BridgePoint® - Automation

Release 3.3 to 4.0

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Automation

Version 4.0-1.3

Documentation Roadmap

This manual is part of the three manual set for the BridgePoint family. Here is an overview of the three manuals.

BridgePoint - OOA

This manual is built around the process of doing OOA. The OOA process is broken down into steps and each step has Process, Method, and Automation sections in the manual. The Process section addresses who does the step, how long it should take, the outputs of the step, and quality issues. The Method section describes the underlying method issues for this step. The Automation section describes how the BridgePoint tool set is used to automate the OOA step.

BridgePoint - Automation

This manual is built around the process of doing file generation using Design By Translation techniques using the BridgePoint Generator tools.

BridgePoint - Tool Guide

This manual deals with BridgePoint tool specific topics that are independent of OOA. Included in this manual are Tool Fundamentals, Specifying User Properties,

General Model Editing, Printing, Version Management, License Management, Importing and Exporting Data, and BridgePoint Installation.

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TASK

Architecture Blueprint

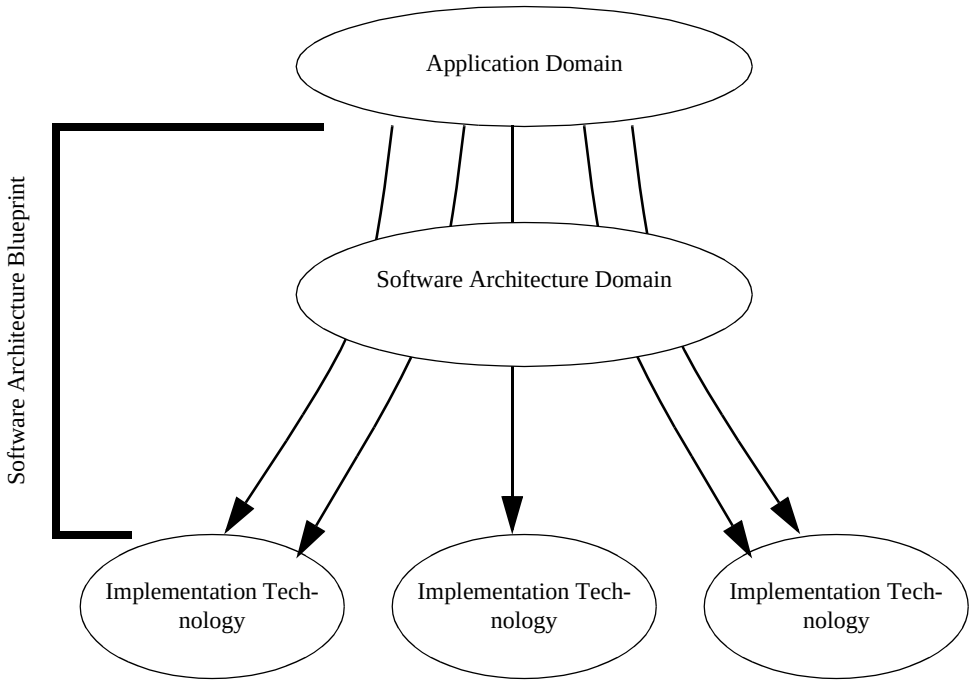
STEP 7

Architecture Characterization

7.1 Method

The Software Architecture Blueprint is a detailed plan of how to make use of a set of Implementation Technologies to implement the functionality defined by the OOA.

The following figure shows what a Software Architecture Blueprint includes:



The following sections outline a set of questions which will guide the determination of the Software Architecture Blueprint. The questions are based upon our experience and consulting - the list is in no way complete and we invite additions to the lists based on your experiences.

7.1.1 Implementation Technologies

7.1.1.1 Programming Language:

- C
- C++
- Smalltalk
- ADA
- COBOL
- Fortran
- Object COBOL
- Assembler
- Objective C
- ...

7.1.1.2 Operating System:

- Mainframe:
  - IBM
  - ...
- UNIX:
  - SunOS
  - System V Release 4
  - HP-UX
  - IRIX
  - AIX
  - ...
- Lightweight Tasking:
  - VxWorks
  - pSOS
  - ...
- OS/2

- Windows
- Windows NT
- ...

7.1.1.3 Database:

- Custom
- Relational Database:
  - Oracle
  - Sybase
  - Informix
  - ...
- Object-Oriented Database:
  - ObjectStore
  - Gemstone
  - Objectivity
  - Versant
  - ...

