

# Definition of CRMdig v 4.0

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# Introduction

## Scope

CRM Digital is an ontology and RDF Schema to encode metadata about the steps and methods of production ("provenance") of digitization products and synthetic digital representations such as 2D, 3D or even animated Models created by various technologies. Its distinct features compared to competitive models is the complete inclusion of the initial physical measurement processes and their parameters. It has been developed as compatible extension of CIDOC CRM, which allows for querying the most relevant facts and returning complete descriptions encoded in this model by generic ISO21127 terms without need to refer to its specific properties. In contrast, competitive models cannot be queried by a more general standard and are restricted to the computational provenance only. Data encoded in the major competitive models can be transformed without loss of meaning into a CRM-Digital-form.

## Status

Published version

# CRMdig v 4.0 class hierarchy, aligned with portions from the CIDOC CRM hierarchy

This class hierarchy lists:

- all classes declared in CRMdig v 4.0
- all classes declared in CIDOC CRM version 7.1.1 that are declared as superclasses of classes declared in the CRMdig v 4.0
- all classes declared in CIDOC CRM version 7.1.1 that are either domain or range for a property declared in the CRMdig v 4.0

*Table 1: Class Hierarchy*

E1	CRM Entity
D13	- Digital Information Carrier
E11	Modification
D7	- Digital Machine Event
D10	- - Software Execution
D3	- - - Formal Derivation
D11	- - Digital Measurement Event
D2	- - - Digitization Process
D12	- - Data Transfer Event
E16	Measurement
D11	- Digital Measurement Event
D2	- - Digitization Process
E22	Human-Made Object
D8	- Digital Device
E26	Physical Feature
D35	- Area
E54	Dimension
D9	- Data Object

E65      Creation

D7        -    Digital Machine Event

D10      -   -   Software Execution

D3        -   -   -   Formal Derivation

D11      -   -   Digital Measurement Event

D2        -   -   -   Digitization Process

D12      -   -   Data Transfer Event

D30      -   Annotation Event

E73      Information Object

D1        -   Digital Object

D9        -   -   Data Object

D14      -   -   Software

D35      -   -   Area

E89      Propositional Object

D29      -   Annotation Object

## List of external classes used in CRMdig v 4.0

*Table 2: List of external classes grouped by model and ordered by model (exception: CRMbase always goes first) and then by class identifier.*

Class identifier	Class name	Model	Version
E1	CRM Entity	CIDOC CRM	7.1.1
E11	Modification	CIDOC CRM	7.1.1
E16	Measurement	CIDOC CRM	7.1.1
E18	Physical Thing	CIDOC CRM	7.1.1
E22	Human-Made Object	CIDOC CRM	7.1.1
E26	Physical Feature	CIDOC CRM	7.1.1
E54	Dimension	CIDOC CRM	7.1.1
E55	Type	CIDOC CRM	7.1.1
E65	Creation	CIDOC CRM	7.1.1
E73	Information Object	CIDOC CRM	7.1.1
E89	Propositional Object	CIDOC CRM	7.1.1

# CRMdig v 4.0 property hierarchy, aligned with portions from the CIDOC CRM hierarchy

This property hierarchy lists:

- all properties declared in CRMdig v 4.0
- all properties declared in CIDOC CRM version 7.1.1 that are declared as superproperties of properties declared in the CRMdig v 4.0

*Table 3: Property Hierarchy*

Property id	Property Name	Entity – Domain	Entity - Range
P3	has note	E1 CRM Entity	E62 String
L47	- has comment	E1 CRM Entity	E62 String
P12	occurred in the presence of (was present at)	E5 Event	E77 Persistent Item
L12	- happened on device (was device for)	D7 Digital Machine Event	D8 Digital Device
L15	- - has sender (was sender for)	D12 Data Transfer Event	D8 Digital Device
L16	- - has receiver (was sender for)	D12 Data Transfer Event	D8 Digital Device
P14	carried out by (performed)	E7 Activity	E39 Actor
L29	- has responsible organization (is responsible organization for)	E7 Activity	E40 Legal Body
L34	- - has contractor (is contractor for)	E7 Activity	E40 Legal Body
L35	- - has commissioner (is commissioner for)	E7 Activity	E40 Legal Body
L30	- has operator (is operator of)	E7 Activity	E21 Person
P16	used specific object (was used for)	E7 Activity	E70 Thing

