IHE-RO Technical Committee
Face-to-Face
September 17-19, 2014 at 8:30-5:30 PM ET, 8:30-11:30 on Sep 20
Marriott Marquis, Room Foothill E, San Francisco

Technical Committee Chairs:
Bruce Curran, MS, ME
Chris Pauer, Accuray

IHERO Task Force Co-Chairs
Dick Fraass, Ph.D., FAAPM, FASTRO, FACR
John Buatti, MD

Mission Statement: *The American Society for Radiology Oncology (ASTRO) has formed a multi-society Task Force to undertake an initiative to promote the Integration of the Healthcare Enterprise (IHE) – Radiation Oncology (RO), fostering seamless connectivity and integration of radiotherapy equipment and the patient health information systems. The Task Force will include members from ASTRO, RSNA, American Association of Physicists in Medicine (AAPM), the American College of Radiology (ACR) and the Medical Imaging and Technology Alliance (MITA). In addition, members of the International community have also been invited to participate in IHE-RO. The IHE-RO Task Force, in close collaboration with radiotherapy product manufacturers, will develop appropriate integration profiles for radiation therapy and setup a demonstration of seamless communication among the full array of radiotherapy products.*

Attendees:

Name	Affiliation	Email	9/17/14	9/18/14	9/19/14	9/20/14
Bruce Curran	VA	bcurran@mcvh-vcu.edu	X	X	X	X
Chris Pauer	Accuray	cpauer@accuray.com	X	X	X	X
Jim Percy	Elekta	Jim.percy@elekta.com	X	X	X	X
Walter Bosch	Wash. Univ.	bosch@wustl.edu	X	X	X	X
Sven Siekmann	Brainlab	Sven.siekmann@brainlab.com	X	X	X	X
Christof Schadt	Brainlab	Christof.schadt@brainlab.com	X	X	X	X
Sam Brain	Stanford	samb@stanford.edu	X	X	X	
Rishabh Kapoor	VA	rkapoor@mcvh-vcu.edu	X			
Anant Gopal	Henry Ford	Agopal1@hfhs.org	X			
Bhawna Chandwani	Viewray	bchanwani@viewray.com	X			
Vikren Sarkar	Univ. of Utah	Vikren.sarkar@gmail.com	X			
Rickard Holmberg	RaySearch	Rickard.holmberg@raysearchlabs.com	X	X	X	X
Yvonne Li	SurDoc	Yvonne@surdocteam.com	X	X		
Uli Busch	Varian	Ulrich.busch@varian.com	X	X	X	X
Sanjay Bari	Elekta	Sanjay.bari@elekta.com		X	X	

Minutes:

I. Call to Order (9/17/14 at 9:00 am)
   a. Review Agenda
   b. Approval of minutes from Aug 2014 Teleconference – **approved without objection**
   c. Other broad topics to add

II. Business
   a. Topic 1: Level Set
      i. Updates on IHE-RO activities
         1. Planning, Oversight, Steering Committees – Chris presented an updated on IHE-RO committees
         2. ICT Contracts - Overview only, specific topics later – updated releases of Test Tools are available on ihe-ro.org
         3. Washington U. Update – Walter reported on WU support for IHE-RO testing. Test datasets for Fall Connectathon have been prepared for distribution as of 9/13/14.
      ii. ACTION 140901: Chris to discuss with other domains if and how they handle triage and helping with solutions on interoperability issues. Speed, red tape, contracting domains or modalities that are not well known or outside of usual contact circle are all concerns. (Nov 1, 2014)
      iii. ASTRO news – Bruce reported on ASTRO activities
         1. ASTRO meeting with FDA representative. Discussion regarding IHE progress in becoming an accredited testing laboratory (IEC 17025). FDA is interested in IHE testing as part of 510(k) process. Requires detailed procedures and capture of results.
         2. Realignment in FDA software group.
         3. ASTRO Multi-disciplinary QA Committee has taken on the task of developing a white paper on guidelines for standardized prescription of radiation therapy.
      iv. DICOM Update – Christof reported on WG-07 activities
         1. DICOM 2nd Gen RT objects specification has been split into five supplements
            a. Prescription and Segment Annotation (expect approval late 2015)
            b. C-arm treatment
            c. Non-C-arm radiations
            d. Dose, DVH, Dose Evaluation
            e. RT Course
      v. Machine Characterization – Jim Percy reported on activities of the group. The key use case has been identified. Work on groups of parameters has begun. Optional attributes and how they are to be represented (DICOM, XML, etc.) are open issues.
      vi. MITA Standards – The RT-2 standard includes specifications for consistent treatment planning display, patient setup graphical representation, and QA sign-off.
      vii. ROSSI (Radiation Oncology Safety Stakeholders Initiative) discussed several suggestions for enhancing safety in RO:
         1. Library of best practices for UI design. There are safety and product feature issues to be evaluated.
         2. Forum for collecting product safety issues and concerns. Issues of ownership, moderation, and user access were discussed.