7.1.1.4 User Interface:

- Character Based:
  - Custom
  - Off-the-Shelf:
  - XVT
  - ...

- Graphical User Interface (GUI):
  - Custom
  - Off-the-Shelf:
  - Galaxy
  - Motif - COSE
  - MS Windows
  - XVT
  - Openlook - XView
  - ...

7.1.1.5 Implemented Service Domains:

- Alarming
- Measurements
- Audits
- Initialization
- ...

7.1.2 Architectural Decisions

7.1.2.1 Data Organization:

- Data Location:
  - Centralized
  - Distributed:
  - Instance Consolidated
  - Instance Dispersed

- Logical Organization:
  - One Table/Class per OOA Object
  - One or More Table/Class per OOA Object
  - 1:1 Objects Aggregated
  - 1:M Objects Aggregated (must use design info to specify what M)
- Physical Organization:
  - Direct correspondence to Logical Organization
  - Static Attributes stored separately from Dynamic Attributes (allows direct disk to memory pump of static data image)
- Memory Management:
  - Operating System, e.g., use default new operator in C++
  - Array/Pool - build own specialized instance management mechanisms
- Instance Relationships:
  - Object-Oriented Approach: Store Related Instances' Handles - direct access to related instances:
  - Store handles as Table Offsets
  - Store handles as Pointers
  - Relational-Oriented Approach: Store Referential Attributes (foreign keys) and search for related instances:
  - Linear Search
  - Hashing
  - B-Tree
- Relationship Integrity:
  - Require all Unconditional Relationships to be instantiated upon object instance creation
  - Allow temporary states of Relationship Conditionality inconsistency
- Referential Attributes:
  - Store as part of Physical Organization
  - Look up across relationship when accessed
- Derived Attributes:
  - Store derived value - re-derive value when dependent data changes
  - Derive for each access

7.1.2.2 Control Organization:

- Action Organization:
  - State Model Consolidated
  - Thread Consolidated
  - Task Allocation:
  - Single Task
  - Multi-Task
    - Peer-Peer
      - Homogeneous
      - Heterogeneous
    - Client-Server
      - Homogeneous
      - Heterogeneous
- Event Priority
  - Events Processed in order Generated
  - Intra-State Model Events Processed first, all other events processed in order Generated
  - Intra-State Model Events Processed first, Inter-State Model Events Processed next, all other events processed in order Generated

- Event Communication Mechanisms:
  - Intra-State Model Events:
    - 1 Queue
    - 1 Queue per Task
    - 1 Queue per State Model
    - 1 Queue per State Machine
    - Function Call
  - Inter-State Model Events:
    - 1 Queue
    - 1 Queue per Task
    - 1 Queue per State Model
    - 1 Queue per State Machine
    - Function Call
  - Inward Bound State Model Events:
    - 1 Queue
    - 1 Queue per Task
    - 1 Queue per State Model
    - 1 Queue per State Machine
    - Function Call
  - Outward Bound External Entity Events:
    - 1 Queue
    - 1 Queue per Task
    - 1 Queue per External Entity
    - Function Call
- Timers:
  - Polling
  - Invocation upon Expiration

7.1.2.3 Source Code Organization:

- Code Naming:
  - Key-letters
  - Names
  - Arbitrary IDs
- Code Allocation to Files:
  - Header Files:
    - 1 File per Domain
    - 1 File per Subsystem
    - 1 File per Object
  - Source Files:
    - 1 File per Domain
    - 1 File per Subsystem
    - 1 File per Object

STEP 8

Architecture Design

8.2 Method

This Domain is modeling the semantic data items which make up OOA. Note that this does NOT include the graphical data associated with the models of OOA - that information is captured in a separate domain.