L10	- had input (was input of)	D7 Digital Machine Event	D1 Digital Object
L2	- - used as source (was source for)	D10 Software Execution	D1 Digital Object
L21	- - - used as derivation source (was derivation source for)	D3 Formal Derivation	D1 Digital Object
L13	- - used parameters (parameters for)	D10 Software Execution	D1 Digital Object
L14	- - transferred (was transferred by)	D12 Data Transfer Event	D1 Digital Object
L23	- used software or firmware (was software or firmware used by)	D7 Digital Machine Event	D14 Software
P31	has modified (was modified by)	E11 Modification	E18 Physical Thing
L18	- has modified (was modified by)	D7 Digital Machine Event	D13 Digital Information Carrier
P39	measured (was measured by)	E16 Measurement	E18 Physical Thing
L1	- digitized (was digitized by)	D2 Digitization Process	E18 Physical Thing
P40	observed dimension (was observed in)	E16 Measurement	E54 Dimension
L20	- has created (was created by)	D11 Digital Measurement Event	D9 Data Object
P81	ongoing throughout	E52 Time-Span	E61 Time Primitive
L61	- was ongoing at	D7 Digital Machine Event	E61 Time Primitive
P90	has value	E54 Dimension	E60 Number
L56	- has pixel width	D9 Data Object	E60 Number
L57	- has pixel height	D9 Data Object	E60 Number
P94	has created (was created by)	E65 Creation	E28 Conceptual Object
L11	- had output (was output of)	D7 Digital Machine Event	D1 Digital Object
L20	- - has created (was created by)	D11 Digital Measurement Event	D9 Data Object
L22	- - created derivative (was derivative created by)	D3 Formal Derivation	D1 Digital Object



L24	- - created logfile (was logfile created by)	D10 Software Execution	D1 Digital Object
L48	- created annotation (was annotation created by)	D30 Annotation Event	D29 Annotation Object
P106	is composed of (forms part of)	E90 Symbolic Object	E90 Symbolic Object
L49	- is primary area of (has primary area)	D35 Area	D1 Digital Object
L50	- is propagated area of (has propagated area)	D35 Area	D1 Digital Object
P125	used object of type (was type of object used in)	E7 Activity	E55 Type
L17	- measured thing of type (was type of thing measured by)	D11 Digital Measurement Event	E55 Type
P128	carries (is carried by)	E18 Physical Thing	E90 Symbolic Object
L19	- stores (is stored on)	D13 Digital Information Carrier	D1 Digital Object
P140	assigned attribute to (was attributed by)	E13 Attribute Assignment	E1 CRM Entity
L60	- documents	D2 Digitization Process	E1 CRM Entity

## List of external properties used in CRMdig v 4.0

Table 4: List of external properties grouped by model and ordered by model and then by property identifier.

P3	has note	CIDOC CRM	7.1.1
P12	occurred in the presence of (was present at)	CIDOC CRM	7.1.1
P14	carried out by (performed)	CIDOC CRM	7.1.1
P16	used specific object (was used for)	CIDOC CRM	7.1.1
P31	has modified (was modified by)	CIDOC CRM	7.1.1
P39	measured (was measured by)	CIDOC CRM	7.1.1
P40	observed dimension (was observed in)	CIDOC CRM	7.1.1

P81	ongoing throughout	CIDOC CRM	7.1.1
P90	has value	CIDOC CRM	7.1.1
P94	has created (was created by)	CIDOC CRM	7.1.1
P106	is composed of (forms part of)	CIDOC CRM	7.1.1
P125	used object of type (was type of object used in)	CIDOC CRM	7.1.1
P128	carries (is carried by)	CIDOC CRM	7.1.1
P140	assigned attribute to (was attributed by)	CIDOC CRM	7.1.1

# CRMdig v 4.0 Class Declarations

The classes are comprehensively declared in this section using the following format:

- Class names are presented as headings in bold face, preceded by the class' unique identifier;
- The line "Subclass of:" declares the superclass of the class from which it inherits properties;
- The line "Superclass of:" is a cross-reference to the subclasses of this class;
- The line "Scope note:" contains the textual definition of the concept the class represents;
- The line "Examples:" contains a bulleted list of examples of instances of this class.
- The line "Properties:" declares the list of the class's properties;
- Each property is represented by its unique identifier, its forward name and the range class that it links to, separated by colons;
- Inherited properties are not represented;

## D1 Digital Object

### Subclass of:

E73 Information Object

### Superclass of:

D9 Data Object

D14 Software

D35 Area

### Scope note:

This class comprises identifiable immaterial items that can be represented as sets of bit sequences, such as data sets, e-texts, images, audio or video items, software, etc., and are documented as single units.