   b. Topic 3.5: BRTO White Paper
      i. A proposal to extend the BRTO contourer to allow structure contours between image slice locations was discussed.
         1. RT Structure Set contours do not have well-defined thickness.

2. In the current BRTO profile the connectedness of contours is inferred from the set of axial positions. Contours must lie on image slice axial positions. If there are contours that are not on image slice locations, their connectedness would need to be represented using DICOM RT Structure Set Attached Contours Sequence.
3. DECISION: Consensus to revise BRTO to with new Transactions to Store and Retrieve high-res contours. ACTION 140915: Sven (assigned as editor) to draft CP. (Oct 2014 TC mtg)
4. Open question: how do we assure that low-resolution contour consumers can handle high-res contours safely?

c. Topic 11: Consistent Patient Identification across RO (CPRO) Development
   i. Two issues were discussed:
      1. Should we use the older, widely-available Modality Worklist or the newer, not yet well-implemented Unified Procedure Step?
      2. Should we include HL7 (for ADT) at this time?
   ii. Is there any way to coordinate management of appointment lists between HIS and TMS? Both HIS and TMS have the concept of a *series* of appointments, but HL7 does not; changes spanning multiple dates can be problematic.
   iii. ACTION 140902: Bruce to contact Kevin O'Donnell and Chris Lindop regarding (a) potential profiles for modality acquisition and (b) whether use of Query Modality requires Modality PS to be implemented. DONE. Continue using MWL, since it is established: no intention from other domains to replace it with UPS. UPS to be in non-acquisition Actors.

d. Topic 8.5: Prescription (RXRO) Profile
   i. The clinical impact statement for this profile has been approved. The Use Case should be reviewed with the PC. There may actually be multiple Use Cases involving, e.g., high-level physician intent and more fine-grained dose-volume constraints for planning.
   ii. The purpose is to exchange information on intent and dosimetric objects for planning, including phases, fractionation and imaging requirements.
   iii. Be clear about what the prescription will *not* do.
   iv. Discuss multi-phase prescriptions in one document and parent/child prescriptions.
   v. ACTION 140903: Chris to send request to Bridget Koontz to ask for resources to evaluate the Use Case, Bruce to solicit IHE-RO PC involvement. Goal is to have 5-6 individuals involved. DONE.
e. Topic 3:Restucturing Technical Framework
   i. Discussion on TF Appendix A (See Action 140513). No current progress – Restructuring workgroup needs to work with DICOM Content Profile group

[Adjourn for the day 5/17/14 at 5:20 pm]
[Start on 9/18/14 at 8:40 am]

f. Topic 9: QAPV
   i. DICOM Change Progress – Chris reviewed the current draft of CP1288, which defines the RT Quality Results IOD. Per WG-06, this IOD will require a Supplement, but such a supplement can be reviewed without extreme effort.
   ii. Discussion of use of Hanging Protocol Modules – The Selector Attribute Value Macro used for Hanging Protocols appears to be appropriate for referencing attributes in DICOM (RT Plan, etc.) instances.