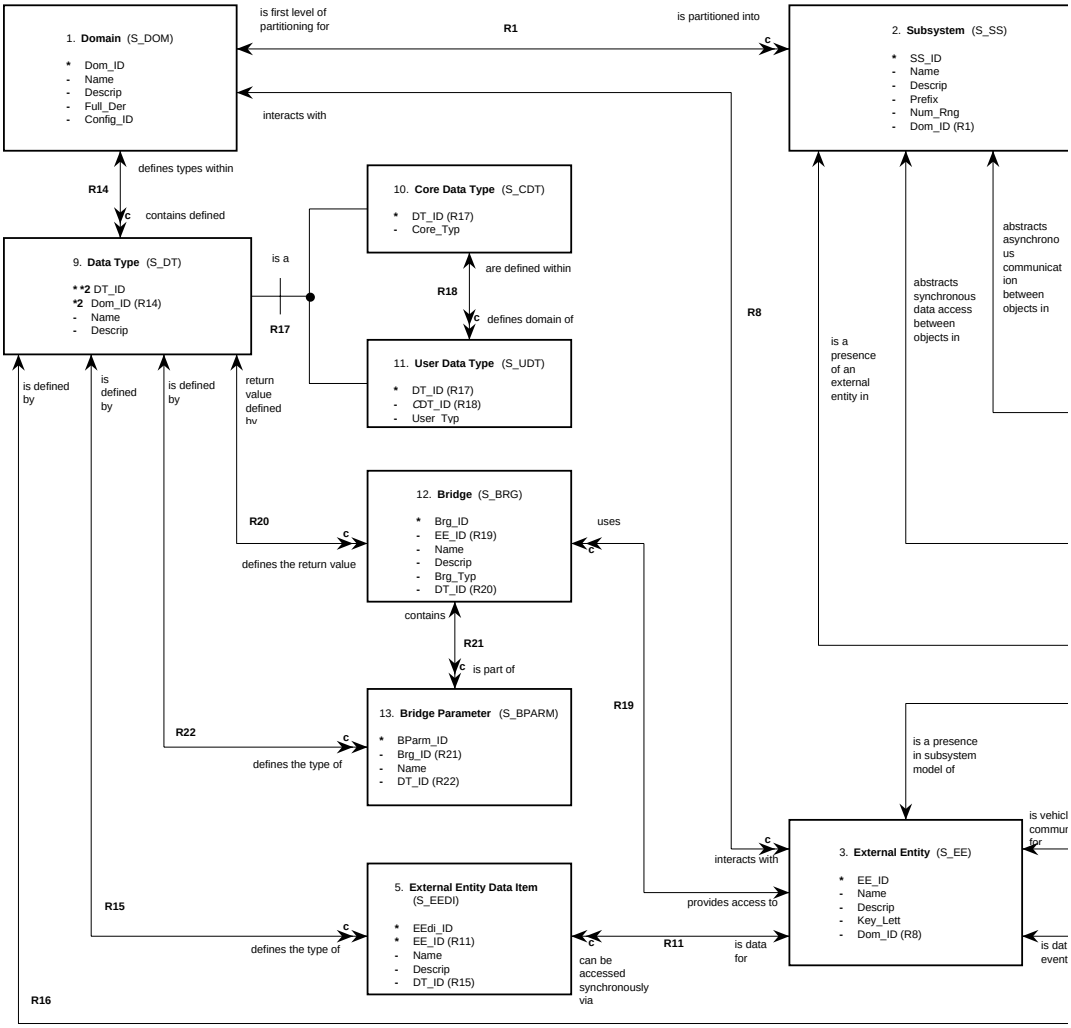
Completeness of this domain is very important - this OOA is to be used to enable translation, i.e. source code generation, from an analysis.

