DICOM SM
Digital Imaging and Communications in Medicine

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STRATEGIC DOCUMENT

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The purpose of this document is to provide a summary of the current activities and future directions of the DICOM Standard. The content of the document is largely based on information submitted by individual working group chairs. The date of the last change of the strategy is marked for each working group; changes to the listing of Secretaries and/or Co-Chairs are made as needed.

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INTRODUCTION

Last substantive update: 2010-06-16

A Brief Background of the DICOM Standard

The introduction of digital medical image sources in the 1970's and the use of computers in processing these images after their acquisition led the American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) to form a joint committee in order to create a standard method for the transmission of medical images and their associated information. This committee, formed in 1983, published in 1985 the ACR-NEMA Standards Publication No. 300-1985. Prior to this, most devices stored images in a proprietary format and transferred files of these proprietary formats over a network or on removable media in order to perform image communication. While the initial versions of the ACR-NEMA effort (version 2.0 was published in 1988) created standardized terminology, an information structure, and unsanctioned file encoding, most of the promise of a standard method of communicating digital image information was not realized until the release of version 3.0 of the Standard in 1993. The release of version 3.0 saw a name change, to Digital Imaging and Communications in Medicine (DICOM), and numerous enhancements that delivered on the promise of standardized communications.

The DICOM Standard now specified a network protocol utilizing TCP/IP, defined the operation of Service Classes beyond the simple transfer of data, and created a mechanism for uniquely identifying Information Objects as they

are acted upon across the network. DICOM was also structured as a multi-part document in order to facilitate extension of the Standard. Additionally, DICOM defined Information Objects not only for images but also for patients, studies, reports, and other data groupings. With the enhancements made in DICOM (Version 3.0), the Standard was now ready to deliver on its promise not only of permitting the transfer of medical images in a multi-vendor environment, but also facilitating the development and expansion of picture archiving and communication systems (PACS) and interfacing with medical information systems.

Scope of DICOM

The DICOM Standards Committee exists to create and maintain international standards for communication of biomedical diagnostic and therapeutic information in disciplines that use digital images and associated data. The goals of DICOM are to achieve compatibility and to improve workflow efficiency between imaging systems and other information systems in healthcare environments worldwide. DICOM is a cooperative standard. Connectivity works because vendors cooperate in testing via either scheduled public demonstrations, over the Internet, or during private test sessions. Every major diagnostic medical imaging vendor in the world has incorporated the Standard into its product design, and most are actively participating in the enhancement of the Standard. Most of the professional societies throughout the world have supported and are participating in the enhancement of the Standard as well.

DICOM is used or will soon be used by virtually every medical profession that utilizes images within the healthcare industry. These include cardiology, dentistry, endoscopy, mammography, ophthalmology, orthopedics, pathology, pediatrics, radiation therapy, radiology, surgery, etc. DICOM is even used in veterinary medical imaging applications. DICOM also addresses the integration of information produced by these various specialty applications in the patient's Electronic Health Record (EHR). It defines the network and media interchange services allowing storage and access to these DICOM objects for EHR systems.

Technology Overview

The DICOM Standard addresses multiple levels of the ISO OSI network model and provides support for the exchange of information on interchange media. DICOM currently defines an upper layer protocol (ULP) that is used over TCP/IP (independent of the physical network), messages, services, information objects and an association negotiation mechanism. These definitions ensure that any two implementations of a compatible set of services and information objects can effectively communicate.

Independence from the underlying network technology allows DICOM to be deployed in many functional areas of application, including but not limited to communication within a single site (often using various forms of Ethernet), between sites over leased lines or virtual private networks (VPNs), within a metropolitan area (often using Asynchronous Transfer Mode), across dial-up or other remote access connections (such as by modem, ISDN or DSL), and via satellite (with optimized protocol stacks to account for increased latency).

At the application layer, the services and information objects address five primary areas of functionality:

- Transmission and persistence of complete objects (such as images, waveforms and documents),
- Query and retrieval of such objects,
- Performance of specific actions (such as printing images on film),
- Workflow management (support of work lists and status information) and
- Quality and consistency of image appearance (both for display and print).

DICOM does not define architecture for an entire system; nor does it specify functional requirements, beyond the behavior defined for specific services. For example, storage of image objects is defined in terms of what information must be transmitted and retained, not how images are displayed or annotated. An additional DICOM service is available to specify how the image must be presented with annotations to the user. DICOM can be considered as a standard for communication across the "boundaries" between heterogeneous or disparate applications, devices and systems.

The services and objects that are defined in DICOM are designed to address specific, real-world applications (such as the performance of an imaging study on an acquisition device). As such, DICOM is not a general-purpose tool for distributed object management. In general, information is transferred "in bulk" according to a "document" paradigm.

By contrast, general-purpose standards for distributed object or database management generally provide lower level, more atomic access to individual attributes. Though the DICOM Standard does provide the so-called "normalized" services for patient and study management, these have not proven popular, and the "composite", document-oriented, services have prevailed. This is most likely a consequence of the natural division of functionality between different vendors, devices and applications. For example, the ability to "set" or "change" a patient's name is generally implemented in a proprietary and centralized manner. To safely distribute responsibility for such a change across boundaries between different applications requires more underlying support than DICOM currently possesses (such as support for transactions and two-phase commitment).

At the present time, the pressing needs in DICOM (as indicated by the priorities of the various working groups) are to address issues relating to new modality technology, structured and coded documents for specific clinical domains, workflow management, security and performance. These needs are being successfully addressed using the conventional "underlying" DICOM technology. Where there are interfaces to standards based on other technologies (such as HL7 V2.x and 3), the focus for harmonization is on a shared "information model." It may be the case that the nature of the underlying technology needs to be revisited in the future, whether it is to make use of more sophisticated off-the-shelf distributed messaging tools such as Web Services, or ubiquitously used encoding tools such as XML. However, the current priority is to address improvements in functionality to better meet the needs of the end-user, rather than to adopt an alternative encoding and distribution technology for the sake of it. This priority is continually reinforced by a desire to remain compatible with the installed base of equipment.

When specific new technology is required, e.g., in support of new features such as security and compression, the strategy is to adopt proven international, industry or de facto standards. Accordingly, network confidentiality and peer authentication in DICOM are provided by the use of either TLS (an Internet standard) or ISCL (an ISO-based standard). Similarly, rather then develop medical-image-specific compression schemes; DICOM adopts standards developed by ISO/IEC JTC 1/SC 29/WG 1 such as JPEG and JPEG 2000. For interchange media, standard file systems compatible with conventional software (such as ISO 9660 and UDF) are used.

DICOM's Relationship to Other Standards

Throughout the development of DICOM, much attention was devoted to establishing working relationships with related standards initiatives throughout the world. The initial version of the Standard leveraged prior work by ASTM. The Internet protocol TCP/IP was adopted in 1993. In the nineties, solid cooperation with CEN, the European Committee for Standardization, resulted in a number of jointly developed supplements. CEN has created and approved a normative reference to the DICOM Standard in EN 12052, an official European Norm. In parallel, the convergence of a Japanese interchange media format (IS&C) with DICOM required much joint work where JIRA, the Japan Industries Association of Radiological Systems, played a major role. In the USA, DICOM participated in the early coordination efforts for healthcare standards with the ANSI-HISB from which DICOM adopted a harmonized patient name structure, and started progressively to define links with HL7. This cooperation has now entered in a very active phase with the creation, in 1999, of a joint DICOM-HL7 working group. DICOM established a Type A liaison with the ISO Technical Committee 215 at its creation in 1999. ISO TC 215 has decided not to create an imaging working group, but to rely on DICOM for bio-medical imaging standards. In 2006, ISO approved DICOM as an ISO reference standard (#12052), as CEN has done. In 2003, the DICOM Standards Committee became a member of the e-Health Standardization Coordination Group, a group endorsed by the ITU with the objective to promote a stronger coordination amongst the key players in the e-Health Standardization area. Additionally, in 2005, DICOM accepted a position on the Board of Directors of ANSI's Healthcare Information Technology Standards Panel and on the Healthcare Technology Task Force of the World Standards Cooperation.

DICOM is also focusing its attention to the evolution of standards linked to the Internet. DICOM's strategy is to integrate Internet Recommendations as soon as they are stable and largely disseminated in consumer commercial products. In this evolution, much care is taken to ensure that the consistency of the DICOM Standard is maintained with its large installed base. DICOM already uses standard healthcare enterprise intranets, the e-mail exchange of DICOM objects (using a Standard MIME type) is possible, and the Web Access to DICOM persistent Objects (WADO) service has been defined in a joint effort with ISO TC215. It is clear that the use of DICOM objects and services in commonly used information technology applications will grow in the future, given the world-wide ambition in healthcare to create Electronic Health Records.

Finally, DICOM has a strong relationship with IHE, the Integrating the Healthcare Enterprise initiative, where profiles of standards are defined as solutions for healthcare workflow and enterprise integration challenges.

DICOM's Organizational Structure

DICOM is an independent, international standards development organization administered by NEMA's Medical Imaging and Technology Alliance. The complete Procedures (bylaws) of the DICOM Standards Committee are available on the DICOM Web page at http://dicom.nema.org. Working groups of the DICOM Committee perform the majority of work on the extension of and corrections to the Standard. Working groups are formed by the DICOM Committee to work on a particular classification of tasks. Once formed, working groups petition the DICOM Committee to approve work items for which the working group will execute the plan delineated in the work item. Once the output of a work item (generally a supplement or correction proposal) has been completed, it is submitted to Base Standards Working Group (WG-06), for their review. Supplements to the Standard then go through a public comment period, after which the DICOM Committee authorizes the supplement for letter ballot by DICOM members. Letter ballots require approval by two-thirds of those voting affirmative or negative and return of more than one-half of the ballots sent to members in good standing relative to letter ballots. Since the working groups perform the majority of work on the extension of and corrections to the Standard, the current status and future directions of the DICOM Standard are best represented by review of each working group.

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The DICOM Standards Committee and Its Working Groups

The DICOM Standards Committee

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
General Secretary	Cheryl Kreider Carey, CAE, MITA ccarey@medicalimaging.org
Secretary	Stephen Vastagh, MITA svastagh@medicalimaging.org
Manager, DICOM Operations	Luiza Kowalczyk, MITA lkowalczyk@medicalimaging.org
Co-Chair	James Philbin, ACR jfphilbin@gmail.com
Co-Chair	Jeroen Medema, Philips Healthcare Jeroen.medema@philips.com

Committee Profile

Last strategy update: 2010-06-16

Scope:

The DICOM Standards Committee exists to create and maintain international standards for communication of bio-medical diagnostic and therapeutic information in disciplines that use digital images and associated data. The goals of DICOM are to achieve compatibility and to improve workflow efficiency between imaging systems and other information systems in healthcare environments worldwide.

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WG-01 (Cardiac and Vascular Information)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
Secretary	Stephen Vastagh, MITA svastagh@medicalimaging.org
Secretary	Cheryl Kreider Carey, CAE, MITA ccarey@medicalimaging.org
Chair	Bruce Bray, ACC bruce.bray@hsc.utah.edu

WG (Working Group) Profile
Last strategy update: 2009-03-27

Scope:

To develop standards for the interchange of cardiovascular information

The Working Group operates in coordination with WG-02 for X-ray angiography imaging, WG-12 for ultrasound imaging, and WG-08 for Structured Reporting.

Roadmap:

The cardiology department is a multi-modality mix of many types of equipment from many different manufacturers. Moreover, cardiovascular medicine requires consultation and interaction between many medical disciplines, and treatment of a patient over extended periods of time. Standardized data interchange is critical in this environment.

The WG-01 roadmap has been a long-term strategy to specify information objects and services to fully digitize and integrate data flow within the cardiology department. The ultimate goal is a comprehensive digital cardiovascular record for the patient, of which the DICOM-based cath lab record and other (non-invasive) imaging exams are a significant part.

The WG-01 work effort has produced DICOM data object formats for X-ray angiography (XA) images; cardiovascular waveforms, with specializations for hemodynamics (HD), cardiac electrophysiology (EPS), and electrocardiography (ECG); and intra-vascular ultrasound (IVUS) images. WG-01 has developed templates for DICOM Structured Reporting for measurements and analysis of these images and waveforms, and for observations made in imaging-based exams (such as procedure logs).

Short Term Goals:

- Specification of information objects and structured reports for electrophysiology
- Specification of information object for intravascular optical coherence tomography (IVOCT)
- Correction Proposals for the existing Standard in support of cardiology needs

Current Status:

WG-01 plans to meet twice per year for 1 day each, plus interim discussions by telephone conference.

Current Work Items:

- Cardiac Electrophysiology

- Intravascular Optical Coherence Tomography
- Waveform Presentation State (inactive)

Risks:

As the major cardiology information types have been addressed, the remaining work is narrowly focused. With constrained travel budgets for WG participants, it will be a challenge to move the remaining items to conclusion with sufficient overview from both clinical and industry members.

Challenges and Opportunities:

The locus of much of the effort toward the digital cardiovascular patient record is now in the IHE Cardiology initiative, which is directed to improving implementation of the Standard and addressing the broader end-to-end workflow integration. WG-01 has actively encouraged the development of the IHE Cardiology initiative, and much of its current work program addresses gaps in the DICOM Standard identified by IHE.

WG-01 will continue to monitor the needs of the cardiology community for further standardization efforts. Areas identified for potential future efforts include pediatric cardiology.

