ASTRO

Integrating the Healthcare Enterprise

IHE-Radiation Oncology Technical Framework Volume 1 – Integration Profiles

Supplement Proposal for Advanced RT Objects Interoperability (re-planning and plan management)

Draft for Trial Implementation

June 3, 2010

Comments may be submitted to:

http://forums.rsna.org under the "*IHE*" forum

Select the "*Radiation Oncology Technical Framework*" sub-forum.

Contents

1 Foreword 3
1.1 Content of the IHE-RO Technical Framework 4
1.1.1 Volume 1 – Integration Profiles 4
1.1.2 Volume 2 – Transactions 4
2 Preface to Volume 1 5
2.1 Intended Audience 5
2.2 How this Volume is Organized 5
2.3 Conventions Used in this Document 5
2.3.1 Technical Framework Cross-references 5
2.3.2 IHE Actor and Transaction Diagrams and Tables 6
2.3.3 Process Flow Diagrams 6
2.4 Copyright Permissions 7
2.5 Comments 7
3 Introduction 8
3.1 Relationship to Standards 8
3.2 Relationship to Product Implementations 9
3.3 Framework Development and Maintenance 9
3.4 Integration Profiles Overview 10
3.5 Radiation Oncology Integration Profiles 11
3.5.1 Overview 11
3.5.2 Scope of Future Work 13
3.6 Product Implementations 13
4 Advanced RT Objects Interoperability Profile 14
4.1 Scope and Purpose 14
Appendix A Actors 15
A.1 Actor Descriptions 15
A.2 RT Specific Actors 15
Appendix B Transactions 22
B.1 Transaction Descriptions 22
Appendix C Glossary 26

1 Foreword

In this supplement, sections 1 through 3 are boilerplate taken from the Technical Framework, and are intended to provide sufficient background to the reader. Sections 4 and greater are intended to be added to the Technical Framework with numbering appropriate to the Technical Framework at the time they are added.

Integrating the Healthcare Enterprise (IHE) is an initiative designed to stimulate the integration of the information systems that support modern healthcare institutions. Its fundamental objective is to ensure that in the care of patients all required information for medical decisions is both correct and available to healthcare professionals. The IHE initiative is both a process and a forum for encouraging integration efforts. It defines a technical framework for the implementation of established messaging standards to achieve specific clinical goals. It includes a rigorous testing process for the implementation of this framework. And it organizes educational sessions and exhibits at major meetings of medical professionals to demonstrate the benefits of this framework and encourage its adoption by industry and users.

The approach employed in the IHE initiative is not to define new integration standards, but rather to support the use of existing standards, HL7, DICOM, IETF, and others, as appropriate in their respective domains in an integrated manner, defining configuration choices when necessary. When clarifications or extensions to existing standards are necessary, IHE refers recommendations to the relevant standards bodies.

This initiative has numerous sponsors and supporting organizations in different medical specialty domains and geographical regions. In North America the primary sponsors are the American College of Cardiology (ACC), the Healthcare Information and Management Systems Society (HIMSS) and the Radiological Society of North America (RSNA). IHE Canada has also been formed. IHE Europe (IHE-EUR) is supported by a large coalition of organizations including the European Association of Radiology (EAR) and European Congress of Radiologists (ECR), the Coordination Committee of the Radiological and Electromedical Industries (COCIR), Deutsche Röntgengesellschaft (DRG), the EuroPACS Association, Groupement pour la Modernisation du Système d'Information Hospitalier (GMSIH), Société Francaise de Radiologie (SFR), and Società Italiana di Radiologia Medica (SIRM). In Japan IHE-J is sponsored by the Ministry of Economy, Trade, and Industry (METI); the Ministry of Health, Labor, and Welfare; and MEDIS-DC; cooperating organizations include the Japan Industries Association of Radiological Systems (JIRA), the Japan Association of Healthcare Information Systems Industry (JAHIS), Japan Radiological Society (JRS), Japan Society of Radiological Technology (JSRT), and the Japan Association of Medical Informatics (JAMI). Other organizations representing healthcare professionals are actively involved and others are invited to join in the expansion of the IHE process across disciplinary and geographic boundaries.

The IHE Technical Frameworks for the various domains (Patient Care Coordination, IT Infrastructure, Cardiology, Laboratory, Radiation Oncology, Radiology, etc.) define specific

implementations of established standards to achieve integration goals that promote appropriate sharing of medical information to support optimal patient care. These are expanded annually, after a period of public review, and maintained regularly through the identification and correction of errata. The current version for these Technical Frameworks may be found at www.ihe.net.

The IHE Technical Framework identifies a subset of the functional components of the healthcare enterprise, called IHE Actors, and specifies their interactions in terms of a set of coordinated, standards-based transactions. It describes this body of transactions in progressively greater depth. The volume I provides a high-level view of IHE functionality, showing the transactions organized into functional units called Integration Profiles that highlight their capacity to address specific clinical needs. The subsequent volumes provide detailed technical descriptions of each IHE transaction.