Any aggregation of instances of D1 Digital Object into a whole treated as single unit is also regarded as an instance of D1 Digital Object.

This means that for instance, the content of a DVD, an XML file on it, and an element of this file, are regarded as distinct instances of D1 Digital Object, mutually related by the P106 is composed of (forms part of) property.

A D1 Digital Object does not depend on a specific physical carrier, and it can exist on one or more carriers simultaneously.

**In First Order Logic:**

$$D1(x) \Rightarrow E73(x)$$

## **D2 Digitization Process**

**Subclass of:**

D11 Digital Measurement Event

**Scope note:**

This class comprises events that result in the creation of instances of D9 Data Object that represent the appearance and/or form of an instance of E18 Physical Thing such as paper documents, statues, buildings, paintings, etc.

A particular case is the analogue-to-digital conversion of audiovisual material.

This class represents the transition from a material thing to an immaterial representation of it.

The characteristic subsequent processing steps on digital objects are regarded as instances of D3 Formal Derivation.

**In First Order Logic:**

$$D2(x) \Rightarrow D11(x)$$

**Properties:**

L1 digitized (was digitized by): E18 Physical Thing

L60 documents: E1 CRM Entity

## **D3 Formal Derivation**

**Subclass of:**

D10 Software Execution

**Scope note:**

This class comprises events that result in the creation of a D1 Digital Object from another one following a deterministic algorithm, such that the resulting instance of digital object shares representative properties with the original object.

In other words, this class describes the transition from an immaterial object referred to by property L21 used as derivation source (was derivation source for) to another immaterial object referred to by property L22 created derivative (was derivative created by) preserving the representation of some things but in a different form. Characteristic examples are colour corrections, contrast changes and resizing of images.

**In First Order Logic:**

$D3(x) \Rightarrow D10(x)$

**Properties:**

L21 used as derivation source (was derivation source for): D1 Digital Object

L22 created derivative (was derivative created by): D1 Digital Object

## D7 Digital Machine Event

**Subclass of:**

E11 Modification

E65 Creation

**Superclass of:**

D10 Software Execution

D11 Digital Measurement Event

D12 Data Transfer Event

**Scope note:**

This class comprises events that happen on physical digital devices following a human activity that intentionally caused its immediate or delayed initiation and results in the creation of a new instance of D1 Digital Object on behalf of the human actor.

The input of a D7 Digital Machine Event may be parameter settings and/or data to be processed. Some D7 Digital Machine Events may form part of a wider E65 Creation event. In this case, all machine output of the partial events is regarded as creation of the overall activity.

**In First Order Logic:**

$D7(x) \Rightarrow E11(x)$

$D7(x) \Rightarrow E65(x)$

**Properties:**

L10 had input (was input of): D1 Digital Object

L11 had output (was output of): D1 Digital Object

L12 happened on device (was device for): D8 Digital Device

L18 has modified (was modified by): D13 Digital Information Carrier

L23 used software or firmware (was software or firmware used by): D14 Software

## D8 Digital Device

**Subclass of:**

E22 Human-Made Object

**Scope note:**

This class comprises identifiable material items such as computers, scanners, cameras, etc. that have the capability to process or produce instances of D1 Digital Object.

**In First Order Logic:**

$D8(x) \Rightarrow E22(x)$

## D9 Data Object

**Subclass of:**

D1 Digital Object

E54 Dimension

**Scope note:**

This class comprises instances of D1 Digital Object that are the direct result of a digital measurement or a formal derivative of it, containing quantitative properties of some physical things or other constellations of matter.

**In First Order Logic:**

$D9(x) \Rightarrow D1(x)$

$D9(x) \Rightarrow E54(x)$

## **D10 Software Execution**

### **Subclass of:**

D7 Digital Machine Event

### **Superclass of:**

D3 Formal Derivation

### **Scope note:**

This class comprises events by which a digital device runs a software program or a series of computing operations on a digital object as a single task, which is completely determined by its digital input, the software and the generic properties of the device.