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WG-02 – Projection Radiography and Angiography

Secretariat (U.S.)	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
Manager, DICOM Operations	Luiza Kowalczyk, MITA lkowalczyk@medicalimaging.org
Secretariat (Europe)	European Society of Radiology
Secretary	Annalisa Trianni, ESR Universitaria "S. Maria della Misericordia," Udine, Italy trianni.annalisa@aoud.sanita.fvg.it
Chair	Francisco Sureda, GE Healthcare francisco.sureda@med.ge.com

WG (Working Group) Profile
Last strategy update: 2016-12-01

Scope:

To develop and maintain the XA-, XRF-, DX-, CR-specific objects for the DICOM standard in the domains of 2D and 3D X-Ray imaging (general radiography, angiography, cardiology, neuro-radiology, radio-fluoroscopy, electrophysiology, interventional oncology etc.), technical reports, dose information and clinical information, related to the patient and medical staff of interventional procedures or general X-ray procedures.

Roadmap:

- The WG-02 roadmap follows a long-term strategy to specify information objects and possibly services to digitize and integrate the data flow within a general Radiography and Angiography laboratory environment.
- There is a wish to foster implementations of RDSR in Digital Radiography (DR) products in the market, which reveals a need of better awareness and technical guidance to DR vendors. We expect to partially answer to this need by providing the new supplement Informative Annex of Radiation Dose Reporting Use Cases with examples to help DR vendors to implement the RDSR.
- Work Item 2015-12-D Cone Beam CT-RDSR: The WG-02 plans to collaborate with WG-28 in the development of a radiation dose report to address Cone Beam CT (CBCT), and potentially define a new

"extended" Radiation Dose SR meant to include new/all modalities and to define a more generic model of irradiation.
- WG-02 plans to review the future IHE profile that has been proposed for Modality Protocol Management.
- The MITA Interventional XR-27 standard (User QC) requires exporting protocol technical information outside the angiographic equipment. WG-02 foresees an opportunity for interoperability with the future "XA Protocol Storage" IOD.
- WG-02 ensures liaison with other groups and organizations like IEC, MITA X-Ray Interventional, AAPM, EFOMP, and IHE.

Current Supplements, Work and Objectives:

- Sup191 - Patient Radiation Dose SR – published for public comment Jan'16, under review for Letter Ballot
- (New Supplement) Update of Radiation Dose Reporting Use Cases (Informative) – Draft
- (New Supplement) XA Protocol Storage (Informative) – Draft
- CP 1319 : Frame Of Reference Reliability (Assigned)
- CP 1513 : Clarification of meaning of entrance dose (Assigned)
- CP 1635 : Add Isocenter Coordinate System to X-Ray Projection RDSR (Assigned)
- Collaborate with WG-07 in the definition of a "trusted" Frame of Reference.
- Participate to Sup164 Contrast Agent and Radiopharmaceutical Administration Reporting
- Collaborate with WG-28 on Sup191 Patient Radiation Dose SR
- Collaborate with WG-28 to improve RDSR with new data to address Sup191 needs (e.g. CP1635)

Current Status:
- WG-02 continues to hold quarterly face-to-face meetings and teleconferences between the face-to-face meetings.
- Short-term goals are defined.
- WG-02 is involved in the IEC PT 61910-1 to create an international standard for dose reporting.
- WG-02 holds joint meetings with WG-28 to define the structure of a Patient Dose SR.

Future Work Items:
- N/a.

Risks:
- Too many proprietary solutions are already in use.
- If clinical users and vendors do not participate, the results may not meet all user requirements or may not be broadly accepted.

Challenges and Opportunities:
- Encourage clinical users to participate to the group in finding solutions and/or validating proposed solutions.
- In the general Radiography and Angiography lab environment already various non-image data exist and need to be exchanged to assure flow of information. The different departments are increasingly switching to digital communication and rely on implementation of Standards

Past Work:

DICOM Supplements and CPs
- Supp 83 - Enhanced XA/XRF Image Storage SOP Class – Standard 2004
- Supp 94 - Radiation Dose Report – Standard 2004
- Supp 116 - 3D X-Ray – Standard 2007
- Supp 140 - XA/XRF Grayscale Softcopy Presentation State Storage SOP Class – Standard 2008
- Supp 139 - Enhanced XA/XRF IOD Informative Annex – Standard 2009
- Supp 167 - X-Ray 3D IOD Informative Annex – Standard 2014c
- CP 1077 - Add CR report type to Dose SR and relax content conditions
- CP 1223 - Additional Items for Dose SR (by IEC PT 61910-1)

DICOM Conferences & Seminars

- 2004 SPIE - Advances in DICOM WG-02 Emerging Enhanced XA
- 2005 DICOM Conference (Budapest) Enhanced XA/XRF
- 2005 DICOM Conference (Budapest) Projection Imaging, Dose Report and XA 3D
- 2007 SPIE - Advances in DICOM WG-02 Enhanced X-Ray and 3D
- 2008 DICOM Conference (Cheng Du) Application cases using the Enhanced XA SOP Class
- 2009 SPIE - Advances in DICOM WG-02 X-Ray Angiography Projection Imaging and 3D
- 2010 SPIE - Advances in DICOM WG-02 X-Ray Angiography Projection Imaging and 3D
- 2011 SPIE - Advances in DICOM WG-02 X-ray Angiography & 3D Presentation

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WG-03 (Nuclear Medicine)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
Secretary	Cheryl Kreider Carey, CAE, MITA ccarey@medicalimaging.org
Chair	Jeff Pohlhammer, Philips Healthcare jeff.pohlhammer@philips.com

WG (Working Group) Profile
Last strategy update: 2012-04-10

Scope:

To develop standards for the digital interchange of Nuclear Medicine and PET images

Roadmap:

There are currently two approved work items for WG-03. These are 1) Creation of a dose reporting structure suitable for reporting patient dose due to a general NM (planar or SPECT NM) or PET scan, and, 2) Creation of a new Enhanced NM IOD based on the architecture of the other new Enhanced IODs such as CT, MR, PET, etc.

Likewise, the group will monitor acceptance and success of the new Enhanced PET IOD, and will develop CPs to address any problems with the PET IOD as they arise.

Working Group 3 has worked very closely with other professional organizations, such as the Society of Nuclear Medicine, American Society of Nuclear Cardiology, IHE, etc., to help promote acceptance of DICOM in NM, and ensure that the standard supports the need of the NM community.

Current Status:

- Work continues on the two work items described above. The Dose report has completed a first reading with Working Group 6. It has now been assigned supplement number 159.
- Completed development of Supplement 117, the new Enhanced PET IOD. This supplement defines a new multi-frame PET IOD consistent with the other new Enhanced IODs (MR, CT, etc.). The group will monitor acceptance and success of the new Enhanced PET IOD, and will develop CPs to address any problems with the IOD as they arise.
- Completed work on CP666, a joint effort with members from other Working Groups. This CP unifies support for cardiac and respiratory gating among all of the new Enhanced IODs, and expands the scope of the support to include prospective and retrospective techniques, multiple methods for specifying the portions of the cardiac or respiratory cycles to be imaged, acquisition of data over multiple cycles, and for dividing the cardiac or

respiratory cycles into multiple time segments. Combination of simultaneous cardiac and respiratory gating is also supported.

Short-Term Objectives:

- Much progress has been made on Supplement 159. A working meeting is in the process of being set up for Tuesday, June 12, 2012, in Miami (during Society of Nuclear Medicine annual meeting).
- There has been some discussion about the structure of the Enhanced NM IOD. Future meetings will include work on this item.
- While CP666 goes a long way in adding support for many new gating features in all of the enhanced IODs, there are still a few details that remain to be addressed. WG3 must begin discussion of possible CPs to address these. This will likely not be possible until adoption of the Enhanced PET IOD begins.

Current Work Items:

1) Create new Dose Reporting structure for reporting patient dose related to PET and general NM scans (Sup159).
2) Create new Enhanced NM IOD.

Risks:

None.

Challenges and Opportunities:

- The older single frame PET, CT and MR IODs, and the NM IOD (which is already multi-frame) are widely supported within the imaging industry. Adoption of the new Enhanced IODs will depend on identification of clear benefits over continued use of these older IODs.
- Gating support is one of these clear advantages for the Enhanced IODs, since the older IODs (especially CT and MR) do not support cardiac gating well, and do not support respiratory gating at all. For PET, which is almost exclusively part of a hybrid system, and NM, which is increasingly also part of a hybrid system, in which PET or NM is paired with another modality; there is a clear advantage to using IODs with similar architecture.
- Working Group 3 can work with other organizations such as InfoRad, to help promote adoption of the new Enhanced PET and NM IODs.

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WG-04 (Compression)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
Secretary	Cheryl Kreider Carey, CAE, MITA ccarey@medicalimaging.org
Chair	Alan Rowberg, MD, University of Washington (ACR) arowberg@earthlink.net

WG (Working Group) Profile
Last strategy update: 2007-11-29

Scope:

To provide data compression facilities for the DICOM standard and to advise on application or object-related definitions of data compression parts of the DICOM Standard created by other working groups.

Roadmap:

Develop appropriate DICOM transfer syntaxes for new Parts of JPEG 2000 as they are released.

Short-Term Objectives:

We plan to serve a maximal number of modalities and clinical situations, with support for growing areas such as telemedicine.

Current Status:

Compression that is already available in the standard:

- JPEG (ISO 10918-1) - all processes
  - lossy (DCT)
  - lossless
  - sequential, progressive
  - Huffman, arithmetic entropy coders
- RLE (aka TIFF Packbits)
  - ultrasound
- JPEG-LS (ISO 14495-1) (DICOM CP-174)
  - lossless, lossy ("near-lossless")
- JPEG 2000 Part 1 (ISO 15444-1)
- JPEG 2000 Part 2 Multi-Component Transfer Syntaxes
- JPEG 2000 JPEG Interactive Protocol (JPIP)

Current Work Items:

None currently, but we are starting to prepare a work item for 3D image compression. We hope to start an educational effort related to compression in medical imaging in the next year.

Challenges and Opportunities:

Both the user and vendor communities have an investment in current technology and may be slow in embracing new compression techniques. The issues surrounding the use of irreversible (lossy) compression in clinical environments have also been a limiting factor.

Relationships to Other Standards:

DICOM has cross-representation to JPEG 2000.

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WG-05 (Exchange Media)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
Secretary	Cheryl Kreider Carey, CAE, MITA ccarey@medicalimaging.org
Chair	David Clunie, MBBS, PixelMed Publishing dclunie@dclunie.com

WG (Working Group) Profile
Last strategy update: 2015-12-03

Scope:

To develop DICOM standards for interchange media.

Roadmap:

- Continue to evaluate new media types that are potentially suitable as they become available, esp. new compression.
- Address workflow issues related to media creation.
- Address workflow issues related to media importation to the PACS (in conjunction with IHE).

Short-Term Objectives:

- Address any DICOM issues arising out of the use of IHE Portable Data for Imaging (PDI) profile.
- Address any DICOM issues arising out of the use of IHE Import Reconciliation Workflow (IRW) profile.

Current Status:

- None.

Current Work Items:

- None

Risks:

- Physical media is growing obsolete and being replaced by network-based alternatives (but not as fast as expected)
- Continuing though diminished problem of CD readability (compliance) issues and/or viewer executability or sufficiency issues (occasional complaints are still received)

Challenges and Opportunities:

- Leverage the popularity of consumer media formats.
- Avoid proliferation of excessive numbers of alternative media and profiles.
- Optimize media related workflow.
- Promote the retirement of media in favor of network-based alternatives

Relationships to Other Standards:

An "informal" liaison with OSTA exists to harmonize efforts with respect to UDF, MOD and DVD, though no interaction has taken place with this group since UDF 2.0 was standardized.

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WG-06 (Base Standard)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
Secretary	Stephen Vastagh, MITA svastagh@medicalimaging.org
Manager, DICOM Operations	Luiza Kowalczyk, MITA lkowalczyk@medicalimaging.org
Chair	Robert Horn, Agfa Healthcare robert.horn@agfa.com
CP Manager	David Clunie, MBBS, PixelMed Publishing dclunie@dclunie.com

WG (Working Group) Profile
Last strategy update: 2016-12-01

Scope:

WG6 maintains the overall consistence of the DICOM standard. It provides technical guidance to all DICOM working groups and serves as the technical coordination point. It also develops extensions (Supplements) to DICOM typically related to overall systems enhancements. Some of the responsibilities include:

- Executing the DICOM Maintenance Process (Correction Proposals). The process is used to make "corrections and minor changes" to the current versions of the Standard. Any corrections made are processed using the normal Letter Ballot procedures as defined by NEMA.
- Provision of technical coordination and guidance for all WGs. This includes review and official approval before the Public Comment, Letter Ballot, and Final Text draft releases of all supplements.
- Development of Supplements to the standard related to Print, Image Management, Workflow Management, etc.
- Tracking the progress of workitems and supplement and report stalled items (no activity over a period of three years) to the DICOM Standards Committee.
- Coordination of joint development efforts with ASTM (DICOS), ISO and JIRA.
- Coordination with MITA for the publication of DICOM.

Roadmap:

On-going DICOM Maintenance Process:

- Correction Proposals submitted by the members and other interested parties will continue to be considered by the WG-06
  - All Correction Proposals accepted by WG-06 and designated for inclusion into voting package, will be published on the FTP server for the comments by all DICOM Committee members at least 2 weeks before the WG-06 meeting considering such voting package for Letter Ballot
  - A regular CP telecon one week before the face to face meeting is now part of the WG-06 meeting process. This teleconferencing for CP processing has been successful for reducing the time needed for CPs in the face to face meetings by about 2 hours. Roughly half of the CPs are handled in the teleconference with only the final approval vote for confirmation at the face to face meeting. The others require face to face discussion.

