

A Harmonization Guide between the caBIG[®] Annotation and Image Markup and DICOM Standard, BRIDG and LS DAM

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1. Scope and Purpose

The AIM model has become a preferred method for capturing image annotation and pixel semantic meaning of medical images in the NCI's research community. In order to enhance the model's acceptance to the research and clinical community, the caBIG[®] Annotation and Image Markup (AIM) [1] 4.0 must be harmonized with the Digital Imaging and Communications in Medicine (DICOM) [2], the worldwide international medical imaging standard, BRIDG[3] and LSDAM[4]. The scope of this document is to provide an approach to this harmonization.

2. Overview

The AIM is used to express and capture image annotation and markup information relevant to images. An annotation can be explanatory or descriptive information, generated by humans or , that directly relates to the content of a referenced image or images. It describes information regarding the meaning of pixel information in images. Image markup includes the graphical symbols or textual descriptions associated with an image. Markup can be used to depict textual information and regions-of-interest (graphical drawing) visually next to, or more typically laid on top of, an image. Information from annotations and markups is used to populate AIM instances via the AIM software library to generate AIM DICOM SR objects and AIM native XML documents.

DICOM is the premier medical imaging standard for digital storage and display, printing, information capturing, and exchange. It covers multiple imaging modalities such as computed radiography, computer tomography, digital radiography, magnetic resonance, nuclear medicine, ultrasound, radiation therapy, ophthalmic tomography and pathology. The DICOM community consists of international standard bodies, medical imaging manufacturer representatives, and individuals from government agencies and academic and private institutions. Having the AIM model as a part of DICOM standard will enhance the adoption rate among industry vendors and research organizations.

2.1. Technology Stack

Artifact	Tools
Annotation and Image Markup	A UML Information Model
Digital Imaging and Communications in Medicine	An Information model for medical related images
Standard C++	Microsoft Visual Studio 2008
XMI	Enterprise Architect 4.5

2.2. Background Knowledge and Assumptions

A reader of this document is assumed to have a good understanding of DICOM, especially the DICOM Structure Reporting and AIM information model. Additional DICOM information can be found in the DICOM Standard Part 3, Structure Reporting (SR) Information Entity. Information about the AIM model can be found in 02_03_AIM_Project_Report.pdf [2].

2.3. AIM 3.0 Model

2.3.1. Overview

The AIM information model is expressed in a UML class diagram [3], which is shown in Figures 1 through 6. The model is used to express and capture image annotation and markup information relevant to images. The AIM 3.0 information model consists of 45 classes and 248 attributes. The model is designed for flexibility. Users can choose which classes to utilize for each specific data collection purpose. The minimum required classes are ImageAnnotation, Person, and ImageReference for a valid AIM ImageAnnotation instance, and AnnotationOfAnnotations and ReferencedAnnotation for a valid AnnotationOfAnnotations instance.

We can categorize the classes into five groups: General Information, Calculation, Image Semantic Content, Markup, and Image References. The General Information group, shown in Figure 2, contains classes that do not

have commonality between each other but collectively serve to gather useful information for AIM annotations. The Calculation group, Figure 3, represents calculation results described in an AIM annotation, which may or may not be directly associated with graphical symbols or markups. The Markup group, Figure 4, captures textual information and graphical representation as DICOM SR's value type SCOORD. The available graphic types are Point, Multipoint, Polyline, Circle, and Ellipse. The classes in the Image Semantic Content group, Figure 5, are used to gather clinical findings of images. The Image Reference group, Figure 6, represents an image or collection of images being annotated. The two possible types of image references are DICOM image reference and web image reference via a URI. For more information about the the AIM model and AIM DICOM SR template, refer to Chapter 4.

2.4. AIM 4.0 Model

2.4.1. Overview

AIM 4.0 model further extends the AIM 3.0 model and uses ISO 21090 data types.

Table 2.4.1-1 illustrates data type mapping between AIM 3.0 and ISO 21090.

AIM 3.0 Data Type	ISO 21090
boolean	BL
CalculationResultIdentifier	Not Applicable
ComparisonOperators	Not Applicable
Date	TS
Double	REAL
Integer	INT or II
String	ST or Uid

Table 2.4.1-1. Data Type Mapping

Table 2.4.1-2 depicts four coding attributes that are combined to create the CD data type in ISO 21090.

AIM 3.0 Data Type	ISO 21090
codeMeaning	CD
codingSchemeDesignator	CD
codingSchemeVersion	CD
codeValue	CD

Table 2.4.1-2. AIM Coding Attributes Mapping to ISO 21090

The initial AIM 4.0 model introduces a new container class called Annotations in which a collection of AIM annotations can be stored. New AIM 4.0 UML class diagram figures will be provided in the next version of this document.

2.4.2. Types of AIM Instances

In the AIM 3.0 model, an AIM annotation can be stored as a DICOM SR object and/or AIM XML document. It is possible for a hundred or thousand AIM DICOM SR objects and/or AIM XML documents to be created from a set of images in a single DICOM Series of a DICOM Study. Management and programmatic usage of these numerous individual AIM objects and documents becomes very complex to handle and process. A container is required to keep a collection of AIM instances in a single AIM DICOM SR object or AIM XML document.

An AIM instance can be of type Annotations in the AIM 4.0 model. The Annotations class was created to collect instances of type ImageAnnotation or AnnotationOfAnnotation generated from images in a single DICOM Series within a DICOM Study. An instance of the Annotations class may contain of number of ImageAnnotation or AnnotationOfAnnotation instances.

See additional classes displayed in a light blue color in AIM_v4_rv2.EAP. A discussion about these classes is required.