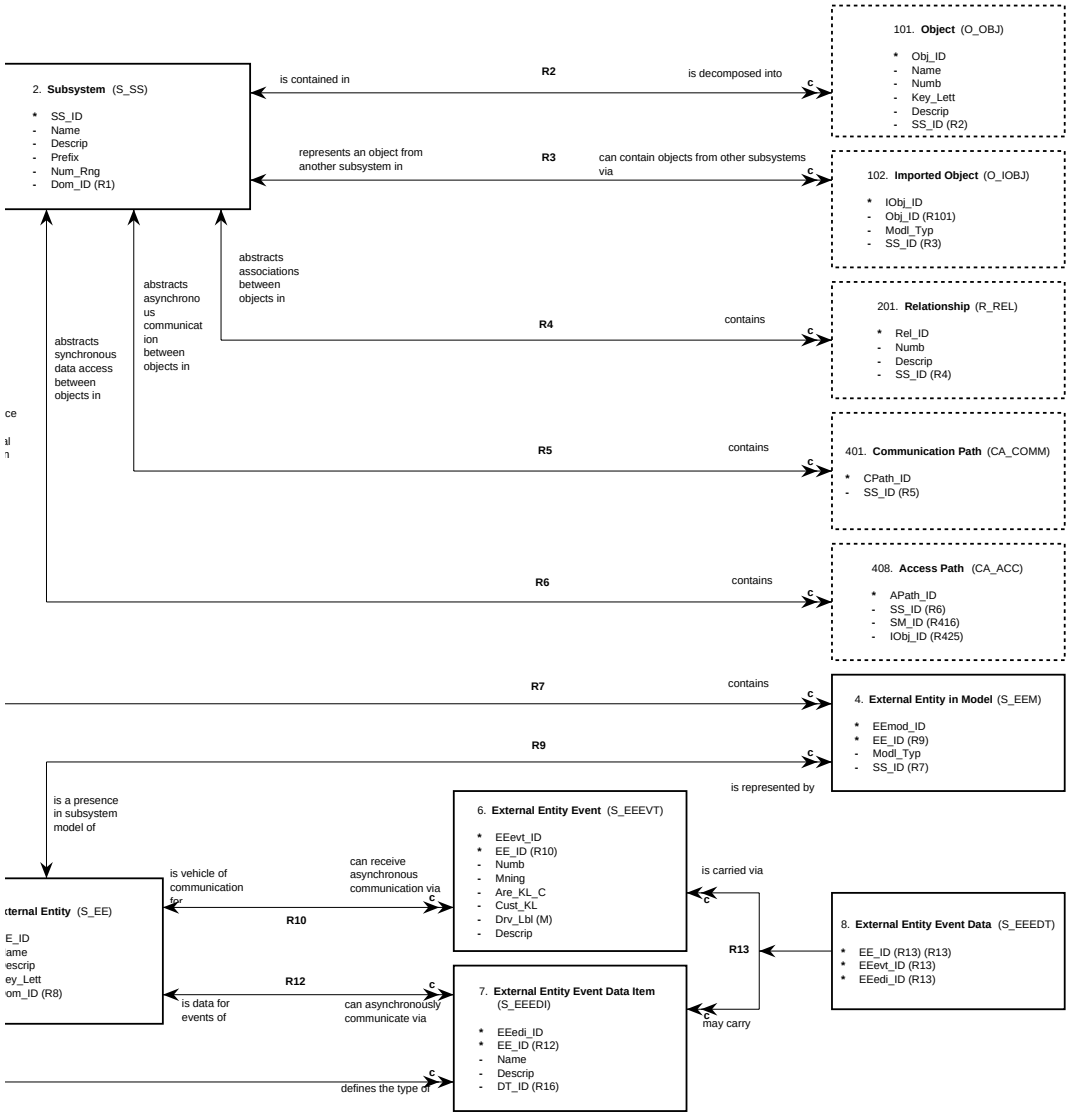
8.2.1 Subsystem ‘Subsystem’

A Subsystem is based on the partitioning of an entire Domain. The number of Subsystems in a Domain is dependent upon the Domain subject matter and complexity.

A Subsystem is composed of objects that tend to cluster, i.e., they have many interconnections with one another but few interconnections with objects in different clusters.

Inter-Subsystem relationships, communications, and accesses are captured in the Subsystem Relationship Model (SRM), Subsystem Communication Model (SCM), and Subsystem Access Model (SAM) respectively.


1. Domain (S_DOM)
* Dom_ID
- Name
- Descrip
- Full_Der
- Config_ID
is first level of partitioning for
R1
is partitioned into
2. Subsystem (S_SS)
* SS_ID
- Name
- Descrip
- Prefix
- Num_Rng
- Dom_ID (R1)
interacts with
defines types within
R14
contains defined
9. Data Type (S_DT)
** *2 DT_ID
*2 Dom_ID (R14)
- Name
- Descrip
is a
R17
10. Core Data Type (S_CDT)
* DT_ID (R17)
- Core_Typ
are defined within
R18
defines domain of
11. User Data Type (S_UDT)
* DT_ID (R17)
- CDT_ID (R18)
- User_Typ
R8
abstracts asynchronous communication between objects in
abstracts synchronous data access between objects in
is a presence of an external entity in
is defined by
is defined by
is defined by
return value defined by
R20
defines the return value
12. Bridge (S_BRG)
* Brg_ID
- EE_ID (R19)
- Name
- Descrip
- Brg_Typ
- DT_ID (R20)
uses
contains
R21
is part of
R22
defines the type of
13. Bridge Parameter (S_BPARM)
* BParm_ID
- Brg_ID (R21)
- Name
- DT_ID (R22)
R19
is a presence in subsystem model of
is vehicl commun for
interacts with
3. External Entity (S_EE)
* EE_ID
- Name
- Descrip
- Key_Lett
- Dom_ID (R8)
provides access to
R15
defines the type of
5. External Entity Data Item (S_EEDI)
* EEdi_ID
* EE_ID (R11)
- Name
- Descrip
- DT_ID (R15)
R11
is data for
is dat event
can be accessed synchronously via
R16