iii. ACTION 140904: Chris to cast CP1288 as a supplement by 10/13/14.
iv. Review of Dose Check Parameters – incorporate changes from DICOM CP1138 (Average Beam Dose Parameters).
v. Discussion of dose specification point / average dose values used by QA applications. (To be revisited after TPPC discussion.) Potential questions to be addressed to QA vendors:
1. Are there QA applications that need to use the Beam Dose Specification Point attribute in conjunction with reading the structure set and then do not need supplied dose depth attributes?
2. Are there QA applications that need to have the explicit depth information listed in the plan information? In this case is it true that the Beam Dose Specification Point coordinates are not needed?
3. Are there devices that use a mixture of these approaches?
4. For those QA applications that are patient based, i.e., not phantom or device based, are there devices that use an entirely different approach?

g. Topic 4:TP-IC
i. Uli reviewed a draft of the TP-IC Integration Profile.
1. Profile scope: volumetric and radiographic images from treatment planning to be used as a reference for treatment.
2. Open issue: Annotation of structures on reference images could use RT Structure Set or DICOM Curve Module.
3. RT Image IOD Content review – details captured in profile draft.
a. Geometry: Frame of Reference must be present. Requires the treatment machine geometry (gantry angle, table positions, table rotations, etc.), Isocenter Position, Patient Position, Image Position (Patient), Image Orientation (Patient).
b. Require Bits Allocated (0028,0100) to be 16.
c. Open Issue: Require Bits Stored (0028,0101) to be 16.
d. Require Pixel Representation (0028,0103) to be 0000H (unsigned integer)
e. Require Pixel Intensity Relationship Sign (0028,1041)
f. Require RT Image Label (3002,0002). RT Image Description (3002,0004) is optional.
4. Discussion of Use Case for TPIC profile: It could include an Image Type of FLUENCE for exit dose as an *Option*. Consensus to keep this as an Open Issue.

[Lunch 9/18/14, 12:15-1:15pm]

5. It was suggested that a Producer may produce *any* Image Type (DRR, Portal Image, Radiographic Image, Fluence?) and that the Consumer must be able to consume *all* of these types. This optionality is an open question.
6. Clarification is needed regarding the plane in which the Image Position is specified. This is especially important (and problematic) for oblique/non-normal images.
7. RT Image SID shall have a value.
8. Referenced RT Plan Sequence shall be present.
9. Where RT Images are referenced was discussed: in Beam or Setup Sequence. It was suggested that the Referenced Beam Number be present if the image is

referenced by a specific Beam in the RT Plan and empty if image is referenced in Patient Setup Module of the RT Plan.

10. Discussion of Exposure Sequence: these attributes are not relevant for DRRs.

ii. Changes to TP-IC captured in draft v. 1.2 to be posted on ihe-ro.org wiki.

h. Topic 5:TD-PC

i. Uli reviewed a draft of the TD-PC Integration Profile.

1. Draft is structured as a DICOM Content Profile. It references attributes in the TP-PC Profile and specifies additional DICOM attribute requirements for treatment delivery.

i. Topic 14: Content Profile Template

i. Uli and Bruce reviewed an example of "Chapter 7" in Technical Framework Volume 3 for an IHE Content Profile Template. This example had been adapted from the structure used for Clinical Document Architecture (CDA) Content in Chapter 6. Section 7.3 organizes DICOM Content:

1. Level 3 - DICOM object types
2. Level 4 - Profile context
3. Level 5 - Module Tables, Module Details
4. Level 6 - Modules (in IOD)

ii. Other combinations of DICOM Composite/Normalized Objects, IODs, Modules, and IHE Profiles were discussed.

iii. Referencing DICOM standard updates was discussed briefly. This may not be needed. Some other IHE domains routinely update profiles to track changes in the standard.