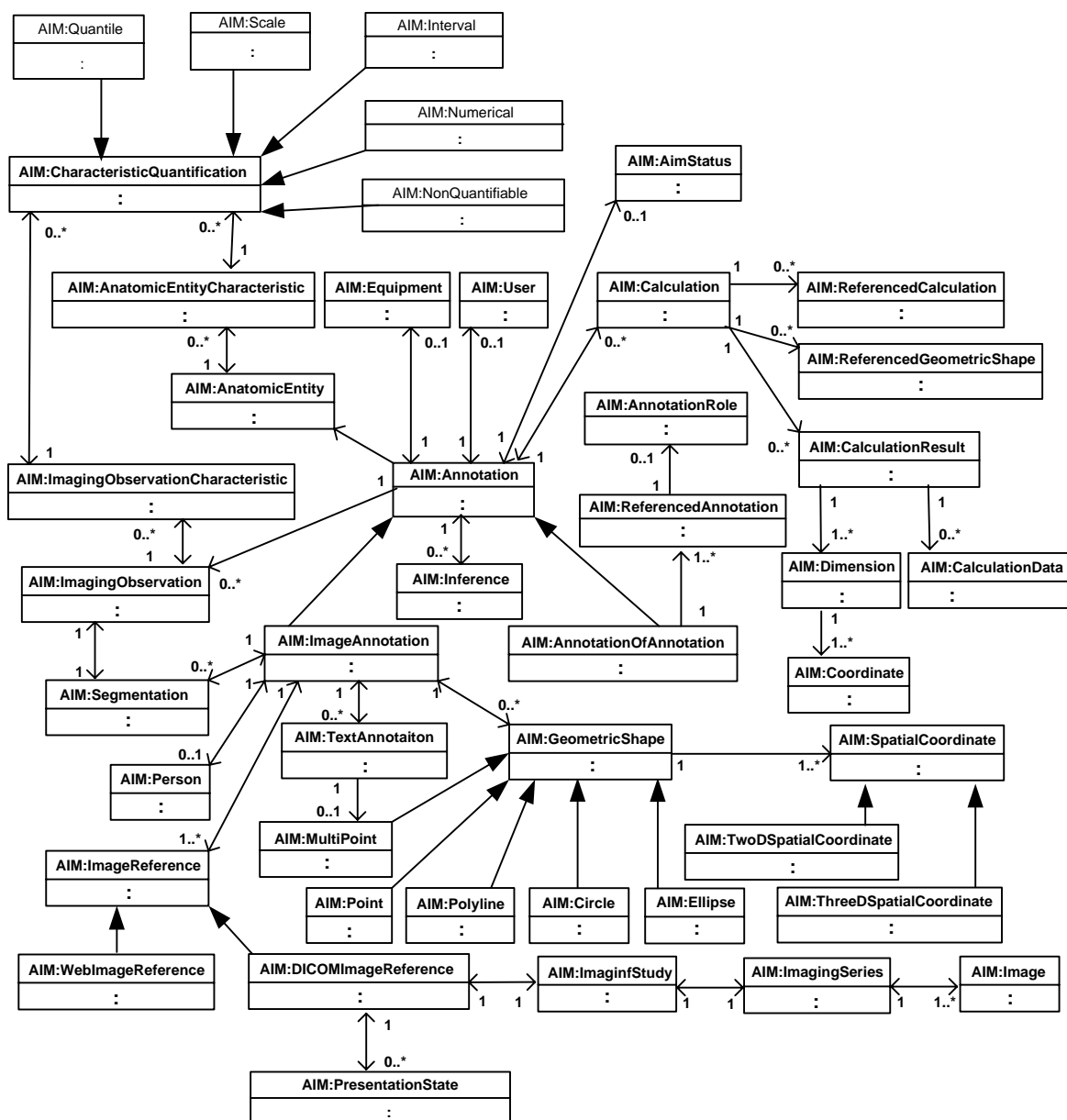


Figure 1. UML Class Diagram for AIM 3.0 Schema

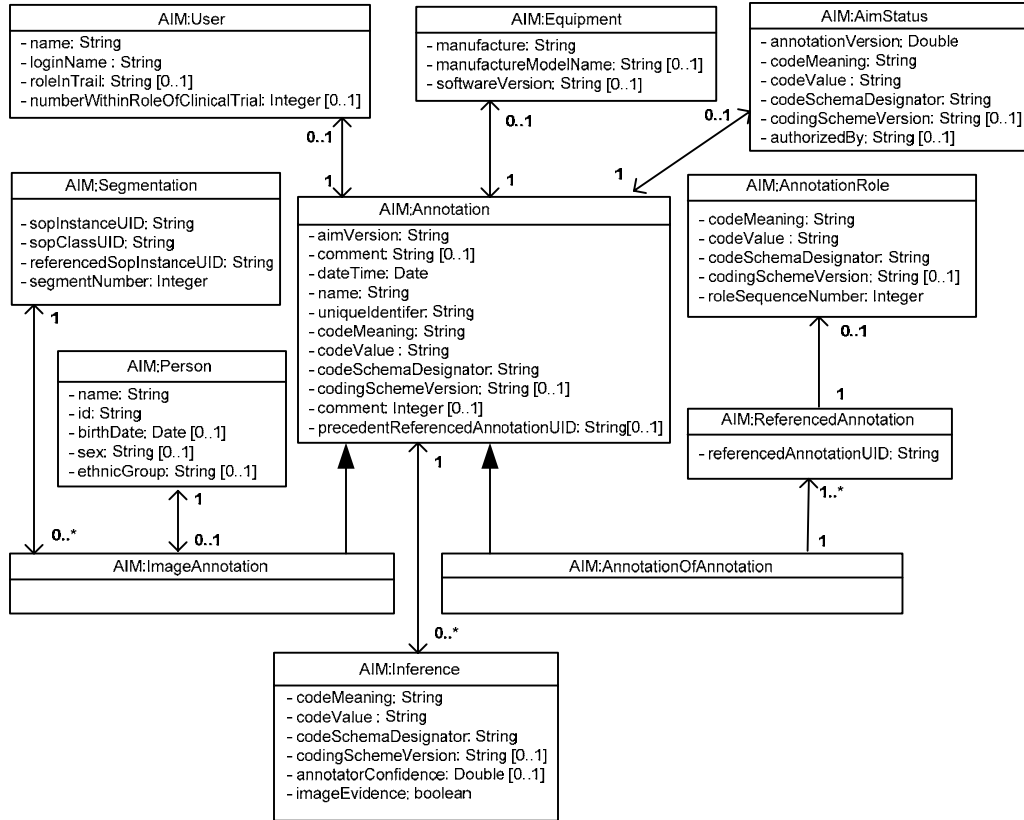


Figure 2. General Information Group

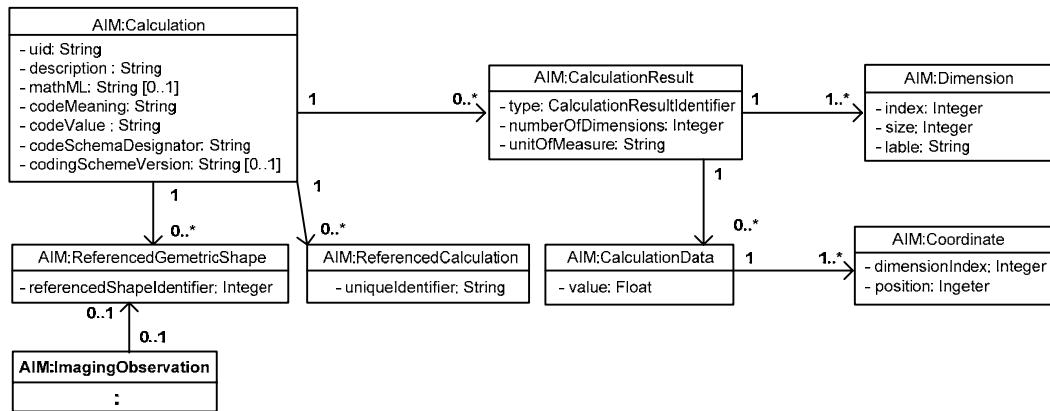


Figure 3. Calculation Group

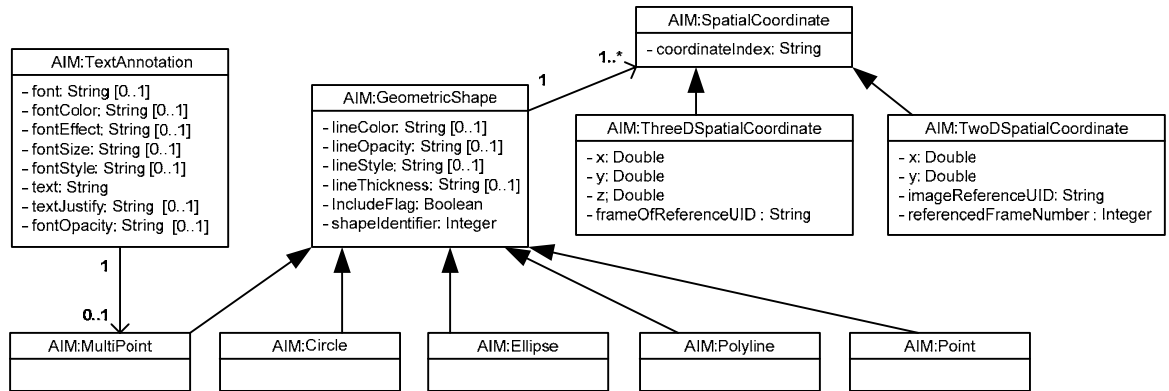


Figure 4. Markup Group

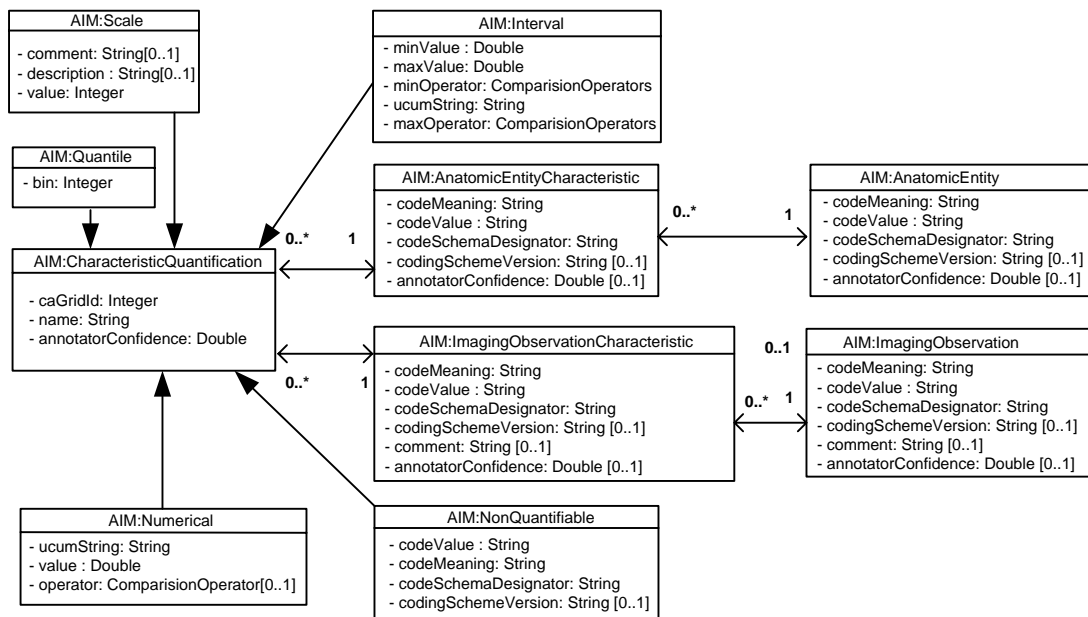


Figure 5. Image Semantic Content Group

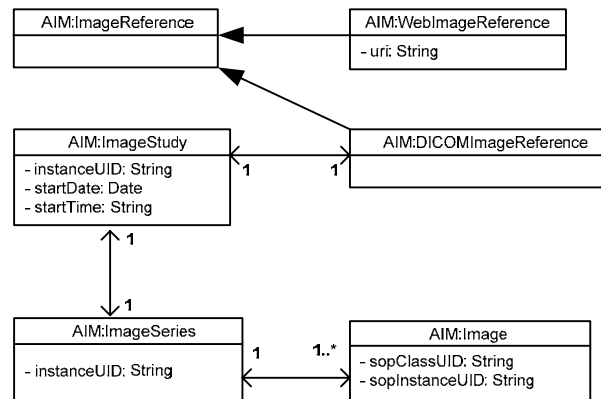


Figure 6. ImageReference Group

2.5. BRIDG

See <http://www.bridgmodel.org/> for a full description of the BRIDG model.

2.6. DICOM

2.6.1. Structured Reporting Information Entity

A DICOM SR Information Entity provides well-defined descriptions and semantic context to describe the complete content of a SR document. A SR document belongs to a single DICOM Series that also belongs to a DICOM Study. A SR document can be of type Basic, Enhanced or Comprehensive SR, starting from simple to complex content structure respectively. AIM DICOM SR document is of type Comprehensive SR.

2.7. LS DAM

See [https://wiki.nci.nih.gov/display/LS/Life+Sciences+Domain+Analysis+Model+\(LS+DAM\)](https://wiki.nci.nih.gov/display/LS/Life+Sciences+Domain+Analysis+Model+(LS+DAM)) for more information about the Life Sciences Domain Analysis model (LS DAM).

3. Gap Analysis Between AIM Model, BRIDG, DICOM and LS DAM

3.1. Mapping Between AIM, BRIDG and LS DAM

BRIDG and LSDAM are based on UML Domain Analysis Models (DAM). DAM is a static conceptual model. It is used to capture and describe required information and its flow as well as related activities by different entities in a model.

The AIM UML model focuses on capturing required information related to semantic meaning of image(s), source of image(s), text, and geometric drawing placed on image(s), calculation techniques and results on image(s), inference, annotation role, and annotation of annotation, but has no workflow information. For the purpose of mapping, the AIM UML classes with ISO data types are manually compared with classes in BRIDG and LSDAM models.

The mapping process between AIM and BRIDG begins with comparing every AIM class with classes in BRIDG sub-domains, namely Adverse Event, Common, Protocol Representation, Regulatory and Study Conduct. Table 3.1-1 depicts an initial mapping between AIM and BRIDG.

Classes and attributes in the sub-domain of Adverse Event and Regulatory do not have any concepts in common with classes and attributes in the AIM model.

AIM Class	Sub-Domain	BRIDG Class
AimStatus		
AnatomicEntity	Study Conduct Protocol Representation	PerformedObservation - targetAnatomicSiteCode DefinedObservation - targetAnatomicSiteCode
AnatomicEntityCharacteristic		
Annotation		
Annotations		
AnnotationOfAnnotation		
AnnotationRole		
Calculation	Study Conduct	ReferenceResult - valueTypeCode - comment
CalculationData		
CalculationResult		
CharacteristicQuantification		
Circle		
Coordinate		
DICOMImageReference		
Dimension		
Ellipse		
Equipment	Common	Manufacturer
GeometricShape		
Image	Protocol Representation	DefinedImaging
ImageAnnotation		
ImageReference		
ImageSeries		
ImageStudy		
ImagingObservation	Study Conduct Protocol	PerformedObservationResult - typeCode - comment DefinedObservationResult

AIM Class	Sub-Domain	BRIDG Class
	Representation	- typeCode - comment
ImagingObservationCharacteristic		
Inference		
Interval		
MultiPoint		
NonQuantifiable		
Numerical		
