACS. HL7 is the data transfer protocol for the HIS and the RIS, whereas DICOM is the standard for the PACS. In this section, we describe our experiences with "mapping" (matching up) data between these two very different protocols.

HL7 messages are made up of segments, sequences, and data elements. Segments can be combined in any arrangement necessary to transfer the appropriate data between systems. This arrangement of segments usually varies widely from vendor to vendor and is a large obstacle when moving data from one system to another. This structure can be seen in Table 1, which is an example of the Patient Identification (PID) used with almost all types of messages within HL7.

DICOM messages are composed of Service Object Pairs (SOP) classes, DICOM Message Service Elements (DIMSE), and attributes.

Table 2
List of Data Elements for DICOM Worklist Management

Attribute Description*	Attribute Tag	Usage
Accession Number	(0008,0050)	Examination number
Referring Physician Name	(0008,0090)	Requesting health care provider
Referenced Study Sequence	(0008,1110)	. . .
> Referenced SOP Class UID	(0008,1150)	. . .
> Referenced SOP Instance UID	(0008,1155)	. . .
Referenced Patient Sequence	(0008,1120)	. . .
> Referenced SOP Class UID	(0008,1150)	. . .
> Referenced SOP Instance UID	(0008,1155)	. . .
Patient Name	(0010,0010)	Patient name
Patient ID	(0010,0020)	Family Member Prefix or Social Security number of sponsor
Patient Birth Date	(0010,0030)	Patient's date of birth
Patient's Sex	(0010,0040)	M or F
Patient Weight	(0010,1030)	. . .
Contrast Allergies	(0010,2110)	. . .
Pregnancy Status	(0010,21C0)	Yes or no
Study ID	(0020,0010)	. . .
Study Instance UID	(0020,000D)	. . .
Requesting Physician	(0032,1032)	. . .
Requested Procedure Description	(0032,1060)	Procedure name
Admission ID	(0038,0010)	. . .
Current Patient Location	(0038,0300)	Requesting location
Modality	(0008,0060)	. . .
Requested Procedure ID	(0040,1001)	Procedure unique identification

*ID = identification, SOP = Service Object Pairs, UID = unique identification.

Attributes in DICOM are the equivalent of sequences in HL7. Whereas the sequences in HL7 are identified by the segment and sequence number (PID-5 is patient name), the attributes in DICOM are identified by tags. DICOM tags can be included in any DICOM message, regardless of the purpose of the message. DICOM tag (0010,0010) corresponds to patient name. Because of this type of organization, DICOM is much more flexible for transferring data. Table 2 is an example of a DICOM message for Worklist Management.

Once the actual connection mechanisms have been decided, the data needed must be mapped between the two different protocols. Although the concepts assigned to the data may be similar, there are few exact matches in terminology between HL7 and DICOM. With a few exceptions like patient name, most of the other data necessary for both RIS and PACS operations are labeled differently in the two protocols. Whether a linear connection or a broker is used, the matching up of data between the two protocols must be accomplished. Concepts such as patient name, patient identification, other patient data, examination data, and report data relevant to HIS and RIS operations must be buffered against concepts such as patient data, examination data, and image data needed to maintain the PACS database (Fig 3).

Although every piece of data may not be necessary, a list of mandatory data and preferred data for each component (HIS, RIS, and PACS) must be established. Table 3 is a partial listing of the data elements the DoD determined to be common to the HIS, RIS, and PACS databases. These data were then mapped between the CHCS and the PACS. The complete listing of the DoD's common data elements for the HIS (CHCS), RIS, and PACS databases is given in the Appendix.

HL 7

ELEMENT NAME	DESCRIPTION
Set ID - Patient ID	Sets repeating segments
External ID (Patient ID)	Patient ID from another institution
Internal ID (Patient ID)	Primary Patient ID
Alternate Patient ID	Other forms
Patient Name	Name in standard format
Mother's Maiden Name	Mother's family name
Date of Birth	Patient's date of birth
Sex	Patient sex
Patient Alias	Other patient names
Race	Race classification
Patient Address	Mailing address of patient
ETC	