Potential work items of other Working Groups:

- WG-06 will provide assistance to the working groups working on their assigned work items.
- All work items (as supplements to DICOM Standard) approved by DSC and prepared by corresponding working groups will be accepted for review by WG-06 and for preparation of Letter Ballot.
- All Supplements approved by the Letter Ballot will be considered in order to prepare Final Text, with addressing of any comments received.

There is a proposed new work item to provide a change management SOP class or classes, as well as normative behavioral text to support the long term management of DICOM objects.

There is an approved new work item to define a Multi-frame Converted Legacy Image SOP Class to allow the fast transfer of series of images in a multi-frame SOP Instance instead of individual single images. This prevents delays by waiting for response message for each individual image.

HL7 Coordination:

WG-06 has begun a regular joint session with WG20 at every meeting to review HL7 project efforts (similar to DICOM Work Items) and coordinate CPs between HL7 and DICOM. The first of these meetings was held in November 2016. Relevant HL7 projects are now being tracked together with DICOM work items.

DICOM Publication

- The publication in multiple forms, including XML, continues. There is both positive and negative feedback regarding the continuous integration of CPs and more frequent publication. Users of the standard appreciate the publication of a new DICOM standard with all final text CPs fully integrated. Unfortunately, this has also caused those less familiar with the process and meaning of CPs to view DICOM as becoming less stable as a standard.
- Maintenance of the other formats, especially the CHTML format, with a stable "current" URL is leading to an increasing use of direct links to the standard from other documents. This is a desirable trend that should be encouraged. Instead of seeing only a large and intimidating 8,000 page collection of PDF documents, the public users are getting directed access to specific sections.

Completed Work Items:

- Supplement 96 – Unified Performed Procedure Step

Current Work Items:

- Supplement 115 – Evidence SOP Class -In early draft. No progress.
- Supplement 121 – Modality Procedure Plan and Protocol Storage -FT
- Supplement 164: Contrast Agent Administration SR Storage- Being prepared for Public Comment
- Whitepapers on change management and long term consistency are in preparation. These will lead to new work item proposals.
- Whitepaper to describe joint approach between DICOM and IHE Radiology for defining the application profiles that describe the usage of DICOM definition for a particular clinical use case.

Risks:

Workload is decreasing due to the limited number of supplements in progress. But a number of supplements in progress need substantial support from WG-06 due the introduction of new and complex functionality or inexperienced editors.

Challenges and Opportunities:

The workload of WG-06 has increased slightly, and now does not fit the allocated meeting time.
The new requirement to provide an educational presentation as part of supplement presentation does increase the workload slightly, but it is very beneficial to maintaining focus for supplements and later educational needs.

We continue using t-cons for supplements that appear to have no technical issues, complex edits, or other demands for face to face discussions. This worked well for Supplements that are in the stage of the review progress that require a line-by-line review. All new activity is being forced to obtain a work item before discussion at WG-06. All the current supplement activity has an approved work item. However, to get an acceptable audience or even a quorum is becoming difficult during tcons.

The meeting agendas and attendance issues are improving with the use of a two stage agenda setting. We first distribute a candidate list of meeting times and allow self-selection of removal from groups that are going to be busy, unavailable, or willing to wait. This has improved the productivity of the meeting time.

For first reads and minor reviews we have started using web display to reduce the travel burden on presenters.

Much of the WG-06 face to face meeting time is spent dealing with clarity, precision, and consistency. This is dealt with somewhat during public comment, and extensively in the final text and letter ballot discussions.

Relationships to other Standards:

WG-06 functions as conduit for joint work with ISO TC215.
Progress of the IHE initiative is being regularly reviewed by WG-06.

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WG-07 (Radiotherapy)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
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Chair	Ulrich Busch, Varian Medical Systems Ulrich.Busch@varian.com
Vice-Chair	Christof Schadt, Brainlab AG Christof.Schadt@Brainlab.com

WG (Working Group) Profile
Date of Last Update: 2013-12-03

Scope:

WG-07 develops and maintains the radiotherapy objects and related functionality in the DICOM Standard, and supports and promotes its adoption by industry and community.
Some of the responsibilities include:

- Developing objects for various treatment modalities
  (External Beam, Brachytherapy, Ion Therapy, Robotic Treatment Devices, Cobalt etc.)
- Taking care, that Imaging is well-integrated into the Radiotherapy Process
- Ensure, that geometric concepts (frame of reference and related constructs) are well-defined so that radio-therapeutic planning and delivery can rely on precise geometric definitions to ensure safe beam placement
- Considering and further developing DICOM Unified Worklist concepts and specifications and make use of those approaches in to the Radiotherapy workflow

Roadmap:

The major goal of WG-07 is to enable departmental workflow, improve safety through tighter standard definition, and open DICOM to new technologies and processes in RT. Those goals are closely related to activities of IHE-RO, where profiles are in development to support the same goals.
WG-07 and IHE-RO directions are well-aligned which each other and the clinical community, and there is a close relationship to IHE-RO (for many individuals on a shared membership basis). Further on professional societies (most prominently ASTRO and AAPM) are asking for more electronic process control and safety checks, which require a powerful workflow environment. WG-07 is committed to serve those interests in the area of interoperability it deals with.
The current and future processes in radiotherapy have considerable evolved since the introduction of Radiotherapy object to DICOM in 1997. Further on, new treatment modalities and positioning techniques seek support for interoperability. This led WG-07 to the conclusion, that the current ('1st Generation') DICOM object for RT are at their limits and a new generation of DICOM Radiotherapy objects is needed.
Therefore the roadmap of WG-07 for the next years focusses of the introduction of the so-called '2nd Generation Radiotherapy objects' to the DICOM standard.
Specifically the following areas are in focus of WG-07 throughout the next years:

- Supplement 147 (Second Generation Radiotherapy)
  - That supplement is the foundation for 2nd Generation Radiotherapy objects, and adds already various treatment modalities to the Standard

    - WG-07 concentrates to get this supplement finished first, followed by some other small supplements which will then incrementally add other objects (e.g. Ions and Brachytherapy) to that foundation.
- Supplement 160 (Patient Positioning and Workflow)
    - This supplement covers the workflow of a Radiotherapy Treatment Session across components of different vendors being involved in preparation, patient positioning, treatment delivery and post-treatment review activities.
    - This supplement makes use of the concepts and definitions in Supplement 147, but maybe used in parts already the context of 1st generation Radiotherapy objects.
    - The supplement is closely related to IHE-RO Profiles (especially the workflow-related profiles)
- Ion Therapy
    - Maintenance of 1st Generation as needed prior to 2nd Generation RT Objects
    - Introduction of Ion therapy object to 2nd Generation along the concepts of Supplement 147
- Brachytherapy
    - Maintenance of 1st Generation as needed prior to 2nd Generation RT Objects
    - Introduction of Brachytherapy therapy object to 2nd Generation along the concepts of Supplement 147
- New Development
    - Companion objects for Treatment Planning, Dose etc.
    - Approaches to represent local data clusters, which reference all objects relevant to a specific use case.
    - New Services to improve efficiency and specificity of retrieving data
    - Reports specific to segmentation and radiotherapy use cases

Short Term Goals:

WG-07 is working to finalize Supplement 147 (Second Generation Radiotherapy) for public comment. The public comment phase ex expected to start in 2014, lasting 6 month.
Work of Supplement 160 should be resumed in conjunction with the IHE-RO Technical Committee subgroup for the DPDW (Discrete Positioning and Delivery Workflow) Profile.
The Brachytherapy and Ion Subgroups will continue to work actively on the agenda described above.

Current Status:

Supplement 147 (Second Generation Radiotherapy) is near to completion to be presented to a wider audience in public comment.
Supplement 160 is available in an initial version and work is ongoing.
WG-07 has established 2 subgroups dealing with the specific treatment techniques of Ion Therapy and Brachytherapy. Those subgroups will contribute the 2nd Generation object definitions, but also will take care of some 1st Generation Standard maintenance as needed.

Completed Work Items (since beginning):

- Supplement 11 (RT Image, RT Structure Set, RT Dose, RT Plan)
- Supplement 29 (RT Treatment Record Objects and Media Support)
- Supplement 102 (Ion Therapy) is part of the DICOM 2006 standard.
- Supplements 74 (Utilization of Worklist in Radiotherapy Treatment Delivery) in connection with WG-06-sponsored Supp 96 (Unified Worklist and Procedure Step)

Current Work Items:

- Supplement 147 (Second Generation Radiotherapy), being developed pursuant to work item 2007-06-B.
- Supplement 160 (Patient Positioning and Workflow), being developed pursuant to work item 2011-12-A.

Risks:

The agenda of WG-07 has a considerable broad scope. Resources working in Radiotherapy and being DICOM literate are not abundant and are shared with IHE-RO Technical Committee activities.

While important for safe and efficient interoperability in modern radiotherapy, the adoption of second generation will require a certain amount of training and implementation by the vendors and community. WG-07 will have to play a key role in that process.
IHE-RO (IHE in Radiation Oncology) is an active initiative requiring support from DICOM for workflow and other activities. WG-07 needs to progress its work at a rate consistent with IHE-RO goals where possible.

Challenges and Opportunities:

Adoption of upcoming second-generation radiotherapy objects represents significant investment by manufacturers. The introduction of electronic workflow (predominantly using Unified Worklist and Procedure Step) is an established goal, but also includes with some challenges in respect to coverage and quality of implementation. Although IHE-RO is also promoting their uptake, synchronization of implementations across the industry represents a challenge. The potential payoff is however high: many existing technologies require the new objects, and workflow implementation across the industry could lead to very significant gains in productivity. Recent radiation safety initiatives will also encourage use of Supplement 147 objects and the follow-up supplement to address some of these concerns. Last not least modern radiotherapy cannot be efficiently handled with the 1st generation objects anymore, and current implementations increasingly use Band-Aids to support today's workflows.

Relationships to Other Standards:

RT objects make use of IEC-61217 for some certain classes of treatment machines, where C-Arm isocentric geometry is suited. ICRU concepts for dosimetry as also referred to. IEC/TR 62266 ("Medical Electrical Equipment - Guidelines for Implementation of DICOM in Radiotherapy"), and IEC 62274 ("Safety of Radiotherapy Record and Verify Systems") have also been published. IEC has started to recognize DICOM as a mean of electronic data transfer, and WG-07 will continue to be involved in review of IEC standards where necessary, especially where IEC Standards could eventually have overlapping definitions on electronic data representations which are covered by DICOM already.
In the scope of IHE-RO and IHE in general, the boundaries between DICOM and HL7 will be increasingly a topic of consideration while developing the new set of objects. WG-07 will assist in the process to identify the appropriateness of protocols (esp. DICOM versus HL7) for the various use cases.
Proceedings in the definition of Patient Dose Recording Regulations will be monitored by WG-07 for the imaging procedures in the context of radiotherapy treatment delivery.

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WG-08 (Structured Reporting)

Secretariat	RSNA
Secretary	Chris Carr, RSNA carr@rsna.org
Co-Chair	David Clunie, MBBS, PixelMed Publishing dclunie@dclunie.com
Co-Chair	Vacant

WG (Working Group) Profile
Last strategy update: 2011-11-18

Scope:

To develop and maintain the DICOM Structured Reporting specification, and to collaborate with DICOM working groups and other standards development committees in the development of specialized reports and other documents based on the generic SR specification.

Short-Term Objectives:

- Create a set of guidelines for template creators.
- Support the creation of general, reusable templates components and outlines.
- Maintain the SR infrastructure.
- Create cross-specialty SR templates.
- Develop a methodology (with a standardized graphical notation) to describe templates.
- Assist WG-20 in the integration of DICOM SR with other standards efforts, in particular HL7, and support SR development in the various DICOM WGs.
- Provide technical support for demonstration of SR as required by IHE, MITA, etc.
- Develop a process for submitting clinical use cases and requirements for SR templates.
- Develop a means of specifying SR presentation.
- Develop a formal syntax for encoding the definition of templates and context groups in efforts to facilitate creation of a machine-readable version of these parts of the Standard.

Current Status:

Working Group Eight meets quarterly. The meetings usually take place at the Radiological Society of North America (RSNA) in Oak Brook, Illinois.

Additional telephone conferences are scheduled as necessary.

Current Work Items:

WG-08 is currently developing Supplement 155, which will formalize the standard for reporting templates, such as those being developed by the RSNA Reporting Subcommittee. These templates differ from current DICOM Structured Reporting ("DICOM SR") in that they are intended to specify report content to be "filled in" by the reporting radiologist. Supplement 155 also will define the transformation of completed reporting templates into HL7 Clinical Document Architecture (CDA) documents.

Risks:

Since the assignment of Clinical Codes to DICOM SR Documents is an essential part of the development process of SR related Supplements, the quality of the resulting Supplements as well as the development speed depends on a close co-operation with providers of Coding Schemes used by DICOM SR.

Challenges and Opportunities:

- Establish co-operations with Coding Scheme providers
- Support WG-20 in the co-operation with HL7 in the field of the Clinical Document Architecture (CDA)

Relationship to Other Standards:

- HL7
- IHE
- RSNA Reporting Committee
- SNOMED
- LOINC
- UCUM
- ISO-TC215
- CEN-TC251
- ACR

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WG-09 (Ophthalmology)

Secretariat	American Academy of Ophthalmology
Secretary	Flora Lum, AAO flum@aao.org
Co-Chair	Lloyd Hildebrand MD, Univ. of Oklahoma / AAO lloyd-hildebrand@ouhsc.edu
Co-Chair	Mark Horton, Indian Health Service, Mark.horton@ihs.gov
Co-Chair	Yijun (Eugene) Huang, Univ. Of Wisconsin yhuang@rc.ophth.wisc.edu

WG (Working Group) Profile
Last strategy update: 2015-11-14

Scope:

To address all issues relating to imaging and reporting of image-based studies in ophthalmic applications.