Person	Common	Person - ethnicGroupCode
Point		
Polyline		
PresentationState		
Quantile		
ReferencedAnnotation		
ReferencedCalculation		
ReferencedGeometricShape		
Scale		
Segmentation		
SpatialCoordinate		
TextAnnotation		
ThreeDimensionSpatialCoordinate		
TwoDimensionSpatialCoordinate		
User	Study Conduct Common	Assessor DocumentAuthor Performer QualifiedPerson
WebImageReference		

Table 3.1-1 AIM model Initial Mapping with BRIDG

Table 3.1-2 contains classes related to imaging. The AIM team in conjunction with DICOM WG-18 will investigate the suitability of these classes for inclusion in AIM model.

Sub-Domain	Class
Protocol Representation	DefinedImaging - enhancementRateValue - enhancementDescription - contrastAgentEnhancementIndicator
Study Conduct	PerformedImaging

Table 3.1-2 BRIDG Classes Related to Imaging

Table 3.1-3 depicts an initial mapping between AIM and LS DAM. LSDAM does not organize its information model into sub-domains or packages like BRIDG. LSDAM has a comprehensive view of the model as an UML class diagram. It also has other UML class diagrams that are more focused on a smaller number of classes of entities and activities. The main focus of LSDAM UML class diagrams are Container, Document, Finding_Biomarker, Generic Assay, Imaging (work-in-progress, not formally accepted by LS DAM committee), MaterialEquipment, Molecular Databases, Molecular Sequences and Sequence Features, Protocol_ExperimentalStudy_Experiment and Taxonomy.

AIM Class	Logical Diagram	LSDAM Class
AimStatus		

AIM Class	Logical Diagram	LSDAM Class
AnatomicEntity	Finding_Biomarker Imaging	PerformedObservation - targetAnatomicSiteCode DefinedObservation - targetAnatomicSiteCode
AnatomicEntityCharacteristic		
Annotation		
Annotations	Container	Container
AnnotationOfAnnotation		
AnnotationRole		
Calculation		
CalculationData		
CalculationResult		
CharacteristicQuantification		
Circle		
Coordinate		
DICOMImageReference		
Dimension		
Ellipse		
Equipment	Generic Assay Generic Assay MaterialEquipment	Manufacturer Software - version
GeometricShape		
Image	Finding_Biomarker	Image - sopClassUID - sopInstanceUID
ImageAnnotation	Finding_Biomarker	ImageAnnotation - uniqueIdentifier - type - dateTime
ImageReference		
ImageSeries		
ImageStudy		
ImagingObservation	Finding_Biomarker	PerformedObservationResult - typeCode - comment
ImagingObservationCharacteristic		
Inference	Finding_Biomarker	PerformedDiagnosis - diseaseStatusCode
Interval		
MultiPoint		
NonQuantifiable		
Numerical		
Person	Imaging Document Generic Assay MaterialEquipment	BiologicEntity - administrativeGenderCode - birthDate Person - name - ethnicGroupCode SubjectIdentifier - identifier
Point		
Polyline		
PresentationState		

AIM Class	Logical Diagram	LSDAM Class
Quantile		
ReferencedAnnotation		
ReferencedCalculation		
ReferencedGeometricShape		
Scale		
Segmentation		
SpatialCoordinate		
TextAnnotation		
ThreeDimensionSpatialCoordinate		
TwoDimensionSpatialCoordinate		
User	Document	DocumentAuthor
WebImageReference		

Table 3.1-3 AIM model Initial Mapping with LSDAM

Table 3.1-4 contains classes related to imaging. The AIM team in conjunction with DICOM WG-18 will further analyze the use of these classes. For more information, see the LSDAM – Imaging UML class diagram in LSDAM_ImagingInfo.eap, then the WG-18 FTP site under the LS_DAM folder. Many classes in the LSDAM – Imaging UML diagram are in Table 3.1-4.