### **In First Order Logic:**

$D10(x) \Rightarrow D7(x)$

### **Properties:**

L2 used as source (was source for): D1 Digital Object

L13 used parameters (parameters for): D1 Digital Object

L24 created logfile (was logfile created by): D1 Digital Object

## **D11 Digital Measurement Event**

### **Subclass of:**

D7 Digital Machine Event

E16 Measurement

### **Superclass of:**

D2 Digitization Process

**Scope note:**

This class comprises actions measuring physical properties using a digital device, that are determined by a systematic procedure and creates an instance of D9 Data Object, which is stored on an instance of D13 Digital Information Carrier.

In contrast to instances of D10 Software Execution, environmental factors have an intended influence on the outcome of an instance of D11 Digital Measurement Event.

Measurement devices may include running distinct software, such as the RAW to JPEG conversion in digital cameras.

In this case, the event is regarded as instance of both classes, D10 Software Execution and D11 Digital Measurement Event.

**In First Order Logic:**
$$D11(x) \Rightarrow D7(x)$$
$$D11(x) \Rightarrow E16(x)$$
**Properties:**

L17 measured thing of type (was type of thing measured by): E55 Type

L20 has created (was created by): D9 Data Object

## D12 Data Transfer Event

**Subclass of:**

D7 Digital Machine Event

**Scope note:**

This class comprises events that transfer a digital object from one digital carrier to another. Normally, the digital object remains the same. If in general or by observation the transfer implies or has implied some data corruption, the change of the digital objects may be documented distinguishing input and output rather than instantiating the property L14 transferred (was transferred by).

**In First Order Logic:**
$$D12(x) \Rightarrow D7(x)$$
**Properties:**



L14 transferred (was transferred by): D1 Digital Object

L15 has sender (was sender for): D8 Digital Device

L16 has receiver (was sender for): D8 Digital Device

## D13 Digital Information Carrier

**Subclass of:**

E1 CRM Entity

**Scope note:**

This class comprises all instances of E84 Information Carrier that are explicitly designed to be used as persistent digital physical carriers of instances of D1 Digital Object. A D13 Digital Information Carrier may or may not contain information, e.g., an empty diskette.

**In First Order Logic:**

$D13(x) \Rightarrow E1(x)$

**Properties:**

L19 stores (is stored on): D1 Digital Object

## D14 Software

**Subclass of:**

D1 Digital Object

**Scope note:**

This class comprises software codes, computer programs, procedures and functions that are used to operate a system of digital objects.

**In First Order Logic:**

$D14(x) \Rightarrow D1(x)$

## D29 Annotation Object

### Subclass of:

E89 Propositional Object

### Scope note:

This class comprises objects that make propositions about other artefacts.

Instances of this class are not the attributes themselves, by which things are annotated, but represent the connection between the concepts related in a proposition, and the activities of creation, modification and deletion.

This class is specialized by appropriate subclasses to express more specific relationships between annotated things, such as knowledge object, same as etc.

### In First Order Logic:

$D29(x) \Rightarrow E89(x)$

### Properties:

L43 annotates (is annotated by): E1 CRM Entity

## D30 Annotation Event

### Subclass of:

E65 Creation

### Scope note:

This class comprises events that describe the creation of associations (â€œAnnotation Objectsâ€• ) between objects or areas of objects of the Repository, with other objects or regions or persons, places, events. It is the event that creates the Annotation Object.

### In First Order Logic:

$D30(x) \Rightarrow E65(x)$

### Properties:

L48 created annotation (was annotation created by): D29 Annotation Object

## D35 Area

### Subclass of:

D1 Digital Object

E26 Physical Feature

### Scope note:

This class describes a part (of any shape or size) of interest in basically any media object stored in the Object Repository, i.e., a text, an image, a video or a 3D model. It points to content consisting of just a portion or area of a file. In some contexts, however, the area can also point to content represented by an integral (i.e., proper) file. It is equal to the METS AREA element.