2. Subsystem (S_SS)
* SS_ID
- Name
- Descrip
- Prefix
- Num_Rng
- Dom_ID (R1)
is contained in
R2
is decomposed into
101. Object (O_OBJ)
* Obj_ID
- Name
- Numb
- Key_Lett
- Descrip
- SS_ID (R2)
represents an object from another subsystem in
R3
can contain objects from other subsystems via
102. Imported Object (O_IOBJ)
* IObj_ID
- Obj_ID (R101)
- Modl_Typ
- SS_ID (R3)
abstracts associations between objects in
abstracts asynchronous communication between objects in
abstracts synchronous data access between objects in
R4
contains
201. Relationship (R_REL)
* Rel_ID
- Numb
- Descrip
- SS_ID (R4)
R5
contains
401. Communication Path (CA_COMM)
* CPath_ID
- SS_ID (R5)
R6
contains
408. Access Path (CA_ACC)
* APath_ID
- SS_ID (R6)
- SM_ID (R416)
- IObj_ID (R425)
R7
contains
4. External Entity in Model (S_EEM)
* EEmod_ID
* EE_ID (R9)
- Modl_Typ
- SS_ID (R7)
R9
is represented by
is a presence in subsystem model of
ternal Entity (S_EE)
E_ID
ame
escrip
ey_Lett
om_ID (R8)
is vehicle of communication for
can receive asynchronous communication via
R10
6. External Entity Event (S_EEEVT)
* EEevt_ID
* EE_ID (R10)
- Numb
- Mning
- Are_KL_C
- Cust_KL
- Drv_Lbl (M)
- Descrip
is carried via
R13
8. External Entity Event Data (S_EEEDT)
* EE_ID (R13) (R13)
* EEevt_ID (R13)
* EEedi_ID (R13)
R12
is data for events of
can asynchronously communicate via
7. External Entity Event Data Item (S_EEEDI)
* EEedi_ID
* EE_ID (R12)
- Name
- Descrip
- DT_ID (R16)
may carry
defines the type of

8.2.1.1 Object and Attribute Descriptions

1. Domain (S_DOM)

Domain (Dom_ID, Name, Descrip, Full_Der, Config_ID)

Identifier *: Dom_ID

Description: A typical software system generally consists of distinct and independent subject matters. A Shlaer/Mellor analysis partition is based within each of these subject matters - each subject matter is called a Domain. A Domain is inhabited by its own conceptual entities (called objects). A domain may be partitioned into subsystems depending upon it's complexity. Each Domain is given a mission statement which provides a charter for the construction of the OOA models.

Domain.Dom_ID

Full Name: Domain Identifier

Attribute Type: Base Attribute

Data Domain: `unique_id`

Domain.Name

Full Name: Domain Name

Attribute Type: Base Attribute

Data Domain: `string`

Domain.Descrip

Full Name: Domain Description

Attribute Type: Base Attribute

Data Domain: `string`

Domain.Full_Der

Full Name: Fully Derived Flag

Attribute Type: Base Attribute

Data Domain: `boolean`

Description: A flag indicating whether the Object Communication Model and Object Access Model are fully derived from the information contained in the Object Information Model and Action Specifications.

Value **`0`** indicates OCM and OAM are not fully derived.

Value **`1`** indicates OCM and OAM are fully derived.

Domain.Config_ID

Full Name: Configuration Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

Description: The Configuration ID of the version management configuration which the domain is a part of (See Page 57 of BridgePoint Tool Guide). This ID can be used to access the V_CONFIG record corresponding to the Domain/Subsystem Configuration.

2. Subsystem (S_SS)

Subsystem (SS_ID, Name, Descrip, Prefix, Num_Rng, Dom_ID)

Identifier *: SS_ID

Description: A Subsystem is based on the partitioning of an entire Domain. The number of Subsystems in a Domain is dependent upon the Domain subject matter and complexity.

A Subsystem is composed of objects which tend to cluster, i.e., objects which have many relationships with one another but few relationships with objects in different clusters.

Inter-Subsystem relationships, asynchronous communications, and synchronous accesses are captured in the Subsystem Relationship Model, Subsystem Communication Model and Subsystem Access Model, respectively.

Subsystem.SS_ID

Full Name: Subsystem Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

Subsystem.Name

Full Name: Subsystem Name

Attribute Type: Base Attribute

Data Domain: **`string`**

Subsystem.Descrip

Full Name: Subsystem Description

Attribute Type: Base Attribute

Data Domain: **`string`**

Subsystem.Prefix

Full Name: Subsystem Keyletter Prefix

Attribute Type: Base Attribute

Data Domain: **`string`**

Description: The subsystem keyletter prefix is used when objects are created in the subsystem - the subsystem keyletter prefix is used as the default prefix in the object keyletters.