LSDAM Logical Diagram	Class
Imaging	DefinedImaging
Imaging	DefinedRadiologyCTImaging
Imaging	ImageAcquisitionProtocol
Imaging	ImagingCenter
Finding_Biomarker	PerformedImaging
Finding_Biomarker	PerformedLesionDescription
Finding_Biomarker	PerformedRadiologyCTImaging
Generic Assay	Equipment

Table 3.1-4 LSDAM Classes Related to Imaging

3.2. Mapping Between AIM and DICOM Standard

The Information Object Definition (IOD) defines a DICOM object. The IOD consists of the IOD description, IOD Entity-Relationship model, IOD module table, and IOD functional group macros. DICOM has established a collection of data sets, data elements, and encoding rules to support and IOD's creation. AIM information is transcoded to a DICOM SR IOD.

The classes and attributes in the AIM UML model can be manually mapped to a DICOM SR template. See Chapter 4 for more information about the AIM DICOM SR template.

Table 3.2-1 illustrates the information mapping between AIM 3.0 and DICOM.

AIM Class Name	DICOM SR
AimStatus	See 4.4
AnatomicEntity	See 4.11
AnatomicEntityCharacteristic	See 4.15
Annotation	See 4.4
Annotations	To be defined, 4.0 model
AnnotationOfAnnotation	See 4.6
AnnotationRole	See 4.14
Calculation	See 4.7
CalculationData	See 4.7

CalculationResult	See 4.7
CharacteristicQuantification	See 4.18
Circle	See 4.9
Coordinate	See 4.7
DICOMImageReference	See 4.8
Dimension	See 4.7
Ellipse	See 0
Equipment	See DICOM Equipment IOD
GeometricShape	See 4.9
Image	See 4.8
ImageAnnotation	See 4.5
ImageReference	See 4.8
ImageSeries	See 4.8
ImageStudy	See 4.8
ImagingObservation	See 4.12
ImagingObservationCharacteristic	See 4.13
Inference	See 4.16
Interval	See 4.18
MultiPoint	See 4.9
NonQuantifiable	See 4.18
Numerical	See 4.18
Person	See DICOM Patient IOD
Point	See 4.9
Polyline	See 4.9
PresentationState	See 4.8
Quantile	See 4.18
ReferencedAnnotation	See 4.6
ReferencedCalculation	See 4.8
ReferencedGeometricShape	See 4.17
Scale	See 4.18
Segmentation	See 4.10
SpatialCoordinate	See 4.9
TextAnnotation	See 4.5
ThreeDimensionSpatialCoordinate	Not Implemented for DICOM
TwoDimensionSpatialCoordinate	See 4.9
User	See 4.1, 4.2
WebImageReference	Not Implemented for DICOM

Table 3.2-1. AIM Information Model and GSPS Capabilities

4. AIM DICOM Template

This section depicts the result of mapping the AIM UML model to a AIM DICOM SR template.

AIM RESULT IOD MODULES

IE	Module	Reference DICOM Part 3	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
Series	SR Document Series	C.17.1	M
	Clinical Trial Series	C.7.3.2	U
Equipment	General Equipment	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M
Document	SR Document General	C.17.2	M
	SR Document Content	C.17.3	M
	SOP Common	C.12.1	M

4.1. Person Observer Identifying Attributes

TID 1002 Extended PERSON OBSERVER IDENTIFYING ATTRIBUTES Type: Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS OBS CONTEXT	CODE	EV (121005,DCM, "Observer Type")	1	MC	IF Observer type is device	DCID (270) Observer Type Defaults to (121006,DCM, "Person")
2	>	HAS OBS CONTEXT	INCLUDE	DTID (1003 Extended) Person observer identifying attributes	1	MC	IFF Row 1 value = (121006,DCM, "Person") or Row 1 is absent	
3	>	HAS OBS CONTEXT	INCLUDE	DTID (1004) Device observer identifying attributes	1	MC	IFF Row 1 value = (121007,DCM, "Device")	

4.2. Person Observer Identifying Attributes

TID 1003 Extended PERSON OBSERVER IDENTIFYING ATTRIBUTES Type: Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			PNAME	EV (121008,DCM, "Person Observer Name")	1	M		

2		HAS OBS CONTEXT	TEXT	EV (121009,DCM, " Person Observer's Organization Name")	1	U		Defaults to Institution Name (0008,0080) of the General Equipment Module
3		HAS OBS CONTEXT	CODE	EV (121010,DCM, " Person Observer's Role in the Organization")	1	U		BCID(7452) Organizational Roles
4		HAS OBS CONTEXT	CODE	EV (121011,DCM, " Person Observer's Role in this Procedure")	1	U		BCID(7453 Extended) Performing Roles
5		HAS OBS CONTEXT	TEXT	EV (zzz026, 99NCIAIM, " Person Observer's Login Name")	1	U		
6		HAS OBS CONTEXT	TEXT	EV (zzz045, 99NCIAIM, "Identifier within Person Observer's Role")	1	U		

- Notes:
1. Person Observer's Login Name is a system login account assigned to a person observer in a particular clinical trial.
 2. Identifier within Person Observer's Role (Row 6) is an identifier (such as a number or letter) assigned to a person observer performing in a particular role (specified in Row 3), to distinguish them from another such observer in the same role. For example, in a clinical trial, there may be two "readers", each of which is designated with an identifier "1" or "2", or "A" or "B".

4.3. AIM Document Root

TID XXX1
AIM DOCUMENT ROOT
Type: Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV(zzz001, 99NCIAIM, "AIM SR Report")	1	M		
2	>	HAS ACQ CONTEXT	TEXT	EV (zzz003, 99NCIAIM, "AIM Version")	1	M		
3	>	HAS CONCEPT MOD	INCLUDE	DTID (1204) "Language of Content Item and Descendants"	1	M		
4	>	HAS OBS CONTEXT	INCLUDE	DTID (1002 Extended) "Observer Context"	1	U	May be present when Observer Type is person	DCID (270) Observer Type defaults to EV(121006,DCM,"Person")
5	>	CONTAINS	CONTAINER	EV(111028, DCM, "Image Library")	1	MC	Shall be present if document contains EV(zzz002, 99NCIAIM, "Annotation") = EV(zzz030, 99NCIAIM, "Image Annotation")	
6	>>	CONTAINS	INCLUDE	DTID (XXX6) "AIM Image Library Entry"	1-n	M		
7	>	CONTAINS	INCLUDE	DTID(XXX2) "AIM Annotation Entry"	1-n	M		