Roadmap:

Integration of the Ophthalmic Photography supplement and other supplements into the Standard has been a major advance for digital ophthalmic devices and applications. Adoption of ophthalmology-relevant objects will be emphasized in eye care environments through education and demonstration projects in collaboration with the ophthalmic users and industry vendors. Coordinated education and demonstration projects for vendors and users will be essential to get broad adoption of the DICOM Standards in eye care. Extensions/refinements to existing objects will be introduced to accommodate new technology and techniques as they become relevant to the medical community through popular use and adoption into the standards of care. Most of the high priority modalities in eye care have been addressed; remaining are wavefront and structured reports for various modalities such as retinal nerve fiber layer and optic nerve head analysis that will be addressed. Other possibilities for consideration in the near future are an expanded scope for optical coherence tomography (angiography), and wide field imaging (corrected display).

Short-Term Objectives:

- Development of a Strategy to Enhance Utility of Supp 130 Ophthalmic Refractive Measurements Storage and SR SOP Classes Supplement
- Development of an Approach to Color Eye Model of the International Color Consortium Medical Imaging Workgroup
- Increase the Participation and Implementation of Vendors of DICOM Standards in Eye Care

Current Status:

- Final Text for Ophthalmic Photography Image SOP Classes Supplement
- Final Text for Ophthalmic Tomography Image Storage SOP Class Supplement
- Final Text for Ophthalmic Axial Length Measurements Storage SOP Classes Supplement
- Final Text for Structured Report Template for Reporting of Macular Grid Thickness and Volume
- Final Text for Visual Fields (OPV) Static Perimetry Measurements Storage SOP Class Supplement
- Final Text of Ophthalmic Thickness Map Storage SOP Class Supplement
- Final Text for Corneal Topography Map Storage SOP Class Supplement
- Final Text Approval of Wide Field Ophthalmic Photography Image Storage SOP Classes Supplement

Current Work Items:

- Structured Report Template for Ophthalmic Reporting of Retinal Nerve Fiber Layer and Optic Nerve Head Analysis

- Acceptance and development of Structured Reporting in the DICOM community for evidence documents and diagnostic reports. Also, determining the boundary between the DICOM domain and the enterprise domain for these structured reports and their encoding in DICOM SR and HL7 CDA.
- The rapid development of web-based distribution of healthcare information. Also, the clear positioning of DICOM in this respect.

Challenges and Opportunities:

Implementation of existing standardized objects in ophthalmic applications and devices is well on its way. While there has been heightened awareness of DICOM in the vendor and user communities, several vendors still do not participate in the standard development process or use the Standard in their products. This is because the companies are weighing the increased resource requirements versus the actual market demand and willingness to pay a higher price, and current regulatory requirements which do not specify DICOM, and deciding not to commit their resources to complete DICOM implementation. The requirements of clinical users and government agencies (users and regulators) for interoperability and compliance with the DICOM format will be the leading indicators driving the increased use of DICOM. The identification and communication of this requirement is important.

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WG-10 (Strategic Advisory)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
Secretary	Stephen Vastagh, MITA svastagh@medicalimaging.org
Manager, DICOM Operations	Luiza Kowalczyk, MITA lkowalczyk@medicalimaging.org
Co-chair	Greg Zeller, American Dental Association zellerg@ada.org
Co-chair	Kevin O'Donnell, Toshiba Medical Research Institute kodonnell@tmriusa.com

WG (Working Group) Profile
Last strategy update: 2016-12-01

Scope:

- Develop and maintain the long-term strategic plan of the DICOM Standards Committee (DSC)
- Consider issues and opportunities related to the strategic evolution of DICOM
- Propose issues/topics to the DSC or existing WGs and/or propose new WGs
- Provide liaison to other standards developing organizations (SDOs)

Current Supplements, Work and Objectives:

- No active workitems, supplements or CPs
- Revised Strategic Report template; rebuilding DICOM Strategic Document
- Maintaining SWOT (Strengths, Weaknesses, Opportunities, Threats) table for DICOM
- Supporting discussions on Chinese translation and testing of DICOM
- Supporting WG-29 to get DICOM website updated

Challenges and Opportunities (Environment):

- Industry focus on Health IT adoption, data portability, interoperability
- Popularity of cloud/web solutions; web-based image sharing
- Interest in analytics, mineable data and Deep Learning (image headers, SR, MPPS, etc)
- Leverage XML Editions; should we have a Value Sets Web Service?

- Concerns about security in healthcare IT
- DICOM communications/marketing is patchy/not pretty
  - Lack strong promotional direction (due to broad work and lack of long term goals/strategy/roadmap)
  - e.g. do DICOMweb now; it's "ready"; need strategy/campaign/plan
  - Don't harness MITA/COCIR well enough to promote DICOM/adoption
    - Request they report to DSC, e.g. plans to engage with ONC/epSOS, etc.
- Non-DICOM/non-medical solutions for web; see DICOM as "big iron"
  - Need strong education/promotion of DICOM-RS
- Low adoption in other -ologies (Endo, Dental, Path, …) & practice mgt SW

Future Roadmap and Objectives (Committee Direction):

- Explore a vision/"5-year-goals" for DICOM

Past Work:

- Supported establishment of DICOM WG-31 (Conformance)
- Renewed DICOM as ISO12052
- Fostered WG-20 review/CP process with WG-6
- Fostered WG-13 video proposal

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WG-11 (Display Function Standard)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
Secretary	Luiza Kowalczyk, MITA lkowalczyk@medicalimaging.org
Chair	Joe Luszcz, Philips joe.luszcz@philips.com

WG (Working Group) Profile
Last strategy update: 2016-12-01

Scope:

To develop DICOM services related to display and presentation.

Roadmap:

- Continue development of Volumetric Presentation States, such as for Surface Rendering and/or Curved MPR, after there is sufficient implementation experience in the use of initial Volumetric Presentation State offerings.

Short Term Goals:

- None planned, awaiting experience in the use of existing Volumetric Presentation States

Completed Work:

- Planar MPR Volumetric Presentation State (Sup 156, FT May, 2015)

Current Work Items:

- Multi-dimensional Presentation States, Supplement (2008-04-C)
    - Volume Rendering Volumetric Presentation State (Sup 190, LB May, 2016, awaiting FT review)

Risks:

Short Term

- Acceptability of initial Volumetric Presentation State objects that have no known implementations at this time.

Long Term

- Staffing – current membership is suspending participation in the working group

Challenges and Opportunities:

Challenges

- Maintaining expertise, champions, vendor and clinical participation.

Opportunities

- Foster the incorporation of volumetric presentation states into clinical use models.

Relationships to Other Standards:

- The Volumetric Presentation States are designed to use existing image objects for the representation of Cartesian volumes as input, such as CT Image, MR Image, PET Image, Enhanced CT Image, Enhanced MR Image, Enhanced PET Image, Enhanced US Volume, etc.

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WG-12 (Ultrasound)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
Secretary	Cheryl Kreider Carey, CAE, MITA ccarey@medicalimaging.org
Chair	Joe Luszcz, Philips Healthcare joe.luszcz@philips.com

WG (Working Group) Profile
Last strategy update: 2011-04-12

Scope:

WG-12's scope is to maintain and extend the DICOM Standard to meet the needs of the ultrasound and echocardiography specialties. This includes aspects of acquisition related workflow, exchange of acquired data consisting of images, 3D/4D data, and physiologic measurements, and other related matters.

Roadmap:

• In conjunction with WG-11, create 3D presentation state IOD(s) addressing, but not being limited to the following clinical needs:
    - Description of how rendered or multi-planar reformatted (MPR) views are obtained from 3D volume datasets (type of processing, viewport position and orientation relative to the volume, crop/slice planes, sculpting masks, etc.
    - Graphical and textual annotations in 3D space
    - Parameters describing usage of the Enhanced Blending and Display Pipeline (including Palette Color Lookup Tables, Opacity Lookup Table, switching parameters, etc.)

- Blending operations between/among multiple images of the same or different modalities

• Improve exchange of 2DUS data, addressing, but not being limited to the following clinical needs:
  - Per-frame calibration
  - Oblique spatially-related frames
  - Separation of data types like tissue, flow velocity, variance, etc.
  - Use of a media application profile including JPEG 2000 compression
  - More appropriate representation of time sequence data (e.g. M-mode, spectral Doppler, and Doppler audio)
  - Waveforms distinct from image

  This item includes the development of a 2D variant of Enhanced US Image as well as other IOD's for Doppler audio and waveforms and other time-sequenced data.

• Define 3D spatial coordinate references from Structured Reporting instances to spatial regions within referenced 3D volume datasets, and if appropriate, define a template for the exchange 3D-specific measurements in Structured Reporting.

• Create an ultrasound general imaging SR template (thyroid, abdomen, gallbladder, pelvic, etc.)

Short-Term Objectives:

• In collaboration with WG-11, develop a multi-dimensional presentation state supplement

Current Status:

• Supplement 43 (3D/4D) achieved Final Text in April, 2009.
• Supplement 78 (Pediatric Echo Structured Reporting) achieved Final Text in March, 2010.
• WG-12 has active relationship with the American Institute of Ultrasound in Medicine.

Risks:

• Lack of implementations of Supplement 43 that would exercise the new standard.

Challenges and Opportunities:

• Encourage adoption of Supplement 78 for fetal/pediatric/congenital and adult echo template and Supplement 43 for 3D/4D image exchange
• Potentially large size of 3D/4D data (particularly for Cardiology applications) and development of improved volumetric compression standards

Relationships to Other Standards:

• IHE, HL7, LOINC and SNOMED terminology

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WG-13 (Visible Light)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
Secretary	Cheryl Kreider Carey, CAE, MITA ccarey@medicalimaging.org
Co-Chair	Hideto Yokoi, Kagawa University Yokoi@med.kagawa-u.ac.jp
Co-Chair	Emmanuel Cordonnier, b<>com Emmanuel.CORDONNIER@b-com.com

WG (Working Group) Profile

Last strategy update: 2017-01-24

Scope:

To accompany the adoption of DICOM standards for still and motion Visible Light color images, produced by endoscopes, microscopes, or photographic cameras, and propose new DICOM standards if required, for creation and use.

Roadmap:

- To contribute to accelerate the adoption of the DICOM by Visible Light Users and Vendors.
- To enlarge (number of modalities) and enrich (quantity of information) the DICOM VL standard.
- To see if other topics must be specifically addressed around the existing standards (either in the Composite Information Objects – e.g. video compression, or in the Normalized Objects – e.g. Workflow management).
- To accompany the adoption of HD video by the medical arena, and its acceptation by the PACS community.

Short-Term Objectives:

- To develop the recently approved NWIP on Real Time Video
- To ascertain the need for the New Work Item on color management in VL applications by focusing on one such application first: endoscopy
- To continue to advise new IHE-Endoscopy domain.

Current Status:

- The NWIP on Real Time Video is at its initial stage.

Future Work Items:

- No new approved work item for the moment.

Risks:

- To develop a Real Time Video supplement which is not deployed by stakeholders, because too early and/or too difficult to implement.

Challenges and Opportunities:

- The emergence of a new approach enabling a better integration among equipment, based on IP in the professional video domain, driven by Video Service Forum in liaison which other SDOs (e.g. SMPTE).
- The need for a standard enabling communication of real time medical imaging information (e.g. fluoroscopy, ultrasound).
- The use of VL images is rapidly growing (non/less invasive surgery, advanced diagnosis, surgery monitoring...). All equipment is migrating from analog to digital technology, thanks to consumer multimedia technologies. Targeted modalities are Gastro-Enterology, Laparoscopy, Orthopedics, Ophthalmology, Ear Nose Throat, Gynecology, Bronchoscopes.
- The manufacturers and users are facing to the necessary integration with other equipment and information system, for quality, safety and efficiency objectives.
- The development of HD video contributes to generalize the digitization of the VL images and to make new requirements appearing in the use of images (e.g. creation and integration of small video clips integrated in

the patient record), which imply connection of VL equipment to the computerized environment, enabled by DICOM.
- However, for multiple reasons including the patient safety, the nature of application is very different than the radiology one, requiring new architecture and design, having significant impact on the use of DICOM.

Relationships to Other Standards:

- MPEG-2, ISO/IEC 13818, 1996
- MPEG-4 AVC, ISO/IEC 14496-10, H.264 ITU
- Blu-ray Disc Association (BDA)
- SMPTE

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WG-14 (Security)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
Secretary:	Stephen Vastagh, MITA svastagh@medicalimaging.org
Secretary:	Cheryl Kreider Carey, CAE, MITA ccarey@medicalimaging.org
Chair:	Lawrence Tarbox, PhD, University of Arkansas for Medical Sciences LTarbox@uams.edu
Chair:	Robert Horn, Agfa Healthcare robert.horn@agfa.com

WG (Working Group) Profile
Last strategy update: 2016-12-01

Scope:

- To develop extensions to DICOM that addresses the technical details of providing secure information exchange.

Current Supplements, Work and Objectives:

- No current supplements.
- Several CPs current being put forward by WG-6, some of which WG-6 may push back to WG-14.
- Updating, modernizing existing security sections in DICOM.
- Considering new work item for DICOMweb security.

Challenges and Opportunities (Environment):

- Mechanisms that are appropriate for one regulatory body are inappropriate for another.
- The mechanisms utilized become obsolete or broken.
- Clearly understanding the level of security required by local and governmental regulations.
- Resolving differences between seemingly conflicting regulations from different bodies.
- Specifying mechanisms that are easily incorporated and do not conflict with work done by other bodies.
- DICOM could be at the forefront of medical device security.