1.1 Content of the IHE-RO Technical Framework

This profile defines the relevant standards and constraints on those standards in order to implement a specific use case for the transfer of information between systems. This document is organized into 2 volumes as follows:

1.1.1 Volume 1 – Integration Profiles

This volume is provided as a high level overview of the profiles including descriptions of the use cases, the actors involved, the process flow, and dependencies on other standards and IHE profiles. It is of interest to care providers, vendors' management and technical architects and to all users of the profile

1.1.2 Volume 2 – Transactions

This volume is intended as a technical reference for the implementation of specific transactions in the use case including references to the relevant standards, constraints, and interaction diagrams. It is intended for the technical implementers of the profile.

2 Preface to Volume 1

2.1 Intended Audience

The intended audience of this document is:

Healthcare professionals involved in informatics

IT departments of healthcare institutions

Technical staff of vendors participating in the IHE initiative

Experts involved in standards development

Those interested in integrating healthcare information systems and workflows

2.2 How this Volume is Organized

Section 2 describes the general nature, purpose and function of the Technical Framework.

Section 3 and the subsequent sections of this volume provide detailed documentation on each integration profile, including the clinical problem it is intended to address and the IHE actors and transactions it comprises.

The appendices following the main body of the document provide a summary list of the actors and transactions, detailed discussion of specific issues related to the integration profiles and a glossary of terms and acronyms used.

2.3 Conventions Used in this Document

This document has adopted the following conventions for representing the framework concepts and specifying how the standards upon which the IHE Technical Framework is based should be applied.

2.3.1 Technical Framework Cross-references

When references are made to another section within a Technical Framework volume, a section number is used by itself. When references are made to other volumes or to a Technical Framework in another domain, the following format is used:

<domain designator> TF-<volume number>: <section number>

where:

<domain designator> is a short designator for the IHE domain (PCC= Patient Care Coordination, ITI = IT Infrastructure, RAD = Radiology, RO = Radiation Oncology)

<volume number> is the applicable volume within the given Domain Technical Framework (e.g., 1, 2, 3), and

<section number> is the applicable section number.

For example: RO TF-1: 3.1 refers to Section 3.1 in volume 1 of the IHE Radiation Oncology Technical Framework, ITI TF-2: 4.33 refers to Section 4.33 in volume 2 of the IHE IT Infrastructure Technical Framework.

2.3.2 IHE Actor and Transaction Diagrams and Tables

Each integration profile is a representation of a real-world capability that is supported by a set of actors that interact through transactions. Actors are information systems or components of information systems that produce, manage, or act on categories of information required by operational activities in the enterprise. Transactions are interactions between actors that communicate the required information through standards-based messages.

The diagrams and tables of actors and transactions in subsequent sections indicate which transactions each actor in a given profile must support.

The transactions shown on the diagrams are identified both by their name and the transaction number as defined in RO TF-2 (Volume 2 of the RO Technical framework). The transaction numbers are shown on the diagrams as bracketed numbers prefixed with the specific Technical Framework domain.

In some cases, a profile is dependent on a prerequisite profile in order to function properly and be useful. These dependencies, if any would be found by locating the desired profile in Table 2.6-1 to determine which profile(s) are listed as prerequisites. An actor must implement all required transactions in the prerequisite profiles in addition to those in the desired profile.

2.3.3 Process Flow Diagrams

The descriptions of integration profiles that follow include process flow diagrams that illustrate how the profile functions as a sequence of transactions between relevant actors.

These diagrams are intended to provide an overview so the transactions can be seen in the context of an institution's or cross-institutions' workflow. Certain transactions and activities not defined in detail by IHE are shown in these diagrams in *italics* to provide additional context on where the relevant IHE transactions fit into the broader scheme of healthcare information systems.

These diagrams are not intended to present the only possible scenario. Often other actor groupings are possible, and transactions from other profiles may be interspersed.

In some cases the sequence of transactions may be flexible. Where this is the case there will generally be a note pointing out the possibility of variations. Transactions are shown as arrows oriented according to the flow of the primary information handled by the transaction and not necessarily the initiator.

2.4 Copyright Permissions

2.5 Comments

IHE Sponsors welcome comments on this document and the IHE initiative. They should be directed to the discussion server at http://forums.rsna.org or to:

Director of Research
American Society for Therapeutic Radiology and Oncology (ASTRO)
8280 Willow Oaks Corporate Drive, Suite 500
Fairfax, VA 22031
ihero@astro.org

3 Introduction

This document, the IHE Radiation Oncology Technical Framework (RO TF), defines specific implementations of established standards. These are intended to achieve integration goals that promote appropriate exchange of medical information to coordinate the optimal patient care among care providers in different care settings. It is expanded annually, after a period of public review, and maintained regularly through the identification and correction of errata. The latest version of the document is always available via the Internet at http://www.ihe.net/Technical_Framework/ , where the technical framework volumes specific to the various healthcare domains addressed by IHE may be found.