4.4. AIM Annotation Entry

TID XXX2
AIM ANNOTATION ENTRY
Type: Non-Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (zzz002, 99NCIAIM, "AIM Annotation")	1	M		
2	>	HAS ACQ CONTEXT	UIDREF	EV (112040, DCM, "Tracking Unique Identifier")	1	M		
3	>	HAS ACQ CONTEXT	CODE	EV(zzz005, 99NCIAIM, "Annotation Type")	1	M		
4	>	HAS ACQ CONTEXT	TEXT	EV (112039,DCM, "Tracking Identifier")	1	M		
5	>	HAS OBS CONTEXT	TEXT	EV(121106, DCM, "Comment")	1	U		
6	>	HAS OBS CONTEXT	UIDREF	EV(zzz068, 99NCIAIM, "Precedent AIM Annotation")	1	U		
7	>	HAS ACQ CONTEXT	CODE	EV(zzz063, 99NCIAIM, "AIM Status")	1	U		
8	>>	HAS OBS CONTEXT	NUM	EV(zzz064, 99NCIAIM, "Annotation Version")	1	M		
9	>>	HAS OBS CONTEXT	TEXT	EV(zzz065, 99NCIAIM, "Authorized By")	1	U		
10	>	HAS OBS CONTEXT	INCLUDE	DTID(XXX11) "Anatomic Entity"	1-n	U		
11	>	HAS OBS CONTEXT	INCLUDE	DTID(XXX12) "Imaging Observation Entry"	1-n	U		
12	>	CONTAINS	INCLUDE	DTID(XXX5) "AIM Calculation Entry"	1-n	U		
13	>	CONTAINS	INCLUDE	DTID (XXX17) "Inference Entry"	1-n	U		
14	>	CONTAINS	INCLUDE	DTID(XXX3) "Image Annotation Entry"	1	MC	XOR ROW 15	
15	>	CONTAINS	INCLUDE	DTID(XXX4) "Annotation of Annotation Entry"	1	MC	XOR ROW 14	

AIM Model mapping notes:

#4 – Annotation Name

#5 – Annotation Comment

Observation DateTime of the Annotation Container (#1) is Annotation Date

Notes:

The Calculation Entries (Row 12) contain values that are calculated from the image information constrained by the Geometric Shapes encoded in Image Annotations (Row 14), or subordinate calculations that are encoded in other Annotations (Row 15).

4.5. AIM Image Annotation Entry

TID XXX3
AIM IMAGE ANNOTATION ENTRY
Type: Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINS	CONTAINER	EV(zzz030, 99NCIAIM, "Image Annotation")	1	M		
2	>	HAS ACQ CONTEXT	INCLUDE	DTID (XXX10) "AIM Segmentation Entry"	1-n	U		
3	>	CONTAINS	INCLUDE	DTID(XXX7) "Geometric Shape Entry"	1-n	U		
4	>	CONTAINS	CONTAINER	EV(zzz028, 99NCIAIM, "Text Annotation")	1-n	U		
5	>>	HAS OBS CONTEXT	TEXT	EV(G-D315, SRT, "Text Value")	1	M		
6	>>	CONTAINS	INCLUDE	DTID(XXX7) "Geometric Shape Entry"	1	U		GRAPHIC TYPE = {MULTIPOINT} AND HAS ONLY TWO POINTS

Notes: Text Annotation Location can have up to two points. Those points represent the start and end points of an arrow connecting the text to a point on the image.

4.6. AIM Annotation of Annotation Entry

TID XXX4

AIM ANNOTATION of ANNOTATION ENTRY

Type: Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINS	CONTAINER	EV(zzz031, 99NCIAIM, "Annotation of Annotation")	1	M		
2	>	CONTAINS	CONTAINER	EV(zzz062, 99NCIAIM, "Referenced Annotation")	1-n	M		
3	>>	HAS ACQ CONTEXT	UIDREF	EV (112040, DCM, "Tracking Unique Identifier")	1	M		The value shall be the Tracking Unique Identifier of another annotation, which may or may not be defined in the same AIM SR SOP Instance.
4	>>	HAS OBS CONTEXT	INCLUDE	DTID(XXX14) "Annotation Role"	1	U		

4.7. AIM Calculation Entry

TID XXX5

AIM CALCULATION ENTRY

Type: Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (zzz011, 99NCIAIM, "Calculation")	1	M		
2	>	HAS CONCEPT MOD	CODE	EV (G-C036, SRT, "Measurement Method")	1	M		DCID (aimcid008) AIM Annotation Calculation Types
3	>	HAS ACQ	UIDREF	EV (112040, DCM, "Tracking Unique	1	M		

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
		CONTEXT		Identifier")				
4	>	HAS ACQ CONTEXT	TEXT	EV (112034, DCM, "Calculation Description")	1	U		
5	>	HAS ACQ CONTEXT	TEXT	EV(zzz013, 99NCIAIM, "Calculation MathML")	1	U		
6	>	HAS OBS CONTEXT	TEXT	EV(111001, DCM, "Algorithm Name")	1	U		
7	>	HAS OBS CONTEXT	TEXT	EV(111003, DCM, "Algorithm Version")	1	U		
8	>	CONTAINS	CONTAINER	EV(zzz014, 99NCIAIM, "Referenced Calculation")	1	UC		
9	>>	HAS PROPERTIES	UIDREF	EV (112040, DCM, "Tracking Unique Identifier")	1-n	M		The value shall be the Tracking Unique Identifier of another calculation (Row 3), which may or may not be defined in the same AIM SR SOP Instance.
10	>	CONTAINS	NUM	EV(zzz015, 99NCIAIM, "Calculation Result")	1-n	UC	Shall be used (rather than Row 12) for the degenerate case of a single dimension with a single numeric value,	DCID 082 Units of Measurement
11	>>	HAS ACQ CONTEXT	TEXT	EV(zzz018, 99NCIAIM, "Dimension Label")	1	M		
12	>	CONTAINS	CONTAINER	EV(zzz015, 99NCIAIM, "Calculation Result")	1-n	UC	Shall not be used for the degenerate case of a single dimension with a single numeric value. See Row 10.	
13	>>	HAS OBS CONTEXT	CODE	EV(zzz016, 99NCIAIM, "Calculation Result Type")	1	M		DCID (aimcid009) AIM Calculation Result Types
14	>>	HAS OBS CONTEXT	NUM	EV(zzz017, 99NCIAIM, "Number of Dimensions")	1	M		Positive Integer. The value must be equal to the actual number of EV(zzz039, 99NCIAIM, "Calculation Dimension") entries present
15	>>	CONTAINS	CONTAINER	EV(zzz039, 99NCIAIM, "Calculation Dimension")	1-n	M		See restriction on number of items in row 14.
16	>>>	HAS ACQ CONTEXT	NUM	EV(zzz040, 99NCIAIM, "Dimension Index")	1	M		Positive Integer
17	>>>	HAS ACQ CONTEXT	NUM	EV(zzz041, 99NCIAIM, "Dimension Size")	1	M		Positive Integer
18	>>>	HAS ACQ CONTEXT	TEXT	EV(zzz018, 99NCIAIM, "Dimension Label")	1	M		
19	>>	HAS ACQ CONTEXT	CONTAINER	EV(zzz019, 99NCIAIM, "Calculation Result Datum")	1	U		
20	>>>	HAS OBS CONTEXT	NUM	EV(zzz020, 99NCIAIM, "Calculation Result Data")	1-n	M		DCID 082 Units of Measurement
21	>>>>	CONTAINS	CONTAINER	EV(zzz042, 99NCIAIM, "Calculation Result Coordinate")	1-n	M		
22	>>>>>	HAS OBS CONTEXT	NUM	EV(zzz040, 99NCIAIM, "Dimension Index")	1	M		Positive Integer

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
23	>>>>>	HAS OBS CONTEXT	NUM	EV(zzz043, 99NCIAIM, "Coordinate Position")	1	M		Positive Integer
24	>	HAS OBS CONTEXT	INCLUDE	DTID(xxx18) "Referenced Geometric Shape Entry"	1-n	U		

Note:

Calculation result is defined as multidimensional structure with each dimension containing multiple values. Conversely, a single value in a calculation result (aka Calculation Result Data) is defined by a list of Calculation Result Coordinates. Each Calculation Result Coordinate identifies a dimension the current value belongs to (Dimension Index) and a position within the dimension the value occupies (Coordinate Position).

Calculation results may or may not be directly associated with graphical symbols or markups. A calculation result can be associated directly with a markup if and only if there is only one computable markup in an ImageAnnotation. For example, given an image with a single ellipse markup, calculation results could be an area in square millimeters and maximum and minimum pixel values. Another example is an image with an arrow pointing to a specific location and two circles, one inside the other, with an area measurement of the larger circle minus the smaller circle. The computation result is of the two circles.