Future Roadmap and Objectives (Committee Direction):

- No current work items.

- Possible future work item to address security concerns with DICOMweb, including a Part 17 example of how to apply security in DICOMweb, possibly coming out at the spring committee meeting.
- The WG expects to leverage existing standards, insofar as possible. The WG has closely cooperated with HL7 in the past, and expect to continue to monitor what is happening in that space (e.g. FHIR).

Past Work:

- <move things here from the Current Work section when they are no longer "recently completed". Provides a sense of what the WG does/did> - leave the FT yyyy
- Supplement 31, FT 1999, specifying secure connections for networks.
- Supplement 41, FT 2000, specifying a general purpose Digital Signature mechanism. Was demonstrated at RSNA Inforad, winning an award.
- Supplement 51, FT 2000, addressing security on interchange media.
- Supplement 55, FT 2001, describing mechanisms for de-identification with possible re-identification.
- WG-14 was also consulted on security issues during the creation of Supplement 85, FT 2003, Web Access to DICOM Persistent Objects (WADO),
- Supplement 86, FT 2004, clarifying the use of the Digital Signature mechanism in Structured Reports.
- IETF RFC 3881, which provides the base message format used by Supplement 95 for audit trails, developed in conjunction with HL7 and ASTM, with input from IHE.
- Supplement 95, FT 2009, Audit Trail Messages, done in conjunction with the NEMA Security and Privacy Committee. This supplement was a frozen draft for several years before being finalized, to incorporate user experience from implementing audit trails within the IHE ATNA (Audit Trail and Node Authentication) profile.
- Supplement 99, FT 2004, Extended Negotiation of User Identity.
- Supplement 113, FT 2006, Email Transport. Note that WG-23 only provided suggestions regarding secure transport of e-mail to WG-6; WG-6 was responsible for creating this supplement.

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WG-15 (Mammography and CAD)

Secretariat	American College of Radiology
Secretary	Wil Creech, ACR wcreech@acr.org
Co-Chair	Dr. Judith Wolfman, Northwestern Memorial (ACR) jwolfman@nmff.org
Co-Chair	Janet E. Keyes, Hologic, Inc. Janet.Keyes@hologic.com

WG (Working Group) Profile
Date of Last Update: 2016-03-30

Scope:

To develop extensions to DICOM to support breast imaging and reporting thereof, including structured reporting of Computer-Aided Detection / Diagnosis (CAD) results.

Roadmap:

The following are potential work items with respect to Structured Reporting:

- Maintenance of the existing Mammography CAD, Chest CAD, Colon CAD and Breast Imaging structured reports and associated coded terminology, based on the ACR BI-RADS® Atlas.
- Extension of CAD objects to support new modalities and applications, such as CAD for breast tomosynthesis.

The following are potential work items with respect to Image IODs:

- Addition of attributes or modules to describe DX/Mammography quality control and phantom images.

Risks:

- Long term: Future extensions to Chest CAD SR are dependent on the clinical input received toward reaching consensus on a subset of chest radiography terminology to use in describing Chest CAD output results, and assignment of codes for that terminology.
- Roadmap: Requests for future work items will be dependent on the active participation of vendors and clinicians that perceive a need to expand the DICOM Standard in a specific area, and support of the Secretariat for those work items. Some items may require cooperation from other working groups.

Short Term Goals:

- Continue work with IHE Radiology Mammography subcommittee on Mammography integration profiles.
- Update Breast Imaging Report templates and context groups relative to ACR BI-RADS® Atlas Fifth Edition, including MRI Section.
- Maintenance of the Digital Mammography X-Ray Image IOD, Breast Tomosynthesis Image IOD, Breast Projection X-Ray Image IOD, Mammography CAD SR IOD, Chest CAD SR IOD, Colon CAD SR IOD, X-Ray Radiation Dose SR IOD (breast x-ray imaging content items) and Breast Imaging Report and Relevant Patient Information for Breast Imaging templates and context groups.

Current Status:

- Meets 2-3 times per year at the ACR in Reston, VA when active.
- Participation by members of the computer aided detection, digital radiography, and reporting system community, a well as clinical and research radiologists and ACR staff involved in mammography, chest, and abdomen radiography.

Current Work Items:

- None.

Challenges and Opportunities:

- Monitor future developments in breast imaging technologies, and the need to store and exchange resulting images and related information in DICOM.
- Monitor future developments in CAD research, particularly those that make the technology actively interactive with radiologists.

Relationships to other Standards:

- Use of American College of Radiology (ACR) BI-RADS® Atlas terminology as the basis of coded terminology for Structured Reporting for Breast Imaging
- Use of the Mammography Quality Control Manual 1999, available from the American College of Radiology (ACR), as a basis of coded terminology for the reporting of mammography image quality characteristics
- Use of the Mammography Quality Standards Act (MQSA) regulations, a federal regulation of the United States government, as a basis of coded terminology for the reporting of mammography image quality characteristics (21 CFR 900)
- American College of Radiology. ACR Standard for the Performance of Pediatric and Adult Chest Radiography. In: Standards. Reston, Va: 2001:95-98
- American College of Radiology. ACR Standard for the Performance of Pediatric and Adult Thoracic Computed Tomography (CT). In: Standards. Reston, Va: 2001:103-107

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WG-16 (Magnetic Resonance)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
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Chair	Wim Corbijn van Willenswaard, Philips Healthcare wim.corbijn.van.willenswaard@philips.com

WG (Working Group) Profile
Last Strategy Update: 2014-03-17

Scope:

The principles of the Enhanced MR object, developed in the 1999-2003 timeframe, had successive follow up by other modalities. The MR group pursues opportunities for further enhancement in the area of clinical interoperability for MR

Roadmap:

Currently there are two items that might result in new work-items. Intention is to form two subgroups each responsible for preparing a supplement. These are the Functional MRI area in cooperation with the QIBA group from RSNA. Second is the cooperation with WG24 (Surgery) on the standardization of DTI information which was originally only focusing on Fiber Tracks but is now extending to get full coverage of data needed.

Short-Term Objectives:

- Create work-items for fMRI and DTI extensions needed
- Make necessary revisions through CPs
- Promote the opportunities and the implementation of the Enhanced MR objects.

Current Status:

- IHE profile for CT/MR Contrast Perfusion is changed through a CP and tested during last US Connectathon with several different vendors for all actors.
- Enhanced MR Color object has been defined. It is not yet broadly supported in the field.
- Push acceptance of enhanced MR objects for ACR accreditation.
- Monitoring work items of other workgroups
    - Dimensional Presentation State
    - Injector record / Contrast Media Dose SR
    - Protocol standardization and exchange
    - New IOD for combining Classic objects into an Enhanced object
    - Registration of implants which will need extra information added to the MR objects.

Current Work Items:

- CPs, as they come from WG-06.
- Update first proposals of IHE profiles for Enhanced MR objects.
- fMRI standardization together with the fMRI technical committee of the QIBA organization

Risks:

- None

Challenges:

- MR applications are constantly being refined. A large number of defined terms have been standardized, but new terms should be added through CPs as soon as new techniques emerge in order to further support interoperability.
- Acceptance of Enhanced MR objects for the accreditation by the ACR
- Overall pressure on traveling increases the difficulty in getting approval for F2F meetings.

Opportunities:

- The fMRI and DTI discussion show that MR is getting more and more integrated in a workflow with other products and needs to work together with these products. The workgroup can explore if other usage of MR data is requiring further definition and integration of the data.

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WG-17 (3D Manufacturing)

Secretariat	MITA (Medical Imaging & Technology Alliance)
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User Co-Chair:	Justin Ryan, Research Scientist, Phoenix Children's Hospital jryan1@phoenixchildrens.com

WG (Working Group) Profile
Last strategy update: 2016-11-05

Rationale:

3D printing (also known as additive manufacturing or AM) is a technology that is seeing rapid adoption at medical institutions, with multiple applications directly related to patient care. There is a strong natural tie between 3D printing and medical imaging at these institutions, as the patient's cross-sectional imaging is often used as the primary input into the design of the object or to validate a proposed object's design relative to patient anatomy.

The Medical Imaging Technology Alliance (MITA) has been approached by members of the clinical community and software developers serving this community with concerns about gaps in interoperability. Of concern is that the DICOM standard currently does not well address a number of key specific needs of medical 3D printing's practitioners. This issue will grow further as in-progress and novel applications for 3D printing make the transition from medical laboratory to clinical practice. No existing DICOM work group appears to have a specific mandate or member expertise to fill this gap. Nor are standards efforts outside of MITA able to address this gap due to the DICOM standard being integral to the data exchange and workflows involved.

There is a risk that the 3D printing medical imaging standards void will be filled with compensating behavior by the clinical community. Specifically, this includes storing imaging-derived data separate from the patient's imaging record, without formal ties to the specific source imaging data. This is problematic for efficient patient care. Additionally, in some cases such "workarounds" could represent a patient safety risk due to increasing the likelihood of wrong patient errors involving custom guides and implants. This is a risk that can be greatly reduced simply by

leveraging the mature and well designed approaches already well-established in imaging systems via the DICOM standard.

The quality and utility of the DICOM Standard will benefit from a Working Group of experts drawn from the medical 3D printing community (both end users and industry), working in tandem with medical imaging experts who are familiar with the nature and structure of DICOM.

Additional Context:

For those who are unfamiliar it, 3D printing is an area of technology whereby a physical object is created by constructing it in an additive manner. That is, the object is created from 3D model data by depositing a miniscule amount of material in a specific location where it is required, leaving the other portions of the build volume empty of permanent material, repeating this thousands of times at other locations, all in a manner that allows the deposited material to fuse to any adjacent material. This additive manufacturing process is typically done layer by layer, with each layer resembling the output of an inkjet printer. Thus, "3D printing" has come to be the common description of the process.

The 3D printing process differs substantially from traditional manufacturing techniques such as milling (removing unwanted material from a larger block) and forming (filling a pre-formed mold with liquid material that hardens within it, prior to the mold being removed). The primary difference is that 3D printing economically addresses the need to create uniquely designed but precisely defined objects, with few limits on external or internal complexity.

3D printing may performed using a variety of materials. These include polymers (both biocompatible or not), ceramics, metals (including implantable titanium), and cells.

Current uses of 3D printing in medicine are myriad, with the most common being creation of:

1. Patient-specific anatomical models for patient education, surgical simulation, or surgical planning
2. Patient-specific implants or implant mount adaptors (including temporary scaffolds for tissue/bone growth)
3. Patient-specific external prosthetics or mount adaptors (including casts)
4. Patient-specific interventional instrument guides
5. Improved test phantoms for medical device calibration/validation
6. Patient-specific artificial organs and tissue
7. Custom laboratory equipment
8. Replacement components for instruments

Items 1 to 5 above are directly relevant to DICOM as medical images are typically the primary data source guiding the shape and dimensions of the printed objects. Item 6 may have relevance, related to sizing and validation of surgical plans. Items 7 and 8 are likely to remain out of scope (see *Scope* definition below).

Scope:

The WG would operate on the following general mandate:

- Extend and promote the use of DICOM for the creation, storage and management of 3D printing models in a healthcare setting, where the model is either (a) derived from medical images, or (b) expected to be compared / composited with medical images

Within this mandate the WG would have the following specific scope of activities:

- Identify and maintain a roadmap of use cases and compatibility concerns that should be addressed (see *Roadmap* below)
- Develop or consult on relevant change proposals (CPs) and Supplements
- Serve as a *liaison* body between the multiple stakeholder groups involved
  - Clinical end-users of 3D printing
  - Vendors offering 3D modeling and printer control software for healthcare applications
  - Vendors of medical image acquisition, processing, and management (i.e. existing MITA members at this point)
  - Standards and professional organizations addressing 3D printing in general (e.g. SME, AMI)
- Facilitate including data relevant to the 3D printing imaging community in DICOM objects

- Provide best practice guidance and reference implementations to promote the use of DICOM in 3D printing applications
    - In particular, ensure that 3D printing vendors entering the medical domain find it easy to adopt the standard (and encourage such vendors to participate in MITA)

Roadmap:

The WG-XX roadmap is based upon the analysis of the 3D printing data and workflow needs through a standard framework. The results of this analysis would then be used to specify information objects and services needed to best serve patients and the imaging-based 3D printing medical community.

As much as possible and compatible with DICOM guiding principles, the new specifications this would be proposed in a manner to (a) leverage the existing and growing ecosystem of DICOM-capable systems in use in healthcare institutions and (b) leverage standards already in use in the 3D printing industry.

The ultimate goal is a comprehensive, standards-based digital platform for 3D printing in the patient care setting, of which DICOM-based imaging would be a significant part.

Short-Term Objectives:

- Establish and organize the new workgroup
- Establish a working relationship with:
    - SME industry association's AM/3DP work group
    - RSNA's 3D printing Special Interest Group
- Establish a working relationship with other DICOM Work Groups currently responsible for related Information Object Definitions (IODs): Computed Tomography, Magnetic Resonance, Encapsulated PDF, and Secondary Capture
- Propose a new IOD, with references to existing IODs, to address the two already identified highest priority needs of the medical 3D printing community
    - Store 3D printing models in the Picture Archiving and Communication Systems (PACS) and Vendor Neutral Archive (VNA) systems in a manner that allows direct association with the relevant patient (and any source images from which the model was derived)
    - Allow for clinical users to review 3D printing models in the context of relevant patient images, prior to printing
- Perform further gap analysis of the existing DICOM standard with respect to potential 3D printing requirements (e.g. intermediate segmentation representation)
- Establish priorities for filling gaps identified

Current Status:

- Proposal of formation.