Subsystem.Num_Rng

Full Name: Subsystem Number Range Start

Attribute Type: Base Attribute

Data Domain: **`integer`**

Description: The subsystem number range start is used when objects and relationships are created in the subsystem - the subsystem number range start is used as the default auto-numbering start value in for the newly created Object's number and newly created Relationship's number.

Subsystem.Dom_ID

Attribute Type: Referential Attribute

Refers To: Domain.Dom_ID (R1) (See Page 20)

3. External Entity (S_EE)

External Entity (EE_ID, Name, Descrip, Key_Lett, Dom_ID)

Identifier *: EE_ID

Description: An External Entity represents something outside of the Domain being modeled that interacts with objects within the Domain being modeled. The interactions are showed by Event Communications in the Object Communication Models and Data Accesses in the Object Access Models. Each External Entity is given a unique name and keyletters within a Domain.

External Entity.EE_ID

Full Name: External Entity Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

External Entity.Name

Full Name: External Entity Name

Attribute Type: Base Attribute

Data Domain: **`string`**

External Entity.Descrip

Full Name: External Entity Description

Attribute Type: Base Attribute

Data Domain: **`string`**

External Entity.Key_Lett

Full Name: External Entity Key Letters

Attribute Type: Base Attribute

Data Domain: **`string`**

External Entity.Dom_ID

Attribute Type: Referential Attribute

Refers To: Domain.Dom_ID (R8) (See Page 20)

4. External Entity in Model (S_EEM)

External Entity in Model (EEmod_ID, EE_ID, Modl_Typ, SS_ID)

Identifier *: EE_ID, EEmod_ID

Description: The External Entity in Model is the presence of an External Entity in a model such as the Object Communication Model or Object Access Model. The same External Entity can be represented by more than one External Entity in Model in the same model to enhance model layout.

External Entity in Model.EEmod_ID

Full Name: External Entity in Model Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

External Entity in Model.EE_ID

Attribute Type: Referential Attribute

Refers To: External Entity.EE_ID (R9) (See Page 23)

External Entity in Model.Modl_Typ

Full Name: Model Type

Attribute Type: Base Attribute

Data Domain: **`integer`**

Description: Value indicates what type of model the External Entity is in:

Value **`6`** indicates Object Communication Model

Value **`7`** indicates Object Access Model

External Entity in Model.SS_ID

Attribute Type: Referential Attribute

Refers To: Subsystem.SS_ID (R7) (See Page 21)

5. External Entity Data Item (S_EEDI)

External Entity Data Item (EEdi_ID, EE_ID, Name, Descrip, DT_ID)

Identifier *: EE_ID, EEdi_ID

Description: Interactions between Objects and External Entities shown in the Object Access Models involve the access of data. An External Entity Data Item is a characteristic of an External Entity that an Object may read.

External Entity Data Item.EEdi_ID

Full Name: External Entity Data Item Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

External Entity Data Item.EE_ID

Attribute Type: Referential Attribute

Refers To: External Entity.EE_ID (R11) (See Page 23)

External Entity Data Item.Name

Full Name: External Entity Data Item Name

Attribute Type: Base Attribute

Data Domain: **`string`**

External Entity Data Item.Descrip

Full Name: External Entity Data Item Description

Attribute Type: Base Attribute

Data Domain: **`string`**

External Entity Data Item.DT_ID

Attribute Type: Referential Attribute

Refers To: Data Type.DT_ID (R15) (See Page 29)

6. External Entity Event (S_EEEVT)

External Entity Event (EEevt_ID, EE_ID, Numb, Mning, Are_KL_C, Cust_KL, Drv_Lbl, Descrip)

Identifier *: EE_ID, EEevt_ID

Description: An External Entity Event identifies an interaction between an Object and an External Entity and is captured on an Object Communication Model. Each External Entity Event is given a unique label.

External Entity Event.EEevt_ID

Full Name: External Entity Entity Event Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

External Entity Event.EE_ID

Attribute Type: Referential Attribute

Refers To: External Entity.EE_ID (R10) (See Page 23)

External Entity Event.Numb

Full Name: External Entity Entity Event Number

Attribute Type: Base Attribute

Data Domain: **`integer`**

External Entity Event.Mning

Full Name: External Entity Entity Event Meaning

Attribute Type: Base Attribute

Data Domain: **`string`**

External Entity Event.Are_KL_C

Full Name: Are Key Letters Custom Flag

Attribute Type: Base Attribute

Data Domain: **`boolean`**

Description: This is a flag that indicates whether custom label keyletters are used for the External Entity Event.