4.8. AIM Image Library Entry

TID XXX6
AIM IMAGE LIBRARY ENTRY
Type: Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			IMAGE	EV(zzz034, 99NCIAIM, "Image Library Entry")	1	M		
2	>	HAS ACQ CONTEXT	UIDREF	EV(110180, DCM, Study Instance UID")	1	M		
3	>	HAS ACQ CONTEXT	TEXT	EV (zzz025, 99NCIAIM, "Web Image URI")	1	MC	Shall be present if image is accessible via a URI	IETF RFC 3986 that describes the allowable form of the URI in the TEXT value
4	>	HAS ACQ CONTEXT	DATE	EV (111060, DCM, "Study Date")	1	MC	Shall be present if Study Date (0008,0020) is in the Image Instance	
5	>	HAS ACQ CONTEXT	TIME	EV (111061, DCM, "Study Time")	1	MC	Shall be present if Study Time (0008,0030) is in the Image Instance	
6	>	HAS ACQ CONTEXT	UIDREF	EV(112002, DCM, "Series Instance UID")	1	M		
7	>	HAS ACQ CONTEXT	UIDREF	EV(zzz069, 99NCIAIM, "Referenced Presentation State UID")	1-n	U		SOP Instance UID of a Presentation State object

4.9. AIM Geometric Shape Entry

TID XXX7
AIM GEOMETRIC SHAPE ENTRY
Type: Non-Extensible Version: 20090930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		CONTAINS	CODE	EV(zzz022, 99NCIAIM,	1	M		

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
				"Geometric Shape")				
2	>	HAS PROPERTIES	SCCOORD		1	MC	XOR ROW 4	
3	>>	R - SELECTED FROM	IMAGE		1	M		
4	>	HAS PROPERTIES	SCCOORD3D		1	MC	XOR ROW 2	
5	>	HAS PROPERTIES	CODE	EV(zzz021, 99NCIAIM, "Include Flag")	1	M		DCID 230 Yes-No
6	>	HAS PROPERTIES	TEXT	EV (112039, DCM, "Tracking Identifier")	1	M		A unique integer for each shape in the annotation

Notes: 1. Include Flag (row 5) is a Boolean flag that specifies whether or not the defined shape is included in the annotation or excluded from the annotation. In the latter case, there must be at least one geometric shape that is included, and all excluded areas are fully contained within the sum of all included areas. An example is the use of multiple geometric shapes to define a lesion with a cavity; the Include Flag specifies if the shape is the "donut" (surrounding included area) or the "hole" (contained excluded area).

2. The Tracking Identifier (row 6) is present to facilitate identification and ordering of shapes by applications and in XML.

4.10. AIM Segmentation Entry

TID XXX10
AIM SEGMENTATION ENTRY
Type: Non-Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			TEXT	EV (zzz006, 99NCIAIM, "Segmentation")	1	M		"Segmentation"
2	>	R-INFERED FROM	IMAGE		1	M		SOP Instance UID of the Segmentation. The SOP Class of the referenced instance shall be Segmentation Storage "1.2.840.10008.5.1.4.1.1.66.4"
3	>	R-INFERRED FROM	IMAGE	EV (zzz047, 99NCIAIM, "Segmented Image")	1	M		
4	>	HAS PROPERTY	NUM	EV (zzz060, 99NCIAIM, "Segmentation Number")	1	M		
5	>	HAS OBS CONTEXT	INCLUDE	DTID(XXX12) "Imaging Observation Entry"	1	U		

4.11. AIM Anatomic Entry

TID XXX11
AIM ANATOMIC ENTITY ENTRY
Type: Non-Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CODE	EV (zzz008, 99NCIAIM, "Anatomic Entity")	1	M		BCID (aimcid002) Anatomic Entity Values

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
2	>	HAS OBS CONTEXT	TEXT	EV(C45561, NCI, "A brief description given for purposes of identification")	1	M		
3	>	HAS PROPERTY	NUM	EV(zzz058, 99NCIAIM, "Annotator Confidence")	1	U		Units = DT(%, UCUM, %)
4	>	HAS OBS CONTEXT	CODE	EV(G-A203, SRT, "Present")	1	U		DCID 230 Yes-No
5	>		INCLUDE	DTID(XXX15) "Anatomic Entity Characteristic"	1-n	U		

4.12. AIM Imaging Observation Entry

TID XXX12

AIM IMAGING OBSERVATION ENTRY
Type: Non-Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS OBS CONTEXT	CODE	EV (zzz009, 99NCIAIM, "Imaging Observation")	1	M		
3	>	HAS OBS CONTEXT	TEXT	EV(C45561, NCI, "A brief description given for purposes of identification")	1	M		
3	>	HAS OBS CONTEXT	TEXT	EV (121106, DCM, "Comment")	1	U		
4	>	HAS OBS CONTEXT	NUM	EV(zzz058, 99NCIAIM, "Annotator Confidence")	1	U		Units = DT(%, UCUM, %)
5	>	HAS OBS CONTEXT	CODE	EV(G-A203, SRT, "Present")	1	U		DCID 230 Yes-No
6	>		INCLUDE	DTID(XXX13) "Imaging Observation Characteristic"	1-n	U		
7	>	HAS OBS CONTEXT	INCLUDE	DTID(XXX18) "Referenced Geometric Shape Entry"	1	U		

4.13. AIM Imaging Observation Characteristic Entry

TID XXX13

AIM IMAGING OBSERVATION CHARACTERISTIC ENTRY
Type: Non-Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS OBS CONTEXT	CODE	EV (zzz010, 99NCIAIM, "Imaging Observation Characteristic")	1	M		
2	>	HAS OBS CONTEXT	TEXT	EV(C45561, NCI, "A brief description given for purposes of identification")	1	M		
3	>	HAS OBS CONTEXT	TEXT	EV (121106, DCM, "Comment")	1	U		

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
4	>	HAS OBS CONTEXT	NUM	EV(zzz058, 99NCIAIM, "Annotator Confidence")	1	U		Units = DT (% , UCUM, %)
5	>		INCLUDE	EV (XXX19) "Characteristic Quantification"	1-n	U		

4.14. AIM Annotation Role Entry

TID XXX14

AIM ANOTATION ROLE

Type: Non-Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CODE	EV (zzz056, 99NCIAIM, "Annotation Role")	1	M		
2	>	HAS PROPERTIES	NUM	EV (zzz057, 99NCIAIM, "Role Sequence Number")	1	M		Units = DT(1, UCUM, "No units"

4.15. AIM Anatomic Entity Characteristic Entry

TID XXX15

AIM ANATOMIC ENTITY CHARACTERISTIC ENTRY

Type: Non-Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS OBS CONTEXT	CODE	EV (zzz052, 99NCIAIM, "Anatomic Entity Characteristic")	1	M		
2	>	HAS OBS CONTEXT	TEXT	EV(C45561, NCI, "A brief description given for purposes of identification")	1	M		
2	>	HAS OBS CONTEXT	NUM	EV(zzz058, 99NCIAIM, "Annotator Confidence")	1	U		Units = DT(% , UCUM, %)
3	>		INCLUDE	DTID(XXX19) "Characteristic Quantification"	1-n	U		

4.16. AIM Inference Entry

TID XXX17

AIM Inference ENTRY

Type: Non-Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS OBS CONTEXT	CODE	EV (zzz054, 99NCIAIM, "Inference")	1	M		
2	>	HAS OBS CONTEXT	NUM	EV(zzz058, 99NCIAIM, "Annotator Confidence")	1	U		Units = DT (% , UCUM, %)
3	>	HAS	CODE	EV(zzz059, 99NCIAIM, "Inference")	1	U		DCID 230 Yes-No

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
		PROPERTIES		"Image Evidence")				

4.17. AIM Referenced Geometric Shape Entry

TID XXX18

AIM REFERENCED GEOMETRIC SHAPE ENTRY

Type: Non-Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			TEXT	EV (zzz055, 99NCIAIM, "Referenced Geometric Shape")	1	M		The value shall be shape identifier of a Geometric Shape defined in the same AIM SR SOP Instance