Current Work Items:

- New IOD for 3D printable models (see Short-Term Objectives above)

Risks:

- 3D printing community is eager for fast progress.
    - Slow progress may result in DICOM proposals being ignored by non-standard, workarounds that become entrenched but hamper interoperability (e.g. private element embedding in secondary capture objects)
- Might not be able to recruit enough 3D printing stakeholders.
    - However, current level of enthusiasm for a standards-based approach in both end-user and vendor community appears high.

Challenges and Opportunities:

- The current level of enthusiasm for a standards-based approach in both end-user and vendor community appears high. Moving quickly to put the WG in motion can leverage this to address both risks above
- There are a number of competing native data format standards for high fidelity 3D models outside of medicine, and no "lingua franca" appears to be developing in the near term
    - Different vendors and end-user communities favor different data formats as their primary working one
    - DICOM would need to take fairly neutral approach with respect to working with these data formats (suggesting an encapsulation approach, similar to what was done with PDF)
    - The STL data format, although older and limited, is near universally supported and thus may be leveraged as a baseline, to maximize interoperability
- A 3D shape visualization capability of PDF is used at many institutions as part of the preview workflow
    - This appears to be compatible with DICOM PDF encapsulation IOD as it exists today
- Unlike the case with medical printers, there appears to be no good case for DICOM directly support communicating with 3D printers themselves
    - There exists a final stage of preparing a 3D model for a specific printer's capabilities and build material options before initiating printing
    - This final stage is already well addressed by vendors in this space and has no dependency on whether the object to be printed is related to a patient or is for some other purpose
    - DICOM's scope can thus stop after delivering a 3D model to this final prep software
- Many institutions have extended their 3D visualization labs to encompass 3D printing requests from clinical staff
    - This presents a community with knowledge of other DICOM-enabled workflow that could be leveraged for WG activities.

Relationship to Other Standards:

- As explained above, a goal of the WG would be to allow for direct compatibility with existing file format standards of the larger (i.e. non-medical) 3D printing community and industry. The most commonly used non-proprietary file format standards for 3D printing are:

    - **G-CODE**: The G-CODE (RS-274) file format provides the typical means by which precise instructions are sent to 3D printer hardware to construct each layer of the model. Thus, is it mainly used as a final step representation intended for a specific printer, loaded with specific consumable materials. This is typically produced from STL (see below).

    - **STL**: The stereolithography (AKA standard tessellation language) file format is essentially the lingua franca of 3D printing. While lacking many of the more advanced concepts of other later formats and being very verbose, its simplicity and longevity has allowed it to become the most common format for interoperable exchange of designs between various pieces of 3D printing software, whether medically-oriented or not.

    - **VRML**: Virtual Reality Modeling Language (ISO/IEC 14772-1:1997) is favored by some software for its ability to represent structures at a more abstract object-oriented level than STL. Use of VRML has in many cases been superseded by X3D (see below). VRML is often used as an intermediate precursor to STL creation.

    - **X3D**: As defined by ISO/IEC 19775/19776/19777, X3D is an XML-based format built as an extension of VRML/WRL, to address more advanced concepts. It is favored by some software for its ability to represent structures at a more abstract object-oriented level than STL. However, many of its concepts (e.g. lighting control) are aimed more at creating 2D projection images than physical objects. X3D is often used as an intermediate precursor to STL creation. X3D is in current use at the NIH for medical 3D printing.

    - **AMF**: The Additive Manufacturing File Format (ISO/ASTM 52915:2013) is a relatively new XML file format gaining in use in the 3D printing community. Unlike STL, VRML and XML, AMF was designed with the intent to specifically to address 3D printing. AMF is favored by some software for its ability to represent structures at a more abstract object-oriented level than STL and also describe materials. While it is sometimes used as an intermediate precursor to STL and/or G-CODE creation, but some 3D printers are

now able to use AMF directly, obviating the need for use of these other formats. There is currently active debate within the community as to whether AMF or 3MF (see below) should supplant STL as the new lingua franca of 3D printing.

- **3MF**: A competing file format to AMF with much the same capabilities, but much more compact in file size. Invented by Microsoft, it is now published and promoted by a multi-vendor consortium. Like AMF, some 3D printers are now able to use 3MF directly, obviating the need for use of these other formats. There is currently active debate within the community as to whether AMF (see above) or 3MF should supplant STL as the new lingua franca of 3D printing.
- **PDF (U3D)**: The Portable Document Format with 3D extension (supported in Adobe 8 and above) is used to allow medical staff to preview 3D models prior to printing, without recourse to platform-specific specialty software. It is not possible to use this format to actually produce a 3D printed object. In the 3D printing context its only purpose is preview. This format should be compatible with the existing DICOM Encapsulated PDF IOD, but the current lack of reference to source images in that IOD is a concern (that could be addressed in a manner similar to *CP 1559 "Reuse reference mechanisms from General Image Module in other contexts"*).

- The potential future roadmap could involve representation of intermediate segmentation steps. This may touch on standards beyond those listed above and/or involve harmonization/extension of existing DICOM IODs related to 3D visualization

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WG-18 (Clinical Trials and Research)

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WG (Working Group) Profile
Last strategy update: 2015-12-03

Scope:
To extend the DICOM Standard to support clinical trials and research using images.

Roadmap:
- Continue to evaluate issues related to performing clinical trials and research using images.

Short-Term Objectives:
- Improve support for encoding of images and image-like objects for research results
- Improve structured reporting and segmentation support for clinical trials results and measurements.

Current Status:
- The work item to define a new IOD and SOP Class to support the encoding of floating point parametric maps has recently been completed and is now final text (Sup 172)
- Various CPs processed directly by WG 6 have improved the encoding of quantitative results for general purposes (including structured reporting and segmentation support for clinical trials results and measurements)

Current Work Items:

- No current work item.

Risks:

- Other groups will develop "standards" related to the performance of clinical trials that are incompatible with DICOM and hence exclude clinical production systems from use in such trials.

Challenges and Opportunities:

- Improve the utility of the DICOM standard for research and clinical trials.
- Broaden the participating members of the working group among workstation vendors and regulatory agencies.
- Reach out to other industry groups such as research quality assurance firms and software engineering organizations.
- Improve cross-fertilization among our group and other DICOM Working Groups

Relationships to Other Standards:

- A strong informal relationship exists between DICOM participants and other bodies involved in clinical trials and research, such as NCI, ACRIN, QIN and QIBA, as well as specific academic projects such as QIICR.
- Common membership with DICOM WG 6 and WG 30 Small Animal Imaging assures harmonization between these related activities

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WG-19 (Dermatology)

This working group is not currently active.

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WG-20 (Integration of Imaging and Information Systems)

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Co-Chair	Elliot Silver, Change Healthcare elliot.silver@mckesson.com

WG (Working Group) Profile
Last strategy update: 2016-12-01

Scope:
Development of DICOM and HL7 standards for image-related information for areas where the consistent use of HL7 and DICOM is of prime concern, and for the coordination and mutual education and understanding between the HL7 and DICOM organizations and their technical committees/working groups.

Roadmap:

- Continued engagement in aligning FHIR and DICOMweb standards to ensure interoperable handoffs
- As previously mentioned, FHIR continues to attract great interest. Working with HL7 to develop FHIR resources and profiles will (a) strengthen the inter-standard cooperation perception, and (b) allow us to ensure

that the next generation of HL7 standard has strong support for DICOM imaging. DICOM should try to leverage the focus FHIR is receiving to direct attention on our own modern RESTful offering (DICOMweb).

Short-Term Objectives:

- Modeling DICOM concepts in the HL7 Reference Information Model.
- Participation in HL7 Version 4 development to maximize compatibility between HL7 and DICOM.

Current Status:

- In an effort to increase inter-standard alignment, HL7 II updated their Decision Making Process at the May 2016 WGM to include a process for notification of imaging-related HL7 standards to WG-06. WG-20 has been added as a recurring agenda item for WG-06 to raise awareness of the cross-organizational developments.
    - During the summer 2016, notification for HL7 FHIR STU3 was distributed to the WG-06 group.
    - During the November 2016 WG-06 meeting, WG-20 presented an overview of current work products
- Market, clinical, and regulatory interest in FHIR continues to grow. Synergy exists between IHE Radiology, FHIR, and DICOM.
- With the decline of Meaningful Use, and other changes to the regulatory environment, interest in advancing diagnostic imaging reporting CDAs may be limited.
    - This may impact attempts to get endorsement of PS 3.20 with HL7
- FHIR development of resources, profiles, and workflows
- Development of IHE Profiles WIC, MHD-I, and RRR-WF.
- HIMSS-SIIM Enterprise Imaging Workgroup and IHE RAD are laying groundwork for an Encounter-based Imaging Workflow IHE profile, which may require changes in DICOM.
- General interest in RESTful APIs (specifically, FHIR), and corresponding decrease in interest of alternate approaches, may increase demands on DICOMweb. This is especially noted in a rising interest in “mobile” solutions which combine FHIR with imaging.

Current Work Items:

- No active DICOM work items
- HL7 Work Items (link)
    - Project 1107: Develop imaging-related FHIR resources for the second DSTU release
        - Complete
    - Project 1230: HL7 Endorsement of DICOM PS3.20: Imaging Reports using HL7 CDA
        - On hold awaiting resources and HL7 project approval
    - Project 1106: HL7 Comments on DICOM Supplement 155
        - Complete
    - Project 1231: FHIR Document Sharing (co-sponsor)
        - On-going. Low WG involvement
    - Project 862: Unique Specimen Identifier Requirements (co-sponsor)
        - On-going. Low WG involvement
    - Project 682: Specimen CMET Second Release (co-sponsor)
        - On-going. Low WG involvement.
    - Expected project proposal for FHIR release 4 work.

CPs:

- No active DICOM CPs
- HL7 FHIR CPs (link)
    - 3753. ImagingStudy doesn't have good enough examples
    - 10273. Add search by ImagingStudy to ImagingManifest
    - 10350. Add "standard" event elements to ImagingStudy
    - 10351. Update ImagingManifest with latest workflow standard elements
    - 11199. Suggest consider include "performer" (will accept inclusion as extension to the resource) - 2016-09 core #353
    - 11283. Definition of ImagingStudy.baseLocation and its children - 2016-09 core #437
    - 11284. radiology services - 2016-09 core #438
    - 12235. Update ImagingStudy to use new Endpoint resource

- 12236. Update ImagingManifest to use new Endpoint resource

- 9253. Add DICOM mappings for Patient
- 9254. Add DICOM mappings for DiagnosticOrder
- 9255. Add DICOM mappings for Practitioner
- 10081. Add mappings for DICOM PN (person name) to HumanName datatype
- 10082. Add mapping for various DICOM IDs/Issuer of IDs to Identifier datatype
- 12262. Add DICOM mappings for Address
- 12263. Add DICOM mappings for ContactPoint
- 12264. Add DICOM mappings for Device
- 12265. Add DICOM mappings for DiagnosticReport
- 12266. Add DICOM mappings for Encounter
- 12267. Add DICOM mappings for EpisodeOfCare
- 12268. Update DICOM mappings for ImagingManifest
- 12269. Update DICOM mappings for ImagingStudy
- 12270. Add DICOM mappings for Organization
- 12271. Add DICOM mappings for Procedure
- 12272. Add DICOM mappings for Substance

- IHE CPs (link)
  - RAD-314: Addressed issues with ImagingManifest (formerly known as ImagingObjectSelection)

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WG-21 (Computed Tomography)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
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Chair	Reinhard Ruf, Siemens AG Healthcare Reinhard.Ruf@siemens.com

WG (Working Group) Profile
Last strategy update: 2011-04-19

Scope:
To develop and maintain the CT-specific objects for the DICOM standard in the domains of nD X-Ray imaging, technical reports, dose information and clinical information, which accompany a patient general X-ray procedure. These include (but are not limited to) acquisition, processing, storage, communication, display and reporting. The CT group pursues opportunities for further enhancements in the area of clinical interoperability for CT.

Roadmap:
- The WG-21 roadmap follows a long-term strategy to specify information objects and possibly services to digitize and integrate the data flow within a CT oriented Radiography and Angiography environment.

Short Term Goals:
- Identify opportunities to cooperate with Working Group 11 (nD Presentation State).

Current Status:
- CT Dose Report has got a few change proposals, ongoing work (CP 1047 Dose Check support in DICOM CT Radiation Dose Report)

Current Work Items:

- None

Challenges and Opportunities:

- Encourage clinical users and vendors to participate in finding solutions.

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WG-22 (Dentistry)

Secretariat	American Dental Association (ADA)
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WG (Working Group) Profile
Last strategy update: 2016-12-01

Scope:

To address all issues relating to the DICOM Standard for dental and maxillofacial applications including imaging and use of imaging in diagnosis, treatment simulation, treatment guidance, and tissue restoration using CAD/CAM. These include (but are not limited to) ordering, acquisition, processing, storage, communication, display and reporting.

Future Roadmap and Objectives (Items discussed but not seen as a current WG22 priority):

- Implant treatment guidance
- Surgical workflow issues in dentistry
- Multi-dimensional presentation states;
- Add "DICOM Implementation of Color in Dentistry" (ICC) or Enhanced Color Mapping in Dentistry

Current Supplements, Work and Objectives:

- DICOM CP 1455 Add Dose Area Product to CT Image IOD

Reviewed by WG 6 and included in CPack 89 for addition to the DICOM Standard, most likely included in 2017a.

- DICOM CP1570 Add Dental Acquisition Context Group to the Visible Light Image Module

Reviewed by WG 6 with revisions. WG6 recommended additional work on the optical path module attributes. This is a larger issue than dental and WG6 recommend that it be taken out of CP1570 and this work is now being tracked under CP1669.