### In First Order Logic:

$D35(x) \Rightarrow D1(x)$

$D35(x) \Rightarrow E26(x)$

### Properties:

L49 is primary area of (has primary area): D1 Digital Object

L50 is propagated area of (has propagated area): D1 Digital Object

# CRMdig v 4.0 Property Declarations

The properties are comprehensively declared in this section using the following format:

- Property names are presented as headings in bold face, preceded by unique property identifiers;
- The line “Domain:” declares the class for which the property is defined;
- The line “Range:” declares the class to which the property points, or that provides the values for the property;
- The line “Superproperty of:” is a cross-reference to any subproperties the property may have;
- The line “Quantification:” declares the possible number of occurrences for domain and range class instances for the property. Possible values are: one to many, many to many, many to one. Quantifications are presented in UML format and in ER format (used by the CIDOC CRM);
- The line “Scope note:” contains the textual definition of the concept the property represents;
- The line “Examples:” contains a bulleted list of examples of instances of this property.

## **L1 digitized (was digitized by)**

### **Domain:**

D2 Digitization Process

### **Range:**

E18 Physical Thing

### **Subproperty of:**

E16 Measurement:P39 measured (was measured by):E18 Physical Thing

### **Scope note:**

This property associates an instance of D2 Digitization Process with an instance of E18 Physical Thing which is a material thing.

### **In First Order Logic:**

$L1(x,y) \Rightarrow D2(x)$

$L1(x,y) \Rightarrow E18(y)$

$L1(x,y) \Rightarrow P39(x,y)$

## **L2 used as source (was source for)**

**Domain:**

D10 Software Execution

**Range:**

D1 Digital Object

**Subproperty of:**

D7 Digital Machine Event:L10 had input (was input of):D1 Digital Object

**Scope note:**

This property associates an instance of D10 Software Execution with an instance of D1 Digital Object which is used as a source, software essential for the performance.

**In First Order Logic:**

$L2(x,y) \Rightarrow D10(x)$

$L2(x,y) \Rightarrow D1(y)$

$L2(x,y) \Rightarrow L10(x,y)$

## **L10 had input (was input of)**

**Domain:**

D7 Digital Machine Event

**Range:**

D1 Digital Object

**Subproperty of:**

E7 Activity:P16 used specific object (was used for):E70 Thing

**Scope note:**

This property associates an instance of D7 Digital Machine Event with an instance of D1 Digital Object which is the input used to specify the machine action.

**In First Order Logic:**

$L10(x,y) \Rightarrow D7(x)$

$L10(x,y) \Rightarrow D1(y)$

$L10(x,y) \Rightarrow P16(x,y)$

## **L11 had output (was output of)**

**Domain:**

D7 Digital Machine Event

**Range:**

D1 Digital Object

**Subproperty of:**

E65 Creation:P94 has created (was created by):E28 Conceptual Object

**Scope note:**

This property associates an instance of D7 Digital Machine Event with an instance of D1 Digital Object which is the output of the activity.

**In First Order Logic:**

$L11(x,y) \Rightarrow D7(x)$

$L11(x,y) \Rightarrow D1(y)$

$L11(x,y) \Rightarrow P94(x,y)$

## **L12 happened on device (was device for)**

**Domain:**

D7 Digital Machine Event

**Range:**

D8 Digital Device

**Subproperty of:**

E5 Event:P12 occurred in the presence of (was present at):E77 Persistent Item

**Scope note:**

This property associates an instance of D7 Digital Machine Event with an object, the D8 Digital Device, which happened with, e.g a capturing event that happened on/with a digital camera, etc.

**In First Order Logic:**

$L12(x,y) \Rightarrow D7(x)$

$L12(x,y) \Rightarrow D8(y)$

$L12(x,y) \Rightarrow P12(x,y)$

## L13 used parameters (parameters for)

**Domain:**

D10 Software Execution

**Range:**

D1 Digital Object

**Subproperty of:**

D7 Digital Machine Event:L10 had input (was input of):D1 Digital Object

**Scope note:**

This property associates an instance of D10 Software Execution with a digital object used as a parameter during the process.

**In First Order Logic:**

$L13(x,y) \Rightarrow D10(x)$

$L13(x,y) \Rightarrow D1(y)$

$L13(x,y) \Rightarrow L10(x,y)$

## L14 transferred (was transferred by)

**Domain:**

D12 Data Transfer Event

**Range:**

D1 Digital Object

**Subproperty of:**

D7 Digital Machine Event:L10 had input (was input of):D1 Digital Object

**Scope note:**

This property identifies a digital object transferred by a D12 Data Transfer Event.