4.18. AIM Characteristic Quantification Entry

TID XXX19

AIM CHARACTERISTIC QUANTIFICATION ENTRY

Type: Non-Extensible Version: 20100930

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1		HAS OBS CONTEXT	CODE	EV(zzz066, 99NCIAIM, "Characteristic Quantification")	1	M		DCID (aimcid13) Characteristic Quantification Type
2	>	HAS OBS CONTEXT	TEXT	EV(112039, DCM, "Tracking Identifier")	1	M		
3	>	HAS OBS CONTEXT	NUM	EV(zzz058, 99NCIAIM, "Annotator Confidence")	1	U		Units=DT(%, UCUM, %)
4	>	HAS PROPERTIES	NUM	EV(C25712, NCI, "A numerical quantity measured or assigned or computed")	1	MC	IFF Row 1 value = (chq001, 99NCIAIM, "Numerical")	DCID 082 Units of Measurement
5	>>	HAS OBS CONTEXT	CODE	EV(C61580, NCI, "A Boolean operator, a symbol that denotes a logical operation")	1	U		DCID (aimcid14) Comparison Operator Types
6	>	HAS PROPERTIES	NUM	EV(C63902, NCI, "An interval into which a given data point does or does not fall")	1	MC	IFF Row 1 value = (chq002, 99NCIAIM, "Quantile")	
7	>	HAS PROPERTIES	CODE	EV(zzz067, 99NCIAIM, "Non-Quantifiable Code")	1	MC	IFF Row 1 value = (chq003, 99NCIAIM, "Non-Quantifiable")	
8	>	HAS PROPERTIES	TEXT	EV(C25712, NCI, "A numerical quantity measured or assigned or computed")	1	MC	IFF Row 1 value = (chq004, 99NCIAIM, "Scale")	
9	>>	HAS OBS CONTEXT	TEXT	EV (121106, DCM, "Comment")	1	U		
10	>>	HAS OBS	TEXT	EV(C25365, NCI, "A	1	U		

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
		CONTEXT		written or verbal statement or explanation of something")				
11	>	HAS PROPERTIES	NUM	EV (G-A437, SRT, "Maximum")	1	MC	IFF Row 1 value = (chq005, 99NCIAIM, "Interval")	UCUM units must be present and be equal to UCUM units in raw 13
12	>>	HAS OBS CONTEXT	CODE	EV(C61580, NCI, "A Boolean operator, a symbol that denotes a logical operation")	1	M		DCID (aimcid14) Comparison Operator Types
13	>	HAS PROPERTIES	NUM	EV (R-404FB, SRT, "Minimum")	1	MC	IFF Row 1 value = (chq005, 99NCIAIM, "Interval")	UCUM units must be present and be equal to UCUM units in raw 11
14	>>	HAS OBS CONTEXT	CODE	EV(C61580, NCI, "A Boolean operator, a symbol that denotes a logical operation")	1	M		DCID (aimcid14) Comparison Operator Types

Notes: Name is mapped to row 2. Scale value is mapped to row 8.

4.19. Performing Roles

Context ID 7453 Extended

Performing Roles

Type: Extensible Version: 20100930

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
Include CID 7453		
DCM	121???	Reader
DCM	121???	Eligibility reader
DCM	121???	Adjudicator
DCM	121???	Reviewer

4.20. Anatomic Entity Values

Context ID aimcid002

Anatomic Entity Values

Type: Extensible Version: 20100930

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
Include CID 4 Anatomic Region		
Include CID 4013 Anatomic Region for Mammography		
Include CID 4016 Anatomic Region for Intra-oral Radiography		
Include CID 4017 Anatomic Region Modifier for Intra-oral Radiography		
Include CID 4030 CT and MR Anatomy Imaged		
Include CID 4031 Common Anatomic Regions		

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4.21. AIM Annotation Calculation Types

Context ID aimcid008

AIM Annotation Calculation Types

Type: Extensible Version: 20100930

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
<i>Include CID 83 Units for Real World Value Mapping</i>		
<i>Include CID 3488 Min/Max/Mean</i>		
<i>Include CID 3627 Measurement Type</i>		
<i>Include CID 7470 Linear Measurements</i>		
<i>Include CID 7471 Area Measurements</i>		
<i>Include CID 7472 Volume Measurements</i>		
SRT	G-A514	Absolute
99NCIAIM	act002	Angle
99NCIAIM	act003	Surface of revolution
SRT	R-10047	Standard Deviation
99NCIAIM	act007	Standard Error
99NCIAIM	act010	Center of Area
99NCIAIM	act011	2D Center of Mass
99NCIAIM	act012	3D Center of Mass
SRT	F-A0400	Summation
DCM	111049	Qualitative Difference
99NCIAIM	act015	Product
99NCIAIM	act016	Quotient
SRT	P0-02073	Perfusion
99NCIAIM	act019	Permeability
SRT	F-30100	Blood Volume
99NCIAIM	act021	Percent Stenosis

4.22. Calculation Result Types

Context ID aimcid009

Calculation Result Types

Type: Extensible Version: 20100930

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99NCIAIM	crt002	Vector
99NCIAIM	crt003	Histogram
99NCIAIM	crt004	Matrix

99NCIAIM	crt005	Array
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4.23. Annotation Type

Context ID aimcid011

Annotation Type

Type: Extensible Version: 20100930

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
		Include CID 6051 Breast Procedure Reason
		Include CID 6144 RECIST Response Criteria
		Include CID 6145 Baseline Category
		Include CID 7010 Key Object Selection Document Title

4.24. Segmentation Types

Context ID aimcid012

Segmentation Types

Type: Extensible Version: 20100930

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99NCIAIM	seg001	Binary
99NCIAIM	seg002	Fractional Probabilistic
99NCIAIM	seg003	Fractional Occupancy
99NCIAIM	seg004	Surface

4.25. Quantification Characteristic Types

Context ID aimcid013

Quantification Characteristic Types

Type: Extensible Version: 20100930

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99NCIAIM	qch001	Numerical
99NCIAIM	qch002	Quantile
99NCIAIM	qch003	Non-Quantifiable
99NCIAIM	qch004	Scale
99NCIAIM	qch005	Interval

4.26. Comparison Operator Types

Context ID aimcid014

Comparison Operator Types

Type: Non-Extensible Version: 20100930

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
SRT	G-A214	Equal
NCI	C1546806	Not equal condition applied to comparisons
NCI	C61585	A statement about the relative size or order of two objects specifying that an object of interest is smaller than another object in quantity or measure or value or status
NCI	C61586	A statement about the relative size or order of two objects specifying that either both objects are the same in quantity or measure or value or status or that the object of interest is smaller than the other object in one of these ways
NCI	C61584	A statement about the relative size or order of two objects specifying that an object of interest exceeds another object in quantity or measure or value or status
NCI	C61583	A statement about the relative size or order of two objects specifying that either both objects are the same in quantity or measure or value or status or that the object of interest exceeds the other object in one of these ways

4.27. Performing Roles

Context ID 7453 Extended

Performing Roles

Type: Extensible Version: 20100930

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
Include CID 7453		
DCM	121???	Reader
DCM	121???	Eligibility reader
DCM	121???	Adjudicator
DCM	121???	Reviewer

4.28. NCIAIM Private Code

99NCIAIM Private Code Definitions

Type: Extensible Version: 20100930

NCIAIM Code Definitions (Coding Scheme Designator “99NCIAIM” Coding Scheme Version “03”)