The IHE Radiation Oncology Technical Framework identifies a subset of the functional components of the healthcare enterprises and health information networks, called IHE actors, and specifies their interactions in terms of a set of coordinated, standards-based transactions.

The other domains within the IHE initiative also produce Technical Frameworks within their respective areas that together form the IHE Technical Framework. Currently, the following IHE Technical Framework(s) are available:

IHE IT Infrastructure Technical Framework

IHE Cardiology Technical Framework

IHE Eye Care

IHE Laboratory Technical framework

IHE Radiology Technical Framework

IHE Patient Care Coordination Technical Framework

Where applicable, references are made to other technical frameworks. For the conventions on referencing other frameworks, see the preface of this volume.

3.1 Relationship to Standards

The IHE Technical Framework identifies functional components of a distributed healthcare environment (referred to as IHE actors), solely from the point of view of their interactions in the healthcare enterprise. At its current level of development, it defines a coordinated set of transactions based on standards (such as HL7, IETF, ASTM, DICOM, ISO, OASIS, etc.) in order to accomplish a particular use case. As the scope of the IHE initiative expands, transactions based on other standards may be included as required.

In some cases, IHE recommends selection of specific options supported by these standards. However, IHE does not introduce technical choices that contradict conformance to these standards. If errors in or extensions to existing standards are identified, IHE's policy is to report them to the appropriate standards bodies for resolution within their conformance and standards evolution strategy.

IHE is therefore an implementation framework, not a standard. Conformance claims for products must still be made in direct reference to specific standards. In addition, vendors who have implemented IHE integration capabilities in their products may publish IHE Integration Statements to communicate their products' capabilities. Vendors publishing IHE Integration Statements accept full responsibility for their content. By comparing the IHE Integration Statements from different products, a user familiar with the IHE concepts of actors and integration profiles can determine the level of integration between them. See http://www.ihe.net/Resources/upload/ihe_integration_statements.pdf for the format of IHE Integration Statements.

3.2 Relationship to Product Implementations

The IHE actors and transactions described in the IHE Technical Framework are abstractions of the real-world healthcare information system environment. While some of the transactions are traditionally performed by specific product categories (e.g. HIS, Clinical Data Repository, Electronic Health record systems, Radiology Information Systems, Clinical Information Systems or Cardiology Information Systems), the IHE Technical Framework intentionally avoids associating functions or actors with such product categories. For each actor, the IHE Technical Framework defines only those functions associated with integrating information systems. The IHE definition of an actor should therefore not be taken as the complete definition of any product that might implement it, nor should the framework itself be taken to comprehensively describe the architecture of a healthcare information system.

The reason for defining actors and transactions is to provide a basis for defining the interactions among functional components of the healthcare information system environment. In situations where a single physical product implements multiple functions, only the interfaces between the product and external functions in the environment are considered to be significant by the IHE initiative. Therefore, the IHE initiative takes no position as to the relative merits of an integrated environment based on a single, all-encompassing information system versus one based on multiple systems that together achieve the same end.

3.3 Framework Development and Maintenance

The IHE Radiation Oncology Technical Framework is continuously maintained and expanded on an annual basis by the IHE Radiation Oncology Technical Committee. The development and maintenance process of the Framework follows a number of principles to ensure stability of the specification so that both vendors and users may use it reliably in specifying, developing and acquiring systems with IHE integration capabilities.

The first of these principles is that any extensions or clarifications to the Technical Framework must maintain backward compatibility with previous versions of the framework (except in rare cases for corrections) in order to maintain interoperability with systems that have implemented IHE Actors and Integration Profiles defined there.

The IHE Radiation Oncology Technical Framework is developed and re-published annually following a three-step process:

The Radiation Oncology Technical Committee develops supplements to the current stable version of the Technical Framework to support new functionality identified by the IHE Strategic and RO Planning Committees and issues them for public comment.

The Committee addresses all comments received during the public comment period and publishes an updated version of the Technical Framework for "Trial Implementation." This version contains both the stable body of the Technical Framework from the preceding cycle and the newly developed supplements. It is this version of the Technical Framework that is used by vendors in developing trial implementation software for the IHE Connectathons.

The Committee regularly considers change proposals to the Trial Implementation version of the Technical Framework, including those from implementers who participate in the Connectathon. After resolution of all change proposals received within 60 days of the Connectathon, the Technical Framework version is published as "Final Text".

The Committee as part of the Technical framework maintenance will consider change proposals received after the publication to the "Final Text".

3.4 Integration Profiles Overview

In this document, each IHE Integration Profile is defined by:

The IHE actors involved

The specific set of IHE transactions exchanged by each IHE actor.

These requirements are presented in the form of a table of transactions required for each actor supporting the Integration Profile. Actors supporting multiple Integration Profiles are required to support all the required transactions of each Integration Profile supported. When an Integration Profile depends upon another Integration Profile, the transactions required for the dependent Integration Profile have not been included in the table.