**In First Order Logic:**

$L14(x,y) \Rightarrow D12(x)$

$L14(x,y) \Rightarrow D1(y)$

$L14(x,y) \Rightarrow L10(x,y)$

## **L15 has sender (was sender for)**

**Domain:**

D12 Data Transfer Event

**Range:**

D8 Digital Device

**Subproperty of:**

D7 Digital Machine Event:L12 happened on device (was device for):D8 Digital Device

**Scope note:**

This property identifies a digital device used as a medium on which data are transferred through a D12 Data Transfer Event.

**In First Order Logic:**

$L15(x,y) \Rightarrow D12(x)$



$L15(x,y) \Rightarrow D8(y)$

$L15(x,y) \Rightarrow L12(x,y)$

## **L16 has receiver (was sender for)**

**Domain:**

D12 Data Transfer Event

**Range:**

D8 Digital Device

**Subproperty of:**

D7 Digital Machine Event:L12 happened on device (was device for):D8 Digital Device

**Scope note:**

This property identifies a digital device used as a medium to receive data through a D12 Data Transfer Event.

**In First Order Logic:**

$L16(x,y) \Rightarrow D12(x)$

$L16(x,y) \Rightarrow D8(y)$

$L16(x,y) \Rightarrow L12(x,y)$

## **L17 measured thing of type (was type of thing measured by)**

**Domain:**

D11 Digital Measurement Event

**Range:**

E55 Type

**Subproperty of:**

E7 Activity:P125 used object of type (was type of object used in):E55 Type

**Scope note:**

This property associates an instance of D11 Digital Measurement Event with the instance of E55Type of object to which it applied.

**In First Order Logic:**
$$L17(x,y) \Rightarrow D11(x)$$
$$L17(x,y) \Rightarrow E55(y)$$
$$L17(x,y) \Rightarrow P125(x,y)$$

## **L18 has modified (was modified by)**

**Domain:**

D7 Digital Machine Event

**Range:**

D13 Digital Information Carrier

**Subproperty of:**

E11 Modification:P31 has modified (was modified by):E18 Physical Thing

**Scope note:**

This property identifies a Digital Information Carrier modified in a Digital Machine Event.

**In First Order Logic:**
$$L18(x,y) \Rightarrow D7(x)$$
$$L18(x,y) \Rightarrow D13(y)$$
$$L18(x,y) \Rightarrow P31(x,y)$$

## **L19 stores (is stored on)**

**Domain:**

D13 Digital Information Carrier

**Range:**

D1 Digital Object

**Subproperty of:**

E18 Physical Thing:P128 carries (is carried by):E90 Symbolic Object

**Scope note:**

This property associates an instance of a D13 Digital Information Carrier with the instance of Digital Object that is stored on it.

**In First Order Logic:**

$L19(x,y) \Rightarrow D13(x)$

$L19(x,y) \Rightarrow D1(y)$

$L19(x,y) \Rightarrow P128(x,y)$

## **L20 has created (was created by)**

**Domain:**

D11 Digital Measurement Event

**Range:**

D9 Data Object

**Subproperty of:**

D7 Digital Machine Event:L11 had output (was output of):D1 Digital Object

**Scope note:**

This property identifies a Data Object that came into existence as a result of a D11 Digital Measurement Event.

**In First Order Logic:**

$L20(x,y) \Rightarrow D11(x)$

$L20(x,y) \Rightarrow D9(y)$

$L20(x,y) \Rightarrow L11(x,y)$

## **L21 used as derivation source (was derivation source for)**

**Domain:**

D3 Formal Derivation

**Range:**

D1 Digital Object

**Subproperty of:**

D10 Software Execution:L2 used as source (was source for):D1 Digital Object

**Scope note:**

This property associates an instance of a D3 Formal Derivation with the instance of D1 Digital Object that is used as a derivation source.

**In First Order Logic:**

$L21(x,y) \Rightarrow D3(x)$

$L21(x,y) \Rightarrow D1(y)$

$L21(x,y) \Rightarrow L2(x,y)$

## **L22 created derivative (was derivative created by)**

**Domain:**

D3 Formal Derivation

**Range:**

D1 Digital Object

**Subproperty of:**

D7 Digital Machine Event:L11 had output (was output of):D1 Digital Object

**Scope note:**

This property associates an instance of D3 Formal Derivation with the Digital Object it used to create a version of.