Value **`0`** indicates custom label keyletters are used.

Value **`1`** indicates External Entity keyletters are used.

External Entity Event.Cust_KL

Full Name: Custom External Entity Event Label Key Letters

Attribute Type: Base Attribute

Data Domain: **`string`**

External Entity Event.Drv_Lbl

Full Name: Derived External Entity Event Label

Attribute Type: Derived Base Attribute

Data Domain: **`string`**

Description: Holds the event label - derived by concatenating the keyletters and the event number.

If the **`Are_KL_C`** attribute is 0, then the value of the **`External Entity.Name`** attribute is concatenated with the **`External Entity.Numb`** attribute.

If the **`Are_KL_C`** attribute is 1, then the value of the **`External Entity.Cust_KL`** attribute is concatenated with the **`External Entity.Numb`** attribute.

External Entity Event.Descrip

Full Name: External Entity Event Description

Attribute Type: Base Attribute

Data Domain: **`string`**

7. External Entity Event Data Item (S_EEEDI)

External Entity Event Data Item (EEedi_ID, EE_ID, Name, Descrip, DT_ID)

Identifier *: EEedi_ID, EE_ID

Description: Synchronous interactions from Objects to External Entities modeled by allowing an Object to synchronously access the data items of the External Entity - the interaction is captured on the Object Communication Model. An External Entity Data Item is a characteristic of an External Entity.

External Entity Event Data Item.EEedi_ID

Full Name: External Entity Event Data Item Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

External Entity Event Data Item.EE_ID

Attribute Type: Referential Attribute

Refers To: External Entity.EE_ID (R12) (See Page 23)

External Entity Event Data Item.Name

Full Name: External Entity Event Data Item Name
Attribute Type: Base Attribute
Data Domain: `string`

External Entity Event Data Item.Descrip

Full Name: External Entity Event Data Item Description
Attribute Type: Base Attribute
Data Domain: `string`

External Entity Event Data Item.DT_ID

Attribute Type: Referential Attribute
Refers To: Data Type.DT_ID (R16) (See Page 29)

8. External Entity Event Data (S_EEEDT)

External Entity Event Data (EE_ID, EEevt_ID, EEedi_ID)
Identifier *: EE_ID, EEevt_ID, EEedi_ID
Description: This object serves as a correlation table.

External Entity Event Data.EE_ID

Attribute Type: Referential Attribute
Refers To: External Entity Event.EE_ID (R13) (See Page 26)
Refers To: External Entity Event Data Item.EE_ID (R13) (See Page 27)

External Entity Event Data.EEevt_ID

Attribute Type: Referential Attribute
Refers To: External Entity Event.EEevt_ID (R13) (See Page 25)

External Entity Event Data.EEedi_ID

Attribute Type: Referential Attribute
Refers To: External Entity Event Data Item.EEedi_ID (R13) (See Page 27)

9. Data Type (S_DT)

Data Type (DT_ID, Dom_ID, Name, Descrip)

Identifier *: DT_ID

Identifier *2: DT_ID, Dom_ID

Description: An analyst can assign a data type to the various data items in the OOA, e.g., object attribute, state model event data item, transformer/ bridge parameter/return value.

This data type does not capture the representation of the data items, but rather, the characteristics of the data items including:

1. Value Definition, e.g., whole numbers
2. Value Range, e.g., values between 0 and 10
3. Operations, e.g., +, -, *, /

Data Type.DT_ID

Full Name: Data Type Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

Data Type.Dom_ID

Attribute Type: Referential Attribute

Refers To: Domain.Dom_ID (R14) (See Page 20)

Data Type.Name

Full Name: Data Type Name

Attribute Type: Base Attribute

Data Domain: **`string`**

Data Type.Descrip

Full Name: Data Type Description

Attribute Type: Base Attribute

Data Domain: **`string`**

10. Core Data Type (S_CDT)

Core Data Type (DT_ID, Core_Typ)

Identifier *: DT_ID

Description: Core Data Types are those data types which are fundamental, or core, to all data types.