Code Value	Code Meaning	Definition	Notes
zzz001	Annotation SR Report	Annotation report container	
zzz002	Annotation	AIM Annotation	
zzz003	AIM version	Version of AIM used	
zzz004	Annotation Comment	Comments	
zzz005	Annotation Type	Type of Annotation	
zzz006	Segmentation	Segmentation	
zzz008	Anatomic Entity	Code for an anatomic entity	
zzz009	Imaging Observation	Code for Imaging Observation	
zzz010	Imaging Observation Characteristic	Code for Imaging Observation Characteristic	
zzz011	Calculation	Container of a calculation	
zzz013	Calculation MathML	Calculation's MathML	
zzz014	Referenced Calculation	Referenced Calculation container	
zzz015	Calculation Result	Calculation Result container	
zzz016	Calculation Result Type	Calculation Result Type	
zzz017	Number of Dimensions	Number of Dimensions in a calculation	
zzz018	Dimension Label	Label of a Dimension	
zzz019	Calculation Result Datum	Container of all Calculation Results Data	
zzz020	Calculation Result Data	Calculation Result value	
zzz021	Include Flag	Yes-No	
zzz022	Geometric Shape	Geometric Shape	
zzz025	Web Image URL	URL of Web Image	
zzz026	Person Observer's Login Name	Login Name of Observer	
zzz028	Text Annotation	Text Annotation	
zzz030	Image Annotation	Image Annotation Container	
zzz031	Annotation of Annotation	Annotation of Annotation Container	
zzz034	Image Library Entry	Code for Image Library Entry	
zzz039	Calculation Dimension	Calculation Result's dimension	
zzz040	Dimension Index	Calculation Result's dimension index	

zzz041	Dimension Size	Calculation Result's dimension size	
zzz042	Calculation Result Coordinate	Calculation Result coordinate data	
zzz043	Coordinate Position	Coordinate position in a dimension	
zzz045	Identifier within Person Observer's Role	A number indicating an identifier to which the person is assigned for a particular role	e.g. a role in clinical trial
zzz047	Segmented Image	Segmented Image	Image on which the segmentation was performed
zzz052	Anatomic Entity Characteristic	Code for an Anatomic Entity Characteristic	
zzz053	Rating	A concept (e.g. , "severity") and numerical value associated with the concept	
zzz054	Inference	A conclusion derived by interpreting an imaging study and/or medical history	
zzz055	Referenced Geometric Shape	A collection of referenced Geometric Shape's Identifiers. It associates a calculation to a specific set of Geometric Shape instances.	
zzz056	Annotation Role	Describes the role of referenced annotation.	
zzz057	Role Sequence Number	Represent ordering within the role.	
zzz058	Annotator Confidence	A real number, between 0 and 1, indicating annotator's confidence that a characteristic is present.	
zzz059	Image Evidence	A flag, if set, indicates that the inference is considered by the annotator to be ground truth.	
zzz060	Segmentation Number	Identification number of the segment. The value of Segment Number (0062,0004) shall be unique within the Segmentation instance in which it is created.	
zzz062	Referenced Annotation	Reference to another AIM annotation	

zzz063	AIM Status	Status of AIM Annotation	
zzz064	Annotation Version	Version of Annotation	
zzz065	Authorized By	Identification of authorization source	
zzz066	Characteristic Quantification	Characteristic Quantification	
zzz067	Non-Quantifiable Code	Non-quantifiable value code	
zzz068	Precedent AIM Annotation	Reference to precedent AIM Annotation	
zzz069	Presentation State Instance UID	Presentation State instance UID	

5. Harmonization Approach Between AIM Model, BRIDG, DICOM and LSDAM

5.1. BRIDG and LSDAM

A meeting with the BRIDG and LSDAM team took place the last week of December 2010. The purpose of the meeting was to provide an overview of the BRIDG and LSDAM model and discuss the overall harmonization process. Steve Sandberg is the lead for BRIDG and is assigned to work with the AIM team. Lisa Schick is the lead for LSDAM and is assigned to work with the AIM team. They will be working with Pat Mongkolwat, the AIM principle investigator.

5.1.1. An Approach to Harmonizing the AIM Model with BRIDG and LSDAM

- Step 1. A member of the AIM team provides this document to the Steve and Lisa.
- Step 2. A member of the AIM team provides an initial version of the AIM 4.0 model to Steve and Lisa.
- Step 3. Steve and Lisa work with the AIM team to incorporate the AIM information model into BRIDG and LSDAM. This process shall take about three weeks..
- Step 4. The AIM team receives feedback from Steve and Lisa. The team discusses and resolves any differences with Steve and Lisa.
- Step 5. The AIM team incorporates feedback from DICOM WG-18, Steve and Lisa.
- Step 6. The AIM team submits an update of the AIM 4.0 model to Steve and Lisa.
- Step 7. Repeat step 3 until model is finalized.

5.2. DICOM

The overall approach for AIM and DICOM harmonization is done via AIM DICOM SR template, as described in Chapter 4. The AIM team will be working with DICOM WG-18 to include the caBIG[®] AIM information model in DICOM standard. The DICOM WG-18 committee consists of David Clunie (chair), Jay Gaeta, and Lawrence Tarbox.

5.2.1. The Initial Meeting with DICOM WG-18

The initial meeting with DICOM WG-18 for harmonizing AIM with DICOM took place on December 2, 2010 during the RSNA 2010 annual conference. The attendees were David Clunie, Jay Gaeta, Larry Tarbox, Vlad Kleper, and Pat Mongkolwat. The items below were discussed during the meeting.

- We need to harmonize the caBIG[®] AIM 4.0 model with BRIDG and LS DAM.
- Comparison between AIM, BRIDG, and LS DAM (see Table 3.1-1, 3.1-2, 3.1-3 and 3.1-4)
- Survey, compare, and reuse existing DICOM SR templates with AIM (see Table 3.2-1)
- Inclusion of DICOM tags in AIM
 - need to follow DICOM approach, not freely entered
 - need WG-18 to approve and find appropriate place within the DICOM structure
- Ask AIM users about the desired DICOM attributes to be included in AIM
- Consider Oncology template from David Clunie to be included in AIM model.
 - ftp://d9-workgrps:goimagego@medical.nema.org/MEDICAL/Private/Dicom/WORKGRPS/Wg18/ClinicalTrialResults/supnnn_01_ClinicalTrialsResults.doc
- Upload BRIDG and LS DAM model to WG-18 document sharing location

5.2.2. An Approach to Harmonize AIM with DICOM

- Step 1. A member of the AIM team provides this document to the WG-18.
- Step 2. A member of the AIM team uploads BRIDG 3.0.3 and LSDAM 2.0.x (with imaging module) to the DICOM WG-18 FTP site.

- Step 3. The AIM team provides an initial version of AIM 4.0 model to WG-18.
- Step 4. The AIM team works with WG-18 to validate feedback from BRIDG and LSDAM.
- Step 5. The AIM team submits an update of the AIM 4.0 model to Steve and Lisa.
- Step 6. The AIM team works with WG-18 to create AIM DICOM SR template.

References

No	Artifact	Type	Link
1	02_03_AIM_Project_Report.doc	Microsoft Word	https://gforge.nci.nih.gov/frs/download.php/9112/AIM_v3.0.1_rv11.rar
2	09_03pu3.pdf	PDF file	ftp://medical.nema.org/medical/dicom/2009/09_03pu3.doc
3	BRIDG Domain Analysis Static Model Style Guide.docx	Microsoft Word	http://gforge.nci.nih.gov/frs/download.php/9082/BRIDG_Release_3.0.3_Package.zip
4	Life Sciences Domain Analysis Model (LSDAM)	Zip file	https://wiki.nci.nih.gov/display/LS/Life+Sciences+Domain+Analysis+Model+(LSDAM)+Select+LSDAM+Release+2.0+Model+Download
5	AIM_v3_rv11_XMI_XML_Schemas.zip	XMI file	https://gforge.nci.nih.gov/frs/download.php/8990/AIM_v3_rv11_XMI_XML_Schemas.zip

Appendix A Glossary

Term	Definition
AIM	Annotation and Image Markup
API	Application Programming Interface
caAERS	Cancer Adverse Events Reporting System
CSPS	Color Softcopy Presentation State
CT	Computed Tomography
DICOM	Digital Imaging and Communications in Medicine
GSPS	Grayscale Softcopy Presentation State
GUI	Graphical User Interface
IOD	Information Object Definition
PCSPS	Pseudo-Color Softcopy Presentation State
SOP	Service-Object-Pair
SR	Structured Report

Term	Definition
TLHC	Top Left Hand Corner
XML	eXtended Markup Language
UID	Unique Identifier
UML	Unified Modeling Language
WG-18	Working Group 18, Clinical Trials and Education