- DICOM CP1571 Add Orthodontics and Forensic Odontology view sets to Structured Display

Reviewed by WG 6 with revisions. WG 6 requested for a table reformat and other minor revisions then it should be able to move forward.

Challenges and Opportunities (Environment):

- Encourage vendors to participate in finding solutions.
- In the general Radiography and Angiography lab environment already various non-image data exist and need to be exchanged to assure flow of information. The different departments are increasingly switching to digital communication and rely on implementation of Standards.

Near Future Roadmap and Objectives (Current Committee Direction):

- 3D optical surface scan
- CAD/CAM Prosthetic Value Chain
- Coordination with WG 28 on Universal Radiation Dose Structured Report (RDSR)

Discussion of 2017 priority. To initiate development of the 3D optical surface scan with ADA support and harmonization with SCDI/SCDP and ISO/TC 106. (Development of DICOM transport of 3D optical surface scan in conjunction with ISO TC/106, ADA SCDI and ADA SCDP as an integral part of the CAD/CAM prosthetic value chain.

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WG-23 (Application Hosting)

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Industry Co-Chair	Gianluca Paladini, Siemens Healthineers gianluca.paladini@siemens.com

WG (Working Group) Profile
Last strategy update: 2016-12-01

Scope:

- To develop DICOM specifications for interfaces between hosted application software and a DICOM host system.

Current Supplements, Work and Objectives:

- No current supplements.
- Outstanding work item regarding an abstract model for structured reports.
- Several suggested new use scenarios for a mechanism like Application Hosting.
- Strong desire to use more modern, simpler technology in Application Hosting, leveraging work done in DICOMweb.

Challenges and Opportunities (Environment):

- Ensuring that Application Hosting is of sufficient interest to the potential contributors to maintain active participation by experts, champions, vendors and clinical users.
- Requests for future work items will be dependent on the active participation of vendors and clinicians that perceive a need to expand the DICOM Standard in a specific area.
- Some items may require cooperation from other working groups, including WG-11 (Display), WG-17 (3D), WG-18 (Clinical Trials and Education), WG-27 (DICOMweb), all of the modality-specific working groups, and the HL-7 FHIR working group.
- Work may require shifts in the scope of the working group.
- Staying focused on the task at hand.
- The mechanisms utilized could become obsolete or broken.
- The technological landscape is constantly shifting, with various tools falling in and out of favor

- Regulatory issues may limit the clinical utility of the Standard.
- Specifying mechanisms that are easily incorporated and do not conflict with work done by other bodies.
- Potential Intellectual Property issues.

Future Roadmap and Objectives (Committee Direction):

- An existing work item to create an abstract model for structured reports may be reconsidered.
- Continued monitoring of potential.
- The WG expects to leverage existing standards, insofar as possible. The WG has closely cooperated with HL7 in the past, and expect to continue to monitor what is happening in that space (e.g. FHIR).

Past Work:

- Supplement 118 FT 2009
- Application Hosting was included in the IHE Post Processing Work Flow (PPWF) profile.

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WG-24 (DICOM in Surgery)

Secretariat	Computer Assisted Radiology and Surgery (CARS)
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Chair	Heinz U. Lemke, PhD, International Society for Computer Aided Surgery hulemke@cars-int.org

WG (Working Group) Profile
Last strategy update: 2014-10-02

Scope

"To develop DICOM objects and services related to image guided surgery (IGS)".

Roadmap

1. Identify and build up a user community of IGS disciplines in WG-24. Initially five surgical disciplines (Neuro, ENT, orthopaedics, cardiovascular, thoracoabdominal) and interventional radiology are selected. Anaesthesia is included as long as surgery is affected.
2. Encourage experts from vendor and academic institutions to join WG-24. Vendors of endoscopic and microscopic devices as well as implants (templates) should be included in addition to the classic vendors of medical imaging and PACS.
3. Compile a representative set of surgical workflows (with a suitable high level of granularity and appropriate workflow modeling standards and surgical ontologies) as a work reference for the scope of WG-24. Initially, 3-5 workflows, characteristic for each discipline, should be recorded with sufficient level of detail. Workflow tools can be provided by the Innovation Center Computer Assisted Surgery, Leipzig, Germany.
4. Derive potential DICOM services from these surgical workflows.
5. Design an information/knowledge model based on electronic medical record (EMR) related work and identify IOD extensions to DICOM. Because of similarities to the IHE activities, a close relationship to IHE should be established.
6. Take account of the special image communication (1D - 5D) requirements for surgery and mechatronic devices. A close cooperation with WG-02 and WG-17 should be established.

7. Work in close cooperation with DICOM experts from radiology, cardiology, radiotherapy and related fields which are represented in other DICOM working groups.
8. Encourage close cooperation with working groups in the International Society for Computer Aided Surgery (ISCAS), Japan Institute of CARS (JICARS), German Society for Computer- and Robot-Assisted Surgery (CURAC), European Federation for Medical Informatics (EFMI), European Association for Endoscopic Surgery, American College of Surgery, International Society for Surgery, International Foundation of Computer Assisted Radiology and Surgery (IFCARS), etc.
9. Disseminate knowledge gained following the roadmap through workshops, conferences and special seminars. Special presentations should be planned each year for CARS, RSNA, DICOM-Meeting, and at a minimum for one surgical conference.
10. Connect to integration profiles specified in existing IHE Domains or in an IHE Domain in surgery (still to be determined).

Short Term Goals

1. Specify the scope of WG-24 relating to intra- and peri-operative workflows, in particular to managerial and clinical decision support for the digital operating room (DOR).
2. Consolidate the relatively large number of interested individuals of WG-24 into effective project groups.
3. The following project groups (PG) have been established:

   PG1 WF/MI Neurosurgery
   PG2 WF/MI ENT and CMF Surgery
   PG3 WF/MI Orthopaedic Surgery
   PG4 WF/MI Cardiovascular Surgery
   PG5 WF/MI Thoracoabdominal Surgery
   PG6 WF/MI Interventional Radiology
   PG7 WF/MI Anaesthesia

   PG131 Supplement 131: Implant Templates
   PG132 Supplement 132: Surface Segmentation
   PG134 Supplement 134: Implantation Plan SR Document

4. Have two WG-24 meetings per year scheduled for CARS and RSNA.

Current Status:

- A surgical PACS related IT meta architecture named Therapy Imaging and Model Management System (TIMMS) has been established. It serves as a reference for the identification of interfaces of IT systems which handle images and models for the purpose of surgical interventions.
- Supplement 132 Surface Segmentation has been accepted as a DICOM standard.
- Supplement 131 Implant Templates and Supplement 134 Implantation Pan SR Document are current work items and are expected to pass the public comment phase during 2010.

Work Items in Preparation

The following entities are being discussed with respect to their relevance as DICOM work items:

- Coordinate Systems
- Extension of Point Clouds by Colors, Properties and Observable Entities
- IOD Optical Surface Scans
- DICOM Workflows and Surgical Workflows

Risks:

- The complexity of surgical workflows (absence of good/best practice surgical procedures) render the implementation of a surgical PACS or TIMMS and the definition of DICOM objects and services a difficult task. To establish a balanced “voice of surgeons” in different surgical disciplines may require risky compromises and may not be achievable.

Challenges and Opportunities:

Challenges

- IGS takes on very different forms between the surgical disciplines. It is important to include the right spectrum of users from different fields of surgery and associated disciplines into WG-24. In order to reduce image communication and management functions from the different IGS disciplines to a canonical set suitable for DICOM supported services, it requires not only analytical but also innovative work.

  This innovative work relates mainly to the way images from different modalities and other information entities of the patient are integrated into a multi-dimensional model of a specific patient (PSM) as well as the management of these models. Realizations of appropriate PSMs are the basis of a model-guided therapy (MGT) which is in effect what many surgical settings are practicing in training and in their actual activities in the OR.

  It is therefore also important to include the right spectrum of experts from vendor and academic institutions into WG-24. An additional challenge is to achieve the above on an international level.

- Workflows for surgical procedures need to be integrated within the overall workflow of patient care, with the aim to integrate the ICT (Information and Communication Technology) island of the OR with the rest of the hospital. Contrary to many other health care activities, a generally accepted surgical ontology and good/best surgical workflow practices are not available to serve as a basis for the activities of WG-24. Links to appropriate R&D activities as well as to IHE activities relating to integration profiles supporting clinical workflows need to be and have been established.

Opportunities

- The digital operating room is becoming a reality. The market potential for those institutions which bring into the OR digital systems (e.g. a surgical PACS) which conform to standards, such as a suitable DICOM extension, is extremely high.
- Last but not least, patients will benefit from every step taken towards an EMR (Electronic Medical Record) which is embedded in a standard DOR infrastructure.

Relationship to other Standards and Standard Bodies

1. Geometric models (stl, vtk, …)
2. X-ray-dose
3. anaesthesia protocols / measurements
4. Electronic patient record (IEEE/ISO 11073 part 5&6)
5. DICOM working groups
6. ISO 182 /SC2 Robots and Robotic Devices in Surgery and Medicine
7. IHE

Miscellaneous

Any comments referring to the Strategic Summary of WG-24 should be mailed to the general chair (hulemke@cars-int.org) of WG-24.

Glossary:
CMF – Cranio-Maxillofacial
DOR – Digital Operating Room
EMR – Electronic Patient Record
ENT – Ear, Nose and Throat
ICT – Information and Communication Technology
IGS – Image Guided Surgery
IOD - Information Object Definition
IPD – Image Processing and Display
MGT - Model-guided Therapy
MI – Medical Imaging
PSM – Patient-specific Model

S-PACS – Surgical PACS
TIMMS - Therapy Imaging and Model Management System
WF - Workflow
WFMS – Workflow Management System

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WG-25 (Veterinary Medicine)

Secretariat	ACVR
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Co-Chair	William Hornof, DVM, MS, Sound-Eklin (a VCA Company) wjhornof@eklin.com

WG (Working Group) Profile
Last strategy update: 2010-11-29

Scope:
To develop DICOM attributes and workflow-related modifications to support identifying and describing veterinary patients, and to develop the nomenclature necessary to support hanging protocols.

Roadmap:
- Define necessary tag/attribute information to allow storage of information in DICOM image headers pertaining to breed, species, neutered state, owner, positioning, body parts, and other unique veterinary patient information as identified by the committee.
- Coordinated education and demonstration projects for vendors and users are essential to achieve broad adoption of the standard in veterinary medicine. Other activities not yet planned.

Short Term Objectives:
- Develop diagrams to support positioning and orientation definitions.
- Work with veterinary IHE implementations as issues arise.

Current Status:
- No CPs under current consideration

Current Work Items:
- None

Long-term Objectives:
- Maintain breed and species code lists.

Challenges and Opportunities:
- DICOM has become a well-accepted standard in veterinary medicine. Most companies in the market must support DICOM or be considered non-viable. A vendor-neutral “showdown” is held annually to assess DICOM file conformance, and CStore capability.
- Maintaining broad participation and focus is an ongoing challenge.

- WG 25 recognizes that there could be numerous advantages of using SNOMED CT breed terminology, but the DICOM Standard uses RT terminology. We hope to find an opportunity to incorporate CT concepts into areas of the standard that can benefit from them.

Risks:

- Veterinary DICOM structures could diverge from other standards (HL7, SNOMED) if careful study of these other standards is not pursued in conjunction with this process.
- User lack of understanding could slow development and adoption of standards.

Relationships to Other Standards:

- HL7 (Section 3.1.1, specifically 3.1.1.35 – 3.1.1.38, and 3.1.2) includes tags related to species, breed, and production use.
- SNOMED contains classifications of species, breeds, and anatomic structures.
- ISO in conjunction with HL7 manages organization UIDs

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WG-26 (Pathology) Strategy

Secretariat (U.S)	College of American Pathologists (CAP) – U.S. meetings
Secretary	Doug Murphy, CAP dmurphy@cap.org Kelly Westfall, CAP kwestfa@cap.org
Secretariat (Europe)	Sociedad Española de Informática de la Salud, (SEIS) – European meetings
Secretary	Marcial García Rojo marcial@cim.es
Co-Chair	Dan Hosseinzadeh, PathCore Inc dan.zadeh@pathcore.ca
Co-Chair	Mikael Wintell mikael.wintell@vgregion.se

WG (Working Group) Profile
Last strategy update: 2016-12-01

Scope
To extend the DICOM Standard to support Pathology images (including cytopathology, surgical pathology, and clinical pathology and autopsy pathology studies). Specific actions are related to:

- Technical standards to facilitate pathology image acquisition, display, transfer and storage. The group will be responsible for formulating components of the DICOM Standard that relate to imaging in the domain of Pathology. The primary focus will be digital formats for clinical imaging, but digital imaging for research applications may also be addressed as appropriate. This would include, for example, conventional imaging, whole slide microscopic imaging, micro-array imaging, flow cytometric "imaging", and molecular "imaging". Multi-spectral imaging shall be addressed in the context of how to properly handle the cross-channel dependencies.
- Issues related to specimen and patient identification and workflow integration. The group will address improving the information model for subject identification and workflow integration within DICOM. This is required to account for the specimen-driven nature of the subject in pathology, which differs from the

primarily patient-driven model in radiology. The goal is a common model shared between DICOM and other Electronic Medical Records standards, such as HL7, that will facilitate consistent specimen identification from acquisition through analysis and reporting.

- Development of standards for integrating images and derived information into pathology reports. These include image annotation, templates for common image-based measurements and analyses, and integration of image-based information with textual and coded pathology report information, including structured pathology reports. Some of these activities may overlap with other standardization groups such as IHE and HL7, e.g. HL7 AP SR, and the group is responsible for coordinating such efforts with the respective counterparts in such groups.
- Special technical issues specific to these application domains. These include compression of multi-gigabyte imagery, as well as efficient whole slide microscopic image browsing, microscopic image analysis etc. This could also include methods for correlating clinical images (radiologic PET/CT, endoscopy, etc.) and pathology images as well as potential workflow integrations related to those.