**In First Order Logic:**

$L22(x,y) \Rightarrow D3(x)$

$L22(x,y) \Rightarrow D1(y)$

$L22(x,y) \Rightarrow L11(x,y)$

**L23 used software or firmware (was software or firmware used by)**

**Domain:**

D7 Digital Machine Event

**Range:**

D14 Software

**Subproperty of:**

E7 Activity:P16 used specific object (was used for):E70 Thing

**Scope note:**

This property associates an instance of D7 Digital Machine Event with the instance of D14 Software that had used.

**In First Order Logic:**

$L23(x,y) \Rightarrow D7(x)$

$L23(x,y) \Rightarrow D14(y)$

$L23(x,y) \Rightarrow P16(x,y)$

**L24 created logfile (was logfile created by)**

**Domain:**

D10 Software Execution

**Range:**

D1 Digital Object

**Subproperty of:**

D7 Digital Machine Event:L11 had output (was output of):D1 Digital Object

**Scope note:**

This property identifies the logfile that was created by a D10 Software Execution in order to record all the activities in the system.

**In First Order Logic:**

$L24(x,y) \Rightarrow D10(x)$

$L24(x,y) \Rightarrow D1(y)$

$L24(x,y) \Rightarrow L11(x,y)$

## **L43 annotates (is annotated by)**

**Domain:**

D29 Annotation Object

**Range:**

E1 CRM Entity

**Scope note:**

This property describes the associations between objects or areas of objects of the RI, with other objects or regions or persons, places, events.

**In First Order Logic:**

$L43(x,y) \Rightarrow D29(x)$

$L43(x,y) \Rightarrow E1(y)$

## **L48 created annotation (was annotation created by)**

**Domain:**

D30 Annotation Event

**Range:**

D29 Annotation Object

**Subproperty of:**

E65 Creation:P94 has created (was created by):E28 Conceptual Object

**Scope note:**

This property identifies the D29 Annotation Object (associations) that came into existence as a result of a D30 Annotation Event.

**In First Order Logic:**

$L48(x,y) \Rightarrow D30(x)$

$L48(x,y) \Rightarrow D29(y)$

$L48(x,y) \Rightarrow P94(x,y)$

## **L49 is primary area of (has primary area)**

**Domain:**

D35 Area

**Range:**

D1 Digital Object

**Subproperty of:**

E90 Symbolic Object:P106 is composed of (forms part of):E90 Symbolic Object

**Scope note:**

This property describes the association between a particular area declared in an original digital object.

**In First Order Logic:**

$L49(x,y) \Rightarrow D35(x)$

$L49(x,y) \Rightarrow D1(y)$

$L49(x,y) \Rightarrow P106(x,y)$

## **L50 is propagated area of (has propagated area)**

**Domain:**

D35 Area

**Range:**

D1 Digital Object

**Subproperty of:**

E90 Symbolic Object:P106 is composed of (forms part of):E90 Symbolic Object

**Scope note:**

This property describes the association between an area and the digital object to which it is propagated.

**In First Order Logic:**

$L50(x,y) \Rightarrow D35(x)$

$L50(x,y) \Rightarrow D1(y)$

$L50(x,y) \Rightarrow P106(x,y)$

## **L54 is same-as (is same-as)**

**Domain:**

E1 CRM Entity

**Range:**

E1 CRM Entity

**Scope note:**

This property describes a non unique identification applied to E1 CRM Entity.

**In First Order Logic:**

$L54(x,y) \Rightarrow E1(x)$



$L54(x,y) \Rightarrow E1(y)$

## **L60 documents**

**Domain:**

D2 Digitization Process

**Range:**

E1 CRM Entity

**Subproperty of:**

E13 Attribute Assignment:P140 assigned attribute to (was attributed by):E1 CRM Entity

**Scope note:**

This property describes the CRM Entities documented by instances of Digitization Processes.

**In First Order Logic:**

$L60(x,y) \Rightarrow D2(x)$

$L60(x,y) \Rightarrow E1(y)$

$L60(x,y) \Rightarrow P140(x,y)$