Note that IHE Integration Profiles are not statements of conformance to standards, and IHE is not a certifying body. Users should continue to request that vendors provide statements of their conformance to standards issued by relevant standards bodies, such as HL7 and DICOM. Standards conformance is a prerequisite for vendors adopting IHE Integration Profiles.

Also note that there are critical requirements for any successful integration project that IHE cannot address. Successfully integrating systems still requires a project plan that minimizes disruptions and describes fail-safe strategies, specific and mutually understood performance expectations, well-defined user interface requirements, clearly identified systems limitations, detailed cost objectives, plans for maintenance and support, etc.

3.5 Radiation Oncology Integration Profiles

3.5.1 Overview

IHE Integration Profiles offer a common language that healthcare professionals and vendors can use to discuss integration needs of healthcare enterprises and the integration capabilities of information systems in precise terms. Integration Profiles specify implementations of standards that are designed to meet identified clinical needs. They enable users and vendors to state which IHE capabilities they require or provide, by reference to the detailed specifications of the IHE Radiation Oncology Technical Framework.

Integration profiles are defined in terms of IHE Actors, transactions and their content. Actors (listed in RO TF-1: Appendix A) are information systems or components of information systems that produce, manage, or act on information associated with clinical and operational activities. Transactions (listed in RO TF-1: Appendix B) are interactions between actors that communicate the required information through standards-based messages.

Vendor products support an Integration Profile by implementing the appropriate actor(s) and transactions. A given product may implement more than one actor and more than one integration profile as in example below.

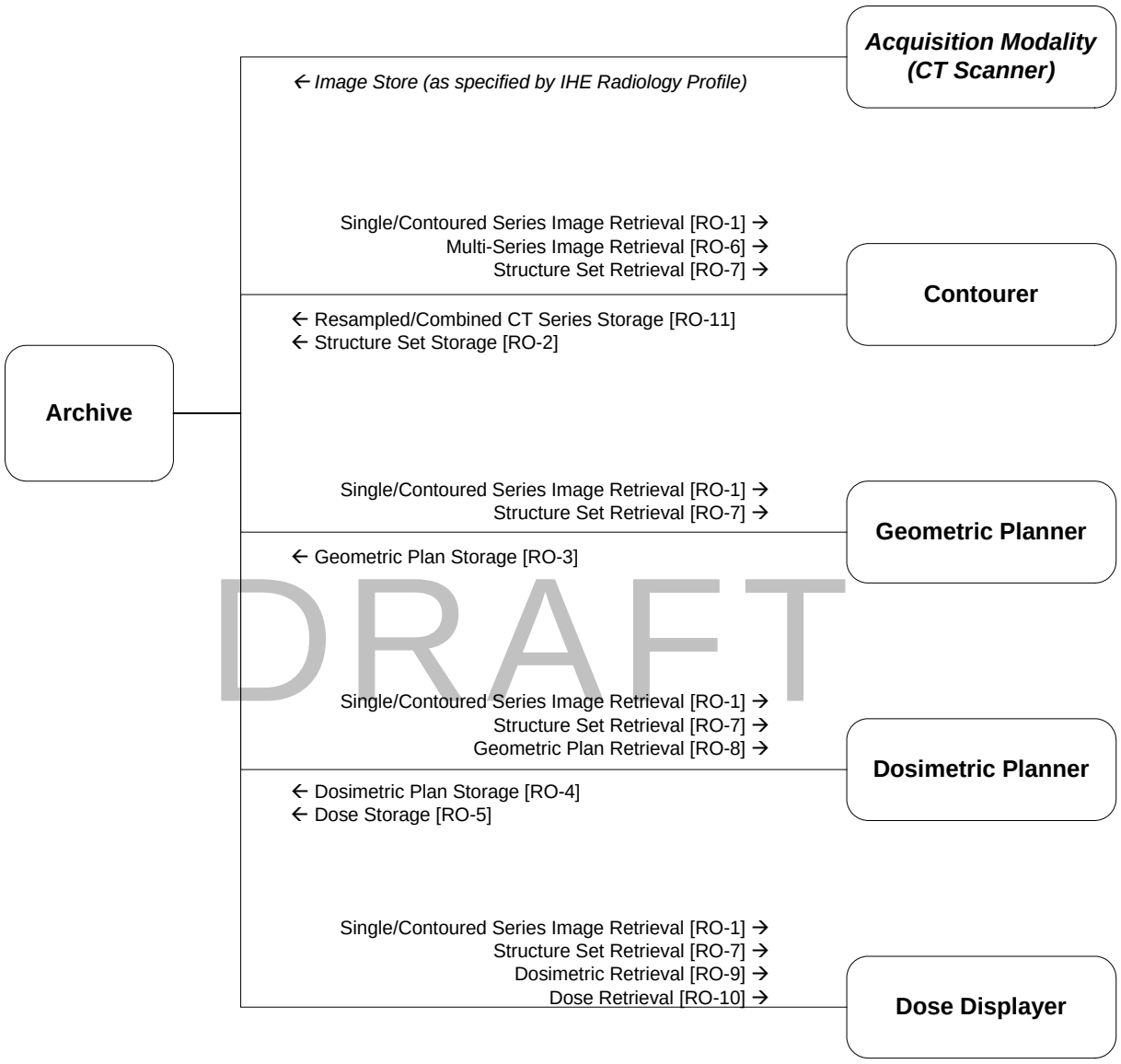

Figure 3.5-1 IHE Radiation Oncology Integration Profiles

To support a dependent profile, an actor must implement all required transactions in the prerequisite profiles in addition to those in the dependent profile. In some cases, the prerequisite is that the actor selects any one of a given set of profiles.

The following profiles are documented in this supplement (to be added to the Technical Framework):

- **Advanced RT Objects Interoperability Profile:** This integration profile involves the exchange of RT Plan information between treatment planning systems and between treatment planning systems and treatment management systems. The emphasis for this profile is on reducing ambiguity involved in re-planning and incorporation of the planning information in to the treatment management system in anticipation of transfer to a treatment delivery system.

3.5.2 Scope of Future Work

- Add pairs of Producer/Consumer actors and Storage/Retrieval transactions for beam techniques (see C.1) not yet addressed, e.g. Ion Beams, Brachy, Cobalt, and radiation therapy modalities whose Standardized representation is under development by DICOM Working Group 7. Future retrieve transactions will necessarily be optional for the Treatment Management System (TMS) actor (see below).

3.6 Product Implementations

Developers have a number of options in implementing IHE actors and transactions in product implementations. The decisions cover three classes of optionality:

For a system, select which actors it will incorporate (multiple actors per system are acceptable).

For each actor, select the integration profiles in which it will participate.

For each actor and profile, select which options will be implemented.

All required transactions must be implemented for the profile to be supported.

Implementers should provide a statement describing which IHE actors, IHE integration profiles and options are incorporated in a given product. The recommended form for such a statement is defined at http://www.ihe.net/Resources/upload/ihe_integration_statements.pdf .

In general, a product implementation may incorporate any single actor or combination of actors. When two or more actors are grouped together, internal communication between actors is assumed to be sufficient to allow the necessary information flow to support their functionality. The exact mechanisms of such internal communication are outside the scope of the IHE Technical Framework.

When multiple actors are grouped in a single product implementation, all transactions originating or terminating with each of the supported actors shall be supported (i.e., the IHE transactions shall be offered on an external product interface).

4 Advanced RT Objects Interoperability Profile

4.1 Scope and Purpose

This integration profile involves the exchange of RT Plan information between treatment planning systems and between treatment planning systems and treatment management systems. The emphasis for this profile is on reducing ambiguity involved in re-planning and incorporation of the planning information in to the treatment management system in anticipation of transfer to a treatment delivery system. The transactions revolved around content rather than workflow.

This profile addresses a broad variety of "Beam Techniques" that exist in Radiation Therapy. Rather than define actors that had broad involvement in many optional transactions, a large number of actors were defined that had specific mandatory/required transactions and a small number of optional transactions that related to beam modifiers. The actors are either producers or consumers of a DICOM RT Plan.

It is expected that the actual products commonly referred to as Treatment Planning Systems will implement one or more of the actors, and that the choice of which actors are implemented (for which adherence is claimed) will depend on the intended functionality (which is not defined by IHE-RO). A Treatment Planning System that is intended to be able to perform re-planning based on the output of another Treatment Planning System would be expected to adhere to one or more of the "consumer" actors.

It is expected that the actual products variously referred to as Oncology Information Systems, Oncology Information Management, or Electronic Medical Record for Oncology will implement the Treatment Management System (TMS) actor. While the profile does not dictate the functionality of the TMS, the TMS is responsible for providing an adequate view of the information provided to it (as a Beam Consumer) that in normal operating practice the appropriate user can ensure that the planning information has been properly consumed, associated with the correct patient, etc. No transactions have been defined between the TMS actor in this profile and the TMS actor in the "Integrated Positioning and Delivery" profile, and any necessary interface is considered private (in the same way that an Image Manager and an Image Archive are related in the Radiology Domain Scheduled Workflow profile). In practice, it is expected that once a TMS has consumed the information provided it by a Beam Producer, the system incorporating the TMS actor will be able to then act as the TMS in the Integrated Positioning and Delivery profile and provide that information to a Treatment Delivery System actor in that profile. It is not expected that the TMS actor for this profile from one vendor will interoperate with the TMS actor for the Integrated Positioning and Delivery profile from another vendor. As indicated in the table identifying actors and transactions, the TMS actor must be able to act as the consumer in all retrieve transactions, i.e. consume all Beam Techniques.

It should also be noted that the Appendix in this Supplement's Volume 2 specifies content that is mandatory across all transactions.