DICOM

ATTRIBUTE DESCRIPTION	ATTRIBUTE TAG
Accession Number	(0008,0050)
Referring Physician Name	(0008,0090)
Referenced Study Sequence	(0008,1110)
> Referenced SOP Class UID	(0008,1150)
> Referenced SOP Instance UID	(0008,1155)
Referenced Patient Sequence	(0008,1120)
> Referenced SOP Class UID	(0008,1150)
> Referenced SOP Instance UID	(0008,1155)
Patient Name	(0010,0010)
Patient ID	(0010,0020)
Patient Birth Date	(0010,0030)
Patient's Sex	(0010,0040)
Patient Weight	(0010,1030)
Contrast Allergies	(0010,2110)
Pregnancy Status	(0010,21C0)
Study ID	(0020,0010)
Study Instance UID	(0020,000D)
Requesting Physician	(0032,1032)
Requested Procedure Description	(0032,1060)
Admission ID	(0038,0010)
Current Patient Location	(0038,0300)
Modality	(0008,0060)
Requested Procedure ID	(0040,1001)

Figure 3. Diagram shows mapping of HL7 elements to DICOM elements. This is a representative listing of just some of the relationships between HL7 and DICOM data elements; the arrows show the pieces of data mapped to one another. Each interface must be mapped on the basis of the available HL7 and DICOM data elements in the HIS, RIS, and PACS databases and will result in dozens and dozens of relationships. *ID* = identification, *SOP* = Service Object Pairs, *UID* = unique identification.

Since exact matches are the exception rather than the rule, some additional "rules" are needed to determine how to match data from one protocol to the other. Three tenets were developed to determine the mapping between the CHCS and the PACS. These tenets have been used in the first few deployments of the interface with good results. It took two or three meetings (8–10 hours cumulative) with each vendor to completely map out all the necessary data elements. After these meetings, no elements were "remapped" during the first quarter of interface operations.

The first of these tenets is "close enough." This tenet is based on the fact that the terms in the HL7 and DICOM standards are similar and easily discernible, even though not exact matches. One of the most common examples of this tenet is HL7 PID-4 Alternate Patient ID and DICOM (0010,0020) Patient ID. Another example is HL7 OBR-13 Relevant Clinical Information and DICOM (0032,1030) Reason for Study. These are two examples of saying the same thing two different ways.

Another tenet is "best guess." This tenet is used when an implicit knowledge of the HIS or RIS database is needed to map these elements. DICOM is fairly straightforward in its use of DICOM tags. Since the tags can be used in several types of messages (Service Object Pairs classes), each instance of the tag must contain exactly the same data in each message. This requirement does not hold true for HL7. The data contained within a sequence may change from message to message depending on its trigger (ie, its causal effect). A prime example is HL7 OBR-22 Results Rpt/Status Chng Date/Time. According to the trigger used to generate the HL7 message, this date-time field could be (*a*) the actual date and time an examination is requested to be performed (not the scheduled date and time, which is OBR-36); (*b*) the date and time a report is signed electronically by a resident; (*c*) the date and time a report is signed electronically by a staff radiologist; or (*d*) the date and time a report amendment is entered. In these cases, OBR-22 corresponds to DICOM tags (0008,0020) Study Date and (0008,0030) Study Time; (0032,1050) Study Completed Date and (0032,1051) Study Completed Time; and (4008,0112) Interpretation Approval Date and (4008,0113) Interpretation Approval Time. OBR-22 could be mapped to any or all of these DICOM tags as needed by the PACS database. The best guess tenet requires extensive knowledge of both databases to determine where to find the data in one database in the other database. This process helps ensure

Table 3
Partial List of Database Elements with HL7 and DICOM Mapping

Data Name	HL7 Segments	DICOM Tags
Patient name	PID-5	(0010,0010)
Primary patient identification	PID-4*	(0010,0020)
Patient's date of birth	PID-7	(0010,0030)
Requested procedure—name	OBR-4†	(0040,1001) (0032,1060)
Requested procedure—code	OBR-4‡	(0032,1064)
Current Procedural Terminology procedure code	OBR-4§	(0040,1400)
Clinical reason for examination	OBR-13	(0032,1030)
Requesting physician	ORC-12‖	(0008,0090) (0040,1010) (0032,1032)
Examination status	. . .	. . .
Performing technologist	OBR-34	(0040,0006)
Report status	OBR-25	(4008,0212)
Report text	OBX-5	(4008,010B)
Interpreting radiologist	OBR-33	(4008,010C) (4008,0102) (0008,1060)
Supervising radiologist	OBR-32	(0008,1060)
Verifying radiologist	ZRR-4	(4008,0114)
Verifying radiologist's facility	ZRR-5	. . .
Verifying supervisor	ZRR-6	(4008,0114)
Verifying supervisor's facility	ZRR-7	. . .
Date of verification	OBR-6, ORC-9	(4008,0112)
Time of verification	OBR-6, ORC-9	(4008,0113)
Result code	OBX-5	(4008,0117)

