# Interfacing the Radiology Information System to the Modality: An Integrated Approach

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**The radiology information system (RIS) provides patient and examination information that is used in setting up and performing a radiologic procedure. In a digital imaging environment, information from the RIS can also be used to populate fields in the Digital Imaging and Communications in Medicine (DICOM) image header. Ideally, information from the RIS should be available at the modality at the time of the examination, and automatically be attached to the image in the appropriate DICOM fields before storage in the picture archiving and communications system (PACS). We have designed a highly integrated RIS interface for a digital radiography (DR) system. This interface employs browser technology to make RIS information conveniently available at the modality, and DICOM modality performed procedure step (MPPS) for RIS/DR information exchange. A novel feature of our approach is that a single display screen at the modality is used to alternatively display either the modality control window or the RIS window. Full access to RIS capabilities is available at the modality, including worklists and prior reports.**


THE REASON FOR INTEGRATING the radiology information system (RIS) with the modality is to provide patient and examination information at the modality, and to return information about the examination to the RIS. Our objective was to design such a RIS/modality interface in a manner that would minimize the workload of the technologist, be platform-independent for use in a multivendor environment, and conform to the Digital Imaging and Communications in Medicine (DICOM) standard.[1]

Our approach was to access the RIS from the modality using standard web-browser software. This eliminates the need for vendor-specific "modality worklist" software at the modality. It also provides for full access to all the RIS features from the modality.

Once a patient is selected from the RIS worklist, patient and examination information is downloaded to the modality. The browser window can then be minimized, or hidden, and the modality control window displayed at the modality workstation. Once the examination is complete, information about the examination (such as its completion status) is returned to the RIS. The RIS window can then be displayed again, in preparation for the next patient.

## MATERIALS AND METHODS

The modality used in our study was the Canon CXDI-11 DR system (Canon Medical Systems, Irvine, CA). This system uses an amorphous silicon detector[2] interfaced to a computer running the Windows NT operating system. We installed Microsoft (Redmond, WA) Internet Explorer on this computer as the browser. The RIS used was IDXrad (IDX Systems Corp, Burlington, VT) with the complementary imaging suite. The DICOM software used at the modality was supplied by Trilix Information Systems (Newark, CA). These systems were installed on an Ethernet network in the Department of Radiology at the Cleveland Clinic Foundation.

## RESULTS

We identified nine items of information that we believe should be displayed to the technologist at the modality: (1) patient name, (2) patient date of birth, (3) patient age, (4) patient sex, (5) medical record number, (6) accession number, (7) examination description, (8) referring physician name, and (9) referring physician phone number. All of this information was available from the RIS browser interface. Once a patient was selected from this browser for examination, a sequence of DICOM messages ensued, as shown in Fig 1. A novel feature of this design is that the three modality performed procedure step (MPPS) service object pair (SOP) classes are used to achieve the functionality that typically would require use of both DICOM modality worklist and MPPS SOP classes.

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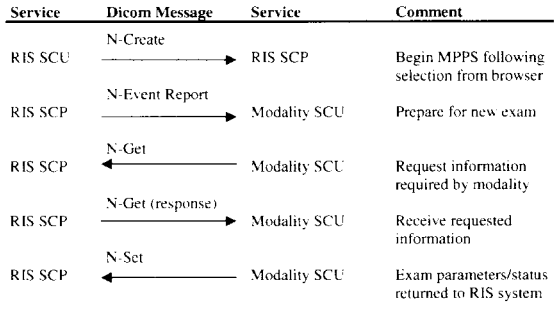


**Fig 1. Summary of DICOM message exchange. (Routine DICOM response messages have been omitted for clarity.)**

This is achieved through the creation of three DICOM application entities: a RIS service class user (SCU), a RIS service class provider (SCP), and a modality SCU. First, an N-Create message is passed from the RIS SCU to the RIS SCP. Next an N-Event report message is sent from the RIS SCP to the modality SCU. The modality SCU responds with an N-Get message requesting the information items required from the RIS SCP. This information is supplied by the N-Get response. Information about the examination, such as "exam complete," is passed back to the RIS SCP using the N-Set message.

A complete examination can routinely be performed with no keyboard interaction required by the technologist. A patient is selected from the RIS worklist using a "mouse" pointing device. The control panel for the modality is operated with "touch screen" selection. In the future, we believe it may be preferable to select from the RIS worklist using a touch screen design as well, thus eliminating the need for a mouse pointing device at the modality.

## DISCUSSION

As we move forward with the "electronic transformation of radiology"[3,4] it is increasingly important that correct and timely information from the RIS be available at the modality, and that information from the modality be made available to the RIS.

In the typical implementation of DICOM modality worklist management, the modality requests worklist information from the RIS. This subset of information from the RIS is displayed at the modality. The modality vendor supplies and supports the modality worklist software. The worklist user interface may vary greatly from vendor to vendor and modality to modality.

In the approach described here, the modality is not limited to the display of a subset of the information in the RIS, but rather has full access to all capabilities of the RIS. Both current and prior examination information is available, for example, and information can be directly added or updated in the RIS from the modality. A further advantage of this approach is that the same browser interface could potentially be used across multiple vendors and modalities, thus reducing operator training requirements.

In this implementation, all RIS/modality communication is achieved using DICOM MPPS. Even though a browser-based RIS worklist was not anticipated by the DICOM standard, it is a tribute to the flexibility of the standard that such an interface can be supported.

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