[Adjourn for the day 9/18/14 at 5:20 pm]
[Start on 9/19/14 at 8:50 am]

j. Topic 6:TP-PC

i. Christof presented a draft (v. 1.2) of the TP-PC Profile that was derived from ARTI.

ii. High Dose Technique – no specific identifier is included in the profile. "If present, must be handled safely."

iii. Beam Dose Verification Control Point Sequence is R+:

1. Require that the Cumulative Meterset Weight values in this sequence shall encompass the range from 0.0 to the Final Cumulative Meterset Weight (300A,010E).
2. It was noted that QCP actors in the QAPV profile may require information (average beam dose point depth, equivalent depth, SSD, etc.) at more than two Control Points, e.g., for arc beams. The number of items in this sequence is not constrained in the profile.

iv. Discussion of what type of plans are to be supported by TPPC: (a) plans with mixed treatment modalities (beam types), (b) multi-isocenter plans, and (c) mixed treatment modalities with multiple isocenters.

1. ARTI does not currently support multi-modality plans. DICOM allows combinations of C-arm photon plans, but not with ion or brachy plans.
2. There is currently no restriction in ARTI on multi-isocenter plans, but not all such plans may be deliverable with some treatment machines. Some systems support one isocenter per prescription.
3. Manufacturers would need to specify combinations of Actors they support. However, there are many permutations not all of which are clinically relevant and there is no formal way to specify this in the IHE Integration Statement.
4. The following suggestions were discussed:

a. Continue testing using single-modality Actors and plans.
b. Add a statement indicating that no Actor combinations are required by this profile, but that the profile allows creation of plans that may exceed capabilities of delivery devices. It is the responsibility of users to create plans that can be safely delivered.

5. ACTION 140905: Bruce to draft language regarding multi-modality plans in TPPC before Oct 2014 TC meeting. DONE.
6. Dose tracking issues for multi-target and multi-isocenter plans were discussed. This remains an open issue.
7. ACTION 140906: Walter and Bruce to consult with clinicians regarding prescriptions and dose tracking for multi-prescription plans. (Forward to IHE-RO Clinical Advisory Subcommittee.) DONE.
8. ACTION 140907: Jim and Uli to draft a proposal to address multi-isocenter plans in TPPC for Oct 2014 TC meeting.

k. Topic 2: Connectathon Update
   i. All Preparations in Place?
      1. ACTION 140803: ASTRO survey for participants is online. Response expected by September 1 to allow adequate time for test data preparation. DONE.
      2. Uli confirmed that organizational preparations are complete for the Fall Connectathon.
   ii. Test Running
      1. ACTION 140802: Manufacturers to run test tools prior to Connectaton and submit test tool *problem reports* to Bruce by Sept 10, submit test tool *results* by Sept 20.
   iii. Test Data Discussion
      1. ACTION 140908: Walter to send email to IHE-RO TC list with links for downloading test data by Sept 20. DONE.
      2. Need ARTI dataset with multiple cranial mets for BR.
      3. Need TPPC dataset for RA for informal testing.
   iv. Test Tool results
      1. Test tool results are due to Bruce by Sept 20.
   v. Testing Issues
      1. Series Description to be used to track ARTI, TPPC Beam Type Actors
      2. Single instance per Series to be used to facilitate query and retrieval from archive.
      3. Data to be retrieved from Brainlab archive using DICOM Q/R (Brainlab tool) or via manual push.
   vi. Connectathon hosting future
      1. Consensus to continue alternating North American and European test events.
      2. Brainlab (Feldkirchen) and RaySearch (Stockholm) have offered to host the Fall 2015 Connectathon, subject to availability of facilities.
      3. Sun Nuclear has offered to host WG-07 and IHE-RO events.
      4. ACTION 140909: Bruce to contact Sun Nuclear regarding 2015 Connectathon. WITHDRAWN: Sun Nuclear is back-up for 2015 NA Connectathon.
      5. Dates to be discussed later in this meeting.

l. Topic 2.5: ICT Test Tools Improvements
   i. Harold has driven development of workflow (IPDW) test tools to support more general UPS workflows. Tools now support more atomic operations. Some gaps

remain. ICT is looking for workflow aware vendors to test the new version of these tools.

ii. Making recent tool sets public
    1. In the past, test tools have been publicly available after a one-year embargo.
    2. It has been suggested to make them available publicly at an earlier stage to encourage development of products for testing.
    3. Further discussion and decision later this meeting.