Core Data Type.DT_ID

Attribute Type: Referential Attribute

Refers To: Data Type.DT_ID (R17) (See Page 29)

Core Data Type.Core_Typ

Full Name: Core Data Type Core Type

Attribute Type: Base Attribute

Data Domain: **`integer`**

Description: Valid Core Types:

0 = void

1 = boolean

2 = integer

3 = real

4 = string

5 = unique_id

6 = current_state

7 = same_as_base

8 = inst_ref<Object>

9 = inst_ref_set<Object>

10 = inst<Event>

11 = inst<Mapping>

12 = inst_ref<Mapping>

11. User Data Type (S_UDT)

User Data Type (DT_ID, CDT_ID, User_Typ)

Identifier *: DT_ID

Description: User Data Types are those data types which have been derived from the core data types - they typically are derived because more assumptions can be made about the range of values which can be stored or they are derived to serve as a common funneling point for several data items which share some common data type.

User Data Type.DT_ID

Attribute Type: Referential Attribute

Refers To: Data Type.DT_ID (R17) (See Page 29)

User Data Type.CDT_ID

Attribute Type: Referential Attribute

Refers To: Core Data Type.DT_ID (R18) (See Page 30)

User Data Type.User_Typ

Full Name: User Data Type User Type

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = *user defined*

1 = date

2 = timestamp

3 = inst_ref<Timer>

12. Bridge (S_BRG)

Bridge (Brg_ID, EE_ID, Name, Descrip, Brg_Typ, DT_ID)

Identifier *: Brg_ID

Description: A Bridge is a method associated with an External Entity - bridges can be synchronously called from Action Specifications.

Bridge.Brg_ID

Full Name: Bridge Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

Bridge.EE_ID

Attribute Type: Referential Attribute

Refers To: External Entity.EE_ID (R19) (See Page 23)

Bridge.Name

Full Name: Bridge Name

Attribute Type: Base Attribute

Data Domain: **`string`**

Bridge.Descrip

Full Name: Bridge Description

Attribute Type: Base Attribute

Data Domain: **`string`**

Bridge.Brg_Typ

Full Name: Bridge Type

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = *user defined*

1 = predefined bridge

Bridge.DT_ID

Attribute Type: Referential Attribute

Refers To: Data Type.DT_ID (R20) (See Page 29)

13. Bridge Parameter (S_BPARM)

Bridge Parameter (BParm_ID, Brg_ID, Name, DT_ID)

Identifier *: BParm_ID

Description: A parameter to a bridge.

Bridge Parameter.BParm_ID

Full Name: Bridge Parameter Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

Bridge Parameter.Brg_ID

Attribute Type: Referential Attribute

Refers To: Bridge.Brg_ID (R21) (See Page 31)

Bridge Parameter.Name

Full Name: Bridge Parameter Name

Attribute Type: Base Attribute

Data Domain: **`string`**

Bridge Parameter.DT_ID

Attribute Type: Referential Attribute

Refers To: Data Type.DT_ID (R22) (See Page 29)

8.2.1.2 Relationship Descriptions

R1

Relationship Type: Simple
Multiplicity/Conditionality: Mc:1
Domain is partitioned into Subsystem
Subsystem is first level of partitioning for Domain
Formalized By: Domain.Dom_ID

R2

Relationship Type: Simple
Multiplicity/Conditionality: 1:Mc
Object is contained in Subsystem
Subsystem is decomposed into Object
Formalized By: Subsystem.SS_ID

R3

Relationship Type: Simple
Multiplicity/Conditionality: 1:Mc
Imported Object represents an object from another subsystem in Subsystem
Subsystem can contain objects from other subsystems via Imported Object
Formalized By: Subsystem.SS_ID

R4

Relationship Type: Simple
Multiplicity/Conditionality: 1:Mc
Relationship abstracts associations between objects in Subsystem
Subsystem contains Relationship
Formalized By: Subsystem.SS_ID

R5

Relationship Type: Simple

Multiplicity/Conditionality: 1:Mc

Communication Path abstracts asynchronous communication between objects in Subsystem

Subsystem contains Communication Path

Formalized By: Subsystem.SS_ID

R6

Relationship Type: Simple

Multiplicity/Conditionality: 1:Mc

Access Path abstracts synchronous data access between objects in Subsystem

Subsystem contains Access Path

Formalized By: Subsystem.SS_ID

R7

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

Subsystem contains External Entity in Model

External Entity in Model is a presence of an external entity in Subsystem

Formalized By: Subsystem.SS_ID

R8

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

Domain interacts with External Entity

External Entity interacts with Domain

Formalized By: Domain.Dom_ID

R9

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

External Entity is represented by External