*Entire sequence.
†Several portions of sequence.
‡Second portion of sequence.
§Fourth portion of sequence.
‖Second and third portions of sequence.

accurate mapping of data between the two databases. In the preceding example, the initial order OBR-22 corresponds to (0008,0020) Study Date and (0008,0030) Study Time in DICOM. On a subsequent transmission, when the patient leaves the imaging center, the OBR-22 transmission would correspond to DICOM tags (0032,1050) and (0032,1051). When the report is actually signed electronically by the radiologist, OBR-22 data would be mapped to DICOM (4008,0112) and (4008,0113).

The last tenet is "use it anyway." This tenet is used when there are no HL7 sequences or DICOM tags that seem close in meaning and there are no logical relationships between the two databases. These problems are most common when one is dealing with nonstandard HL7 segments (those beginning with Z, such as ZM1) and private DICOM attributes. One of the DoD examples is HL7 OBR-3 Filler Order Number and DICOM (0008,0050) Accession Number. There is no HL7 sequence described as an accession number, whereas DICOM has a dedicated tag. These data are necessary to establish a one-to-one relationship between the databases for the text-based data surrounding an encounter (order, examinations, and patient) with the associated images for that encounter. Since HL7 does not subscribe to this concept, some HL7 sequence must be chosen to carry these data. Rather than creating a nonstandard (Z) segment, existing sequences that are not in use within this database can be adapted for use in this case. This process reduces the number of nonstandard segments and keeps the database from growing too large. However, care must be taken to use only relevant HL7 sequences. In this case, the Filler Order Number and Placer Order Number sequences are used to identify specific orders within the HIS. A unique order number is transmitted in the Placer Order Number; appropriate radiology, laboratory, and pharmacy numbers are transmitted in the Filler Order Number. In the radiology data, this number is the equivalent of the accession number.

Another example is HL7 OBR-4 Universal Service ID and DICOM tags (0040,1001) Requested Procedure ID and (0032,1060) Requested Procedure Description. A unique property of HL7 is its ability to hold several bits of data within a single sequence. They are called components and subcomponents and are built into the very fabric of HL7. Each message header (MSH) segment explicitly identifies the control characters used to identify both the components and subcomponents of each message. DICOM tags are designed to hold only a single “component”; DICOM even goes so far as to separate dates and times into individual tags. HL7 has a format titled TimeStamp (TS), which contains the date and time in a single numeric representation. In the DoD implementation of HL7, there are seven components of OBR-4, each corresponding to a different DICOM tag. Caution must be exercised when using what seem to be relatively unused HL7 attributes because they may appear in other implementations of HL7 in other interfaces and cause unwanted interactions in future interfaces. This area is very interface specific, and an entire exercise could be devoted to this single tenet.

Conclusions

Interfacing two or more information systems includes many levels of planning and preparation. Certain aspects of the protocols such as their communication structures, communication schemes, and physical connections must be researched and identified to the HIS, RIS, and PACS vendors. The information moved between systems must also be identified and labeled in both HL7 and DICOM protocols. This process involves flexibility in knowing where the data are contained in each database and their intended purpose and location in the opposite database. Finally, some creativity is needed to map those elements that are not readily discernible as containing corresponding data. Such planning, flexibility, and creativity are necessary to share data between databases when the two disparate protocols HL7 and DICOM are used.

This interface is in use at 20 military facilities throughout the world. The interface reduces the amount of manual entry into more than one automated system to the smallest level possible. Data mapping during installation saved time, improved productivity, and increased user acceptance during PACS implementation. It also resulted in more standardized database entries in both the HIS (CHCS) and the RIS (PACS).