[Lunch 9/19/14, 12:15-1:15pm]

m. Topic 12: TDW-II
    i. Uli reviewed Message Semantics for Worklist Query (version 8).
    ii. Discussion of the Treatment Delivery Type (300A,00CE) attribute for RT Beams Delivery Instruction for continuation following a previously interrupted UPS. This attribute is specified on the Beam level and must be "TREATMENT" (not "CONTINUATION") for beams whose delivery was not previously started.
    iii. There is no way to indicate that a beam listed in a Beams Delivery Instruction has already been treated.
    iv. The TDW-II Profile is now stable.
    v. ACTION 140910: DICOM WG-07 chairs to recommend to IHE-RO TC that TDW should be retired in favor of TDW-II as TDW is inconsistent with the DICOM standard.

n. Topic 13: Enhancing TDW – Clinical Presentation
    i. TomoTherapy RT Plan Content
        1. Proposal to enhance TDW-II by
            a. Re-working the BDI as a Content Profile,
            b. Writing a Dose tracking Content Profile, and
            c. Writing new TDW profile that references the BDI and Dose tracking content.
        2. Dose tracking to a reference point is problematic for treatment techniques that do not treat every point in space at each control point. The cumulative meterset (% completion of the beam) is a better representation of delivery progress, but is less clinically relevant than delivered dose. Single-point dose tracking does not accurately reflect delivery in such cases. DICOM supports tracking of dose delivery at multiple points.
        3. It was suggested to construct a Tomotherapy or CyberKnife Dose Reference plan. The Referenced Dose Reference Sequence in the Control Point Sequence could be to compute reference dose for partial deliveries.
        4. ACTION 140911: Chris to draft (Uli and Sanjay to review) a strategy for building dose tracking information into a Tomo (dose reference) plan and how it is reflected in the Treatment Record. (Oct 2014 TC meeting)
        5. ACTION 140916: Chris to draft dose tracking content based on DICOM Content Profile template (in development) which includes the prescription module, the fraction scheme, and the beam module and corresponding entries in the RT Treatment Record. The ARTI specifications for dose tracking are to be used as a starting point.
    ii. Cross-delivery machine plans
    iii. Interrupted treatments requiring new appointments

o. Topic 10:DPDW Workgroup

i. Uli reported on the status of the workgroup. The group is now making progress on drafting the Profile. The scenarios are pretty much in place and the group is working on transactions.
ii. Uli plans to step down as chair of the workgroup and has nominated Tomas Schwerer (Varian) to lead the workgroup. Tomas was appointed by a quorum of the IHE-RO TC as the new DPDW chair without objection.

p. Topic 7:Brachytherapy Profile Discussion
i. The Brachytherapy working group (DICOM WG-07 sub-group) is working on brachytherapy profiles.
ii. ACTION 140917: Uli to request that a Supplement Proposal be prepared by the DICOM WG-07 Brachy sub-group.

q. Topic 8:Ion Profile Discussion
i. The Ion working group (DICOM WG-07 sub-group) is working on ion therapy profiles.
ii. ACTION 140918: Uli to request that a Supplement Proposal be prepared by the DICOM WG-07 Ion sub-group.