Roadmap

The WG-26 roadmap is based upon the analysis of the pathology workflow through the IHE framework to specify information objects and services to fully digitize and integrate data flow from different imaging systems within the pathology department. The ultimate goal is a comprehensive, standards-based digital platform for pathology practice, of which DICOM-based imaging is a significant part.

To be useful in the clinical environment, such a standards based digital platform must support:

- A wide range of diverse imaging approaches and systems,
- Strong interactions between said systems,
- Integration of "tissue processes" (such as histology) and "imaging processes",
- Tight consultation between health care providers,
- Correlation of image, textual, coded, and numeric medical data (clinical imaging, …)
- Efficient Analysis and Retrieval functionalities

Standardized interchange of correlated data is critical in this environment. There are important distinctions among:

- Acquisition and primary processing of image data in image capture systems,
- Distribution and sharing of image data among multiple systems, within and across enterprises,
- Creation of image-based analysis data and reports in workstations and software packages, and
- Persistent archive.

This group will focus on better defining the data exchange environment among these domains.

Short-Term Objectives

The WG-26 work effort will be directed toward:

- Definition or extension of DICOM information object definitions for pathology:
    - Framework to properly handle multi-spectral information in WSI
    - DICOM Worklist procedures and procedure steps for:
        - Requesting and staining glass slides
        - Requesting and scanning WSI
    - Investigation and analysis of how flow-cytometry data could be standardized, working with ISAC and ICCS.

Completed Work

- Supplement 145 to the DICOM Standard providing for "Whole Slide Microscopic Image IOD and SOP Classes" was formally approved in 2010.
- Supplement 145 to the DICOM standard introduces an SOP class for WSI
- Supplement 122 to the DICOM Standard providing for "Specimen Module and Revised Pathology SOP Classes" was formally approved in 2008.
- The Specimen Module has been harmonized with the HL7 v2 SPM segment and the HL7 v3 draft Specimen Domain Information Model.
- Supplement 122 to the DICOM standard introduces a new mechanism of pathology specimen identification and revisions to composite Information Object Definitions to use that mechanism.

Current Work Items:

- 2016 Basic Workflow Pathology Domain
- 2016 Supplement 145 Patent issues
- 2016, Structure Report Template for pathology
- Coordinating with IHE/HL7 AP in workflow

Risks:

Integration with other Electronic Medical Records standards can be difficult if they have a different approach incompatible with DICOM. Whole-slide microscopic imaging is only beginning to be used in Pathology department, and there are some technical issues (large storage needs, speed of scanning, slide reading efficiency) that need to be improved.

Challenges and Opportunities

Pathology presents specific challenges and opportunities to DICOM. In particular:

- Some pathology-related image formats do not as yet have applicable DICOM Information Object Definitions. Examples include (flow) cytometry, electron microscopy, molecular imaging (optical techniques) and others. [Note – Flow cytometry applications have much technical overlap with imaging modalities, even though they do not form an image. It will be important to make imaging standards that have cross-application utility between flow cytometry and immuno-histo-chemistry.]

- Many pathology processes (for example, flow cytometry) provide challenges in distinguishing "objective" image data from "interpretive" image information. These challenges will include specifying standards for pathology specific markup that would reliably distinguish "unprocessed" from "processes" image data, image annotations from primary image data and "constructed" images from "raw" images, etc.

Liaisons and Joint Meetings with Other Relevant Standards Groups

- Association pour le Développement de l'Informatique en Cytologie et en Anatomie Pathologique (ADICAP)
- American Telemedicine Association (ATMA) – Special Interest Group for Pathology
- Association for Pathology Informatics (API) – Laboratory Digital Imaging Project
- College of American Pathologists (CAP) – Council for Scientific Affairs (pathology reporting standards)
- DICOM WG-04 (Compression) (JPEG2000 interactive protocol and multi-component transfer syntax)
- DICOM WG-8 (Structured Reporting)
- DICOM WG-11 (Display Function Standard)
- DICOM WG-13 (Visible light)

- Health Level 7 (HL7) – Pathology Special Interest Group
- Integrating the Healthcare Enterprise (IHE) – Pathology Committee
- Japanese Society of Pathology
- Sociedad Española de Informática de la Salud, (SEIS = Spanish Society of Health Informatics)
- European Cooperation in the field of Scientific and Technical Research – COST Action IC0604 "Euro-Telepath"

Future Work Items

- Structured Reports and/or Evidence Documents in Pathology involving full demographic information;
- Correlation of radiologic and pathologic images, including image-guided biopsies;
- Coding information based upon existing WHO codification, SNOMED-CT and also ADICAP thesaurus;
- Navigating in a hierarchy of images by means of annotations of images and/or drawings (e.g., gross imaging annotated with blocks' localization);
- Integration of automated image analysis tools with WSI;
- Automation in the histology and pathology process, utilizing DICOM Worklists and other standards.

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WG-27 (Web Technology for DICOM)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
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Co-Chair	James Philbin, ACR jfphilbin@gmail.com

WG (Working Group) Profile

Last strategy update: 2016-11-30

Scope:

- Work Group 27 is focused on leveraging Web technologies and defining Web based extensions to DICOM that address the communication needs resulting from clinical use cases for medical image distribution, viewing and processing. These extensions should enable Web-based intra- and inter-enterprise communication and management of the medical imaging record and associated workflows; as well as facilitate integration with other healthcare IT systems. Work Group 27 also coordinates its work with other standards organizations such as HL7 and IHE, so that DICOM Web Services efficiently interoperate with other Web-based medical informatics standards.

Roadmap:

- Add rendered images to WADO-RS
- Add Part 10 binary DICOM to all RESTful Web Services and extend XML and JSON so that all RESTful services can represent resources in binary Part 10, XML or JSON.
- Create a supplement for Unified Workflow and Procedure Step by RESTful Web Services
- Create a supplement for Notification of Availability for DICOM Objects (NADO-RS) using Web Sockets.
- Re-document Part 18 in order to improve clarity, uniformity and understandability

- Continue harmonizing our work with IHE and HL7 initiatives that are web based, so that images can be shared using the same approach as non-image documents.
- Analyze the requirements for moving Web Services to HTTP 2.0 and issue CPs and Supplements if necessary
- We will keep a keen eye on new emerging technologies in the scope intra- and cross-enterprise sharing of image information and patient medical context, and leverage these when applicable.

Short-Term Objectives:

- Maintain the working relationship with ISO TC 215
- Maintain the working relationship with the IHE ITI and IHE Radiology domain committees
- Maintain the working relationship with the HL7 Imaging Integration committee
- Develop supplements for the current work items.

Final Text:

- DICOM 3.0 PS18 Web Access to DICOM Persistent Objects. (WADO-URI)
- DICOM Supplement 148: WADO via Web Services (WADO-WS)
- DICOM Supplement 161: WADO by RESTful Web Services (WADO-RS)
- DICOM Supplement 163: Store Over the Web by RESTful Web Services (STOW-RS)
- DICOM Supplement 166: Query on ID for DICOM Objects (QIDO-RS)

Work in Progress:

- 2013-12-B: Re-Document Web Services
- 2013-08-B: Web Service Notification
- 2015-12-C: RESTful Non-Patient Object Storage
- Proposal: Retire WADO-WS (PS3.18, Section 6.4)
- Coming Proposal: Add RESTful Retrieve Thumbnail.

CPs:

Final Text

1502, 1509, 1510, 1518, 1536, 1540, 1582, 1602

In Progress

1163, 1423, 1540, 1554, 1576, 1580, 1581, 1583, 1614, 1634, 1667

Risks:

- Destabilize the present DICOM standard and its implementations
  To date this risk has been minimized
- Insufficient requirements input from the HIT vendors that own the applications with the patient medical context information
  To date this risk has been avoided
- Fast changing information technology in this scope, and heated debates about what's the best
- Many relationships that need to be fostered in order to obtain consistency in the approach

Challenges and Opportunities:

- DICOM+JSON needs improvement.
- Generalized Notifications

Relationship to Other Standards:

- Relationship with IHE ITI and RAD Work Groups
- Relationship with HL7 Imaging Integration and FHIR committees
- Relationship with ISO TC215/WG2

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WG-28 (Physics)

Secretariat-U.S. Meetings Secretary	AAPM (American Association of Physicists in Medicine) Shayna Knazik, AAPM shayna@aapm.org
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Co-Chair	Annalisa Trianni, EFOMP trianni.annalisa@aoud.sanita.fvg.it
Co-Chair	Donald Peck, PhD, Henry Ford Hospital, AAPM donaldp@mtu.edu

WG-28 (Working Group) Profile
Last Strategy Update: 2017-05-10

Scope:

- To develop or consult on CPs and Supplements requiring detailed expertise on physics and/or the needs and work of medical physicists.
- To serve as a *liaison* body to facilitate including data relevant to the physics community in DICOM objects.

Current Supplements, Work and Objectives:

- WI 2015-12-D "Cone Beam CT-RDSR

Challenges and Opportunities (Environment):

- Physics wish-list could get too far ahead of vendor and user expectations.
- Encourage more medical physicists to participate to the activities of the group

Future Roadmap and Objectives (Committee Direction):

- Work Item 2015-12-D Cone Beam CT-RDSR: The WG-02 plans to develop a radiation dose report to address Cone Beam CT (CBCT), and potentially define a new "extended" Radiation Dose SR meant to include new/all modalities and to define a more generic model of irradiation.
- The MITA Interventional XR-27 standard (User QC) requires exporting protocol technical information outside the angiographic equipment. WG-28 is collaborating with WG-02 in developing the "XA Protocol Storage" IOD.
- WG-28 collaborates with other groups and organizations like IEC, MITA X-Ray Interventional, AAPM, EFOMP, FDA and IHE.

Past Work:

DICOM Supplements and CPs

- Supp 191: Patient Radiation Dose Report (P-RDSR)
- CP1513: Clarification of Meaning of Entrance Dose

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WG-29 (Education, Communication, and Outreach)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
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Co-Chair	Jeroen Medema, Philips Healthcare Jeroen.medema@philips.com

WG (Working Group) Profile
Last strategy update: 2013-09-12

Scope:
The goal of WG-29 is to coordinate DICOM education, communication, and outreach efforts with all current and potential stakeholders, including patients, health care providers, policymakers, and developers.

Education:

- Organize the DICOM International Conference
- Define competency requirements for target audiences
- Discuss whether to accredit educational providers, and if so, how
- Define the content that should be provided

Communication:

- Develop and maintain an Executive Summary document to explain and define DICOM's role in healthcare
- Redesign and manage the DICOM website
- Optimize the DICOM community communication methods (listserv, FTP)

Outreach:

- Create printed articles and/or video presentations about DICOM
- Assist with implementation and use of new supplements including through support to customers and manufacturers
- Establish reciprocal connections with patient advocates, policy makers, medical informatics leaders, and others

Short-term goals:

- Reclaim ownership of "dicom.org" domain name
- Redesign and revise DICOM web site
- Begin planning process for next DICOM International Conference
- Create "executive summary" document to describe DICOM's role in health care
- Begin outreach efforts with policymakers and non-imaging informatics experts

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WG-30 (Small Animal Imaging)

Secretariat	NIH (National Institutes of Health)
Secretary	Eve Shalley eve.shalley@nih.gov
Chair	Joseph Kalen, National Cancer Institute kalenj@mail.nih.gov

WG (Working Group) Profile
Last strategy update: 2016-04-08

Scope:
To extend and promote use of DICOM in Small Animal Imaging for Pre-Clinical and Co-Clinical Research

Roadmap:

- Evaluate issues related to deployment of DICOM for this purpose
- Add new informative material to expedite and facilitate deployment (completed)
- Add new extensions to existing IODs for pre-clinical and small animal specific information (completed)
- Add new IODs for modalities that fit poorly into existing repertoire (not prioritized)

Short-Term Objectives:

- Promote use of new Small Animal Acquisition Context SOP Class
- Promote use new content in existing image SOP Classes related to identification and description of animals

Current Status:

- Completed extensions to existing IODs for pre-clinical and small animal specific information (Sup 187)
- Received approval from IHTSDO to use SNOMED codes incorporated in Sup 187 and CP 1478
- Completed update of image samples to using newly assigned standard data elements and codes

Current Work Items:

- 2015-05-A completed (Sup 187)
- No new work items yet submitted

Risks:

- Potential for loss of enthusiasm and continued commitment of users and vendors due to completion of existing work item and CPs, lack of resources and priority of remaining subject matter

Challenges and Opportunities:

- Broaden the participating members of the working group amongst more vendors and users
- Encourage adoption of standard solutions rather than tolerating existing proprietary approaches or expedient manual workarounds

Relationships to Other Standards:

- NCI provides coordination with other pre-clinical and co-clinical activities that they sponsor, including those related to mouse models, vocabulary, and quantitative imaging.

Relationships to Other Standards:

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WG-31 (Conformance)

Secretariat	MITA (Medical Imaging & Technology Alliance, a Div. of NEMA)
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Co-Chair	Jeroen Medema, Philips Healthcare Jeroen.medema@philips.com

WG (Working Group) Profile

Last strategy update: New Working Group – Profile under development

Scope:

The purpose of the Group will include facilitating conformance verification and testing in locales without the English language skills to interpret the normative Standard. The DSC invited and welcomes participation in this new Working Group 31 from all parties that are interested in conformance testing and validation, especially those working on national conformance requirements and processes.

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