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Appendix

List of the DoD’s Common HIS, RIS, and PACS Database Elements

Common Name*	DICOM Element	HL7 Sequence
Examination date	0008,0020 Study Date	OBR-22 Results Rpt/Status Chng Date/Time
Examination time	0008,0030 Study Time	OBR-22 Results Rpt/Status Chng Date/Time
Examination ID	0008,0050 Accession Number	OBR-3 Filler Order Number
Procedure class description	0008,0060 Modality	ZRR-1 Imaging Type
Procedure class code	. . .	. . .
Requesting facility’s name	0008,0080 Institution Name	OBR-24 Diag Service Section ID
Unique procedure ID	0008,0100 Requested Procedure Code Value	OBR-4 Universal Service ID
Requesting facility’s ID	0008,0102 Requested Procedure Coding Scheme Designator	MSH-4 Sending Facility
Patient name	0010,0010 Patient Name	PID-5 Patient Name
Primary patient ID	0010,0020 Patient ID	PID-4 Alt Patient ID
Patient’s date of birth	0010,0030 Patient Date of Birth	PID-7 Date of Birth
Patient’s sex	0010,0040 Patient Sex	PID-8 Sex
Body part imaged	0018,0015 Body Part Examined	. . .
Study instance UID	0020,000D Study Instance UID	. . .
Order status	0032,000a Study Status ID	ZRE-1 Rad Exam Status
Examination priority	0032,000c Study Priority ID	OBR-27 Quantity/Timing

(continued on next page)

List of the DoD's Common HIS, RIS, and PACS Database Elements *(continued from previous page)*

Common Name*	DICOM Element	HL7 Sequence
Clinical reason for examination	0032,1030 Reason for Study	OBR-13 Relevant Clinical Information
Requesting physician's name	0032,1032 Requesting Physician	OBR-16 Ordering Provider
Requesting location	0032,1033 Requesting Ward/Clinic	ORC-13 Enterer's Location
Requested procedure—name	0032,1060 Requested Procedure	. . .
Requested procedure—code	0032,1064 Requested Procedure	. . .
Procedure description	0040,000a Sched Procedure Step desc	OBR-4 Universal Service ID
Procedure requested date and time	0040,0002 Sched Procedure Step Start Date/Start Time	OBR-7 Observation Date/Time
Procedure ID	0040,0009 Sched Procedure Step ID	OBR-4 Universal Service ID
Requested imaging location	0040,1005 Requested Procedure ID	OBR-24 Diag Service Section ID
DMIS/order ID	. . .	. . .
HIS order number	0040,2006 Plac Ord Num ISR	OBR-2 Placer Order Number
Requesting location	0040,2009 Order Enterers Location	ORC-13 Enterer's Location
Requesting provider's UID	. . .	OBR-16 Ordering Provider
Requested facility ID	0040,0010 Scheduled Station Name	OBR-24 Diag Service Section ID
Report status	4008,0212 Interpretation Status ID	OBR-25 Result Status
Report text	4008,010B Interpretation Text	OBX-5 Observation Value
Interpreting radiologist	4008,0102 Interpretation Recorder	OBR-33 Assistant Result Interpreter
Supervising radiologist	. . .	OBR-32 Principal Result Interpreter
Verifying radiologist	4008,0114 Physicians Approving Interpretation	ZRR-5 Verifying Radiologist
Verifying radiologist's facility	. . .	ZRR-6 Verifying Radiologist Division
Verifying supervisor	4008,0114 Physicians Approving Interpretation	ZRR-7 Supervising Radiologist
Verifying supervisor's facility	. . .	ZRR-8 Supervising Radiologist Division
Date of verification	4008,0112 Interpretation Approval Date	OBR-22 Results Rpt/Status Chng Date/Time
Time of verification	4008,0113 Interpretation Approval Time	OBR-22 Results Rpt/Status Chng Date/Time
CPT procedure name	. . .	ZL1-3 CPT Code
CPT procedure code	. . .	ZL1-3 CPT Code
Facility coding scheme ID	Private	PID-3 Patient ID (Internal ID)
Encounter ID	Private	PID-18 Patient Account Number
Provider facility coding scheme	Private	ORC-13 Enterer's Location
Division name	Private	ORC-13 Enterer's Location
Division ID	Private	ORC-13 Enterer's Location
Reason for sending image(s)	Private	. . .
Examination status	. . .	ZRE-1 Rad Exam Status
Performing technologist	. . .	OBR-34 Technician

*CPT = Current Procedural Terminology, DMIS = Defense Medical Information Systems, ID = identification, UID = unique identification.