Appendix A: Actors

A.1 Actor Descriptions

<No additions>

A.2 RT Specific Actors

<for reference purposes, no changes implied>
Archive (including RT) – A system that stores the RT SOP Classes in addition to the CT images and is capable of transmitting them.

Treatment Delivery Device (TDD) – A system that delivers therapeutic radiation to a correctly positioned patient. The TDD fulfils the role of a UPS-Pull 'Pull Performer' SCU as described in DICOM Supplement 96 Part 17 Table Z.1-1.

<additional text>

Treatment Management System (TMS) – An information system that manages oncology information and is responsible for the scheduling of radiotherapy activities (i.e. is a workflow manager). The TMS fulfils the role of a UPS-Pull 'Worklist Manager' SCP as described in DICOM Supplement 96 Part 17 Table Z.1-1. Note that a specific product implementation could potentially fulfill the role of both a TMS and an Archive, in which case the supplied AE Title in Input and Output Sequences may be an AE Title managed by that implementation. Also, an information system that consumes RT Plan information in the "Advanced RT Objects Interoperability" profile.

The following table is to be added to the Appendix, and it shows which transactions are required to be supported by the actors in the **Advanced RT Objects Interoperability profile.**

Table A.2-5 Advanced RT Objects 1

Actors	Transactions	Optionality	Section in Vol. 2
Archive	Basic Static Beam Storage	R	RO-ARTI-01
	Motorized Wedge Beam Storage	R	RO-ARTI-03
	Hard Wedge Beam Storage	R	RO-ARTI-05
	Virtual Wedge Beam Storage	R	RO-ARTI-07
	Arc Beam Storage	R	RO-ARTI-09
	Conformal Arc Beam Storage	R	RO-ARTI-11
	Step & Shoot Beam Storage	R	RO-ARTI-13
	Sliding Window Beam Storage	R	RO-ARTI-15
	Static Electron Beam Storage	R	RO-ARTI-17
	Stereotactic Beam Storage	R	RO-ARTI-19
	IMAT/VMAT Beam Storage	R	RO-ARTI-21
	Bolus Beam Modifier Storage	R	RO-ARTI-23
	Block Beam Modifier Storage	R	RO-ARTI-25
	Compensator Beam Modifier Storage	R	RO-ARTI-27
	Hard Wedge Beam Modifier Storage	R	RO-ARTI-29
	Basic Static Beam Retrieval	R	RO-ARTI-02
	Motorized Wedge Beam Retrieval	R	RO-ARTI-04
	Hard Wedge Beam Retrieval	R	RO-ARTI-06
	Virtual Wedge Beam Retrieval	R	RO-ARTI-08
	Arc Beam Retrieval	R	RO-ARTI-10
	Conformal Arc Beam Retrieval	R	RO-ARTI-12

Actors	Transactions	Optionality	Section in Vol. 2
	Step & Shoot Beam Retrieval	R	RO-ARTI-14
	Sliding Window Beam Retrieval	R	RO-ARTI-16
	Static Electron Beam Retrieval	R	RO-ARTI-18
	Stereotactic Beam Retrieval	R	RO-ARTI-20
	IMAT/VMAT Beam Retrieval	R	RO-ARTI-22
	Bolus Beam Modifier Retrieval	R	RO-ARTI-24
	Block Beam Modifier Retrieval	R	RO-ARTI-26
	Compensator Beam Modifier Retrieval	R	RO-ARTI-28
	Hard Wedge Beam Modifier Retrieval	R	RO-ARTI-30
	Stereotactic Arc Retrieval	R	RO-ARTI-32
	Basic Static MLC Beam Retrieval	R	RO-ARTI-34
	MLC Arc Beam Retrieval	R	RO-ARTI-36
Treatment Management System	Basic Static Beam Retrieval	R	RO-ARTI-02
	Motorized Wedge Beam Retrieval	R	RO-ARTI-04
	Hard Wedge Beam Retrieval	R	RO-ARTI-06
	Virtual Wedge Beam Retrieval	R	RO-ARTI-08
	Arc Beam Retrieval	R	RO-ARTI-10
	Conformal Arc Beam Retrieval	R	RO-ARTI-12
	Step & Shoot Beam Retrieval	R	RO-ARTI-14
	Sliding Window Beam Retrieval	R	RO-ARTI-16
	Static Electron Beam Retrieval	R	RO-ARTI-18
	Stereotactic Beam Retrieval	R	RO-ARTI-20
	IMAT/VMAT Beam Retrieval	R	RO-ARTI-22
	Bolus Beam Modifier Retrieval	R	RO-ARTI-24
	Block Beam Modifier Retrieval	R	RO-ARTI-26
	Compensator Beam Modifier Retrieval	R	RO-ARTI-28