[Adjourn for the day 9/19/14 at 5:30 pm]
[Start on 9/20/14 at 8:50 am]

r. Request for nominations for IHE-RO Technical Committee clinical co-chair.
i. Candidates solicited to date: Lakshmi Santanam (AAPM or ASTRO), Rishabh Kapoor (VA), Scott Hadley (AAPM).
ii. Nominations open until Oct. 1; Balloting after this date.

s. Topic 15: ROI Templates –
i. Walter reviewed an early attempt to cast the ROI Template information using the DICOM Hanging Protocol IOD.
ii. The CT Protocols IOD (DICOM Supp 121, Public Comment) was reviewed. This supplement defines non-patient protocol IOD, as well as patient-specific planned and acquired protocol IODs.
iii. ACTION 140919: Walter to create a working group to include members of AAPM TG-263 to assist in drafting a supplement.

t. TPPC Discussion – Producer/Consumer Transaction Groupings
i. Bruce presented a statement (TPPC section 6.2.1) regarding safe handling of undeliverable plans
1. Adherence to the profile does not guarantee that a plan is deliverable.
2. Where possible, upstream producers should be configured so that such undeliverable plans are not created.
3. In any event, downstream consumers (TPS, TMS, TDD) must handle any such plans in a safe manner (reject them) consistent with their capabilities.
4. Applications adhering to this profile as multiple Multi-modality plans can be stored by a Producer, but may not be semantically usable to a Consumer. They must be handled safely.
ii. It was the consensus of the TC that the statements as drafted are too strong and should not reference testing. IHE-RO adherent applications may be capable of producing and

consuming mixed modality plans, but this behavior is outside the scope of the Profile. (see wording in MMRO-II regarding scope.)

u. Review of IHE-RO PC priority scores for active IHE-RO profiles
   i. Scoring results from PC:
      1. High clinical significance (< 6) was assigned to CPRO, RXRO, DCOM
      2. Mid-level significance (6-9): TDIC DPDW, TDPC, QAPV, DRRO, MMRO-III, TPIC TPPC
      3. Lower-level (> 9) assigned to ROIT, QRRO, TF.
   ii. It was noted that the root cause of issues which underlie Use Cases is not always clear. Also, infrastructure profiles may be valuable beyond what is understood in terms of clinical capabilities.

III. Future Meetings

a. IHE-RO Meetings
   i. IHE-RO Domain Connectathon – Oct 6-10, 2014, TC Mtg Oct 12-15, 2014
   ii. IHE-RO Development Meeting – Jan 19-23, 2015 in Newport Beach or San Diego
   iii. IHE-RO EU Connectathon – May 4-8, 2015 TC Mtg, May10-13, 2015 in Europe (Munich or Stockholm)
   iv. IHE-RO NA Connectathon – Sep 21-25, 2015, TC Mtg Sep 27-30, 2015, preferred location is Washington, DC, alternate is Melbourne, FL.
   v. IHE-RO Meeting at ASTRO – Oct 21-24, 2015 in San Antonio, TX

b. Other meetings through 2015
   i. DICOM WG-7 Nov 3-7, 2014 in Washington, DC
   ii. AAPM July 12-17, 2015 in Anaheim, CA
   iii. DICOM WG-7 Mar 16-20, 2015 location TBD
   iv. DICOM WG-7 Jul 15-18 in Anaheim, CA
   v. DICOM WG-7 Nov 2-6, 2015 location TBD
   vi. IHE European Connectathon, Apr 20-24, 2015 in Luxemburg
   vii. World Congress on Medical Physics and Biomedical Engineering, Jun 7-12, 2015, Toronto
   viii. ESTRO Forum Apr 24-28, 2015 in Barcelona – GEC meeting?
   ix. PTCOG May 18-23, 2015 in San Diego, CA

c. ACTION 140912: Bruce and Walter to prepare Connectathon Application(s) 2015 to IHE Testing and Tools Committee by Oct 6.
d. ACTION 140913: Rickard to verify availability of RaySearch facility in Stockholm by Sep 26, 2014.
e. ACTION 140914: Bruce and Walter to solicit formal archive support for 2015 connectathons by Nov 1, 2014.

IV. Adjournment at 12:00pm on 9/20/14