Actors	Transactions	Optionality	Section in Vol. 2
	Hard Wedge Beam Modifier Retrieval	R	RO-ARTI-30
	Stereotactic Arc Retrieval	R	RO-ARTI-32
	Basic Static MLC Beam Retrieval	R	RO-ARTI-34
	MLC Arc Beam Retrieval	R	RO-ARTI-36
Basic Static Beam Producer	Basic Static Beam Storage	R	RO-ARTI-01
	Bolus Beam Modifier Storage	O	RO-ARTI-23
	Block Beam Modifier Storage	R	RO-ARTI-25
	Compensator Beam Modifier Storage	O	RO-ARTI-27
Basic Static Beam Consumer	Basic Static Beam Retrieval	R	RO-ARTI-02
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24
	Block Beam Modifier Retrieval	R	RO-ARTI-26
	Compensator Beam Modifier Retrieval	O	RO-ARTI-28
Motorized Wedge Beam Producer	Motorized Wedge Beam Storage	R	RO-ARTI-03
	Bolus Beam Modifier Storage	O	RO-ARTI-23
	Block Beam Modifier Storage	O	RO-ARTI-25
	Compensator Beam Modifier Storage	O	RO-ARTI-27
Motorized Wedge Beam Consumer	Motorized Wedge Beam Retrieval	R	RO-ARTI-04
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24
	Block Beam Modifier Retrieval	O	RO-ARTI-26
	Compensator Beam Modifier Retrieval	O	RO-ARTI-28
Hard Wedge Beam Producer	Hard Wedge Beam Storage	R	RO-ARTI-05
	Bolus Beam Modifier Storage	O	RO-ARTI-23
	Block Beam Modifier Storage	O	RO-ARTI-25
	Compensator Beam Modifier Storage	O	RO-ARTI-27

Actors	Transactions	Optionality	Section in Vol. 2
	Hard Wedge Beam Modifier Storage	R	RO-ARTI-29
Hard Wedge Beam Consumer	Hard Wedge Beam Retrieval	R	RO-ARTI-06
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24
	Block Beam Modifier Retrieval	O	RO-ARTI-26
	Compensator Beam Modifier Retrieval	O	RO-ARTI-28
	Hard Wedge Beam Modifier Retrieval	R	RO-ARTI-30
Virtual Wedge Beam Producer	Virtual Wedge Beam Storage	R	RO-ARTI-07
	Bolus Beam Modifier Storage	O	RO-ARTI-23
	Block Beam Modifier Storage	O	RO-ARTI-25
	Compensator Beam Modifier Storage	O	RO-ARTI-27
Virtual Wedge Beam Consumer	Virtual Wedge Beam Retrieval	R	RO-ARTI-08
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24
	Block Beam Modifier Retrieval	O	RO-ARTI-26
	Compensator Beam Modifier Retrieval	O	RO-ARTI-28
Arc Beam Producer	Arc Beam Storage	R	RO-ARTI-09
	Bolus Beam Modifier Storage	O	RO-ARTI-23
Arc Beam Consumer	Arc Beam Retrieval	R	RO-ARTI-10
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24
Conformal Arc Beam Producer	Conformal Arc Beam Storage	R	RO-ARTI-11
	Bolus Beam Modifier Storage	O	RO-ARTI-23
Conformal Arc Beam Consumer	Conformal Arc Beam Retrieval	R	RO-ARTI-12
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24
Step & Shoot Beam Producer	Step & Shoot Beam Storage	R	RO-ARTI-13
	Bolus Beam Modifier Storage	O	RO-ARTI-23
	Block Beam Modifier Storage	O	RO-ARTI-25
	Hard Wedge Beam Modifier Storage	O	RO-ARTI-29

Actors	Transactions	Optionality	Section in Vol. 2
Step & Shoot Beam Consumer	Step & Shoot Beam Retrieval	R	RO-ARTI-14
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24
	Block Beam Modifier Retrieval	O	RO-ARTI-26
	Hard Wedge Beam Modifier Retrieval	O	RO-ARTI-30
Sliding Window Beam Producer	Sliding Window Beam Storage	R	RO-ARTI-15
	Bolus Beam Modifier Storage	O	RO-ARTI-23
	Block Beam Modifier Storage	O	RO-ARTI-25
	Hard Wedge Beam Modifier Storage	O	RO-ARTI-29
Sliding Window Beam Consumer	Sliding Window Beam Retrieval	R	RO-ARTI-16
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24
	Block Beam Modifier Retrieval	O	RO-ARTI-26
	Hard Wedge Beam Modifier Retrieval	O	RO-ARTI-30
Static Electron Beam Producer	Static Electron Beam Storage	R	RO-ARTI-17
	Bolus Beam Modifier Storage	O	RO-ARTI-23
	Block Beam Modifier Storage	O	RO-ARTI-25
Static Electron Beam Consumer	Static Electron Beam Retrieval	R	RO-ARTI-18
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24
	Block Beam Modifier Retrieval	O	RO-ARTI-26
Stereotactic Beam Producer	Stereotactic Beam Storage	R	RO-ARTI-19
	Bolus Beam Modifier Storage	O	RO-ARTI-23
Stereotactic Beam Consumer	Stereotactic Beam Retrieval	R	RO-ARTI-20
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24
IMAT/VMAT Beam Producer	IMAT/VMAT Beam Storage	R	RO-ARTI-21
	Bolus Beam Modifier Storage	O	RO-ARTI-23
IMAT/VMAT Beam Consumer	IMAT/VMAT Beam Retrieval	R	RO-ARTI-22
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24

Actors	Transactions	Optionality	Section in Vol. 2
Stereotactic Arc Beam Producer	Stereotactic Arc Beam Storage	R	RO-ARTI-31
	Bolus Beam Modifier Storage	O	RO-ARTI-23
Stereotactic Arc Beam Consumer	Stereotactic Arc Beam Retrieval	R	RO-ARTI-32
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24
Basic Static MLC Beam Producer	Basic Static MLC Beam Storage	R	RO-ARTI-33
	Bolus Beam Modifier Storage	O	RO-ARTI-23
	Compensator Beam Modifier Storage	O	RO-ARTI-27
Basic Static MLC Beam Consumer	Basic Static MLC Beam Retrieval	R	RO-ARTI-34
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24
	Compensator Beam Modifier Retrieval	O	RO-ARTI-28
MLC Arc Beam Producer	MLC Arc Beam Storage	R	RO-ARTI-35
	Bolus Beam Modifier Storage	O	RO-ARTI-23
MLC Arc Beam Consumer	MLC Arc Beam Retrieval	R	RO-ARTI-36
	Bolus Beam Modifier Retrieval	O	RO-ARTI-24

Appendix B Transactions

B.1 Transaction Descriptions

Transactions are interactions between actors that transfer the required information through standards-based messages. The following are the transactions defined in this supplement and referenced throughout the rest of this document. <The transactions contain the identifier ARTI to avoid numbering clashes, however, when inserted in to the Technical Framework, the transactions will be renumbered to align with the Technical Framework at that time. The Transactions will be referred to by name rather than number throughout the document to avoid confusion>

RO-ARTI-01: Basic Static Beam Storage

RO-ARTI-02: Basic Static Beam Retrieval

RO-ARTI-03: Motorized Wedge Beam Storage

RO-ARTI-04: Motorized Wedge Beam Retrieval

RO-ARTI-05: Hard Wedge Beam Storage

RO-ARTI-06: Hard Wedge Beam Retrieval

RO-ARTI-07: Virtual Wedge Beam Storage

RO-ARTI-08: Virtual Wedge Beam Retrieval

RO-ARTI-09: Arc Beam Storage

RO-ARTI-10: Arc Beam Retrieval

RO-ARTI-11: Conformal Arc Beam Storage

RO-ARTI-12: Conformal Arc Beam Retrieval

RO-ARTI-13: Step & Shoot Beam Storage

RO-ARTI-14: Step & Shoot Beam Retrieval

RO-ARTI-15: Sliding Window Beam Storage

RO-ARTI-16: Sliding Window Beam Retrieval

RO-ARTI-17: Static Electron Beam Storage

RO-ARTI-18: Static Electron Beam Retrieval

RO-ARTI-19: Stereotactic Beam Storage

RO-ARTI-20: Stereotactic Beam Retrieval

RO-ARTI-21: IMAT/VMAT Beam Storage

RO-ARTI-22: IMAT/VMAT Beam Retrieval

RO-ARTI-23: Bolus Beam Modifier Storage

RO-ARTI-24: Bolus Beam Modifier Retrieval

RO-ARTI-25: Block Beam Modifier Storage

RO-ARTI-26: Block Beam Modifier Retrieval

RO-ARTI-27: Compensator Beam Modifier Storage

RO-ARTI-28: Compensator Beam Modifier Retrieval

RO-ARTI-29: Hard Wedge Beam Modifier Storage

RO-ARTI-30: Hard Wedge Beam Modifier Retrieval

RO-ARTI-31: Stereotactic Arc Storage

RO-ARTI-32: Stereotactic Arc Retrieval

RO-ARTI-33: Basic Static MLC Beam Storage

RO-ARTI-34: Basic Static MLC Beam Retrieval

RO-ARTI-35: MLC Arc Beam Storage

RO-ARTI-36: MLC Arc Beam Retrieval

The following table (Table B.1-1) shows which transactions are used in which Integration Profiles.

<This corresponding table in the IHE-RO TF is to be modified to include all of the transactions in this supplement which are all part of the Advanced RT Objects Interoperability profile, and these transactions are not used in any other profile. The profile defined in this supplement does not utilize any transactions other than the ones defined in this supplement>

Table B.1-1 IHE-RO Profile Transactions

Appendix C Glossary

C.1 Beam Technique: A term used to describe a clinically meaningful method of delivering tele-therapy, and to disambiguate different approaches to delivering a beam of radiation. Adjectives other than "technique" have been applied to the word Beam elsewhere (e.g. DICOM), so the word "technique" was chosen to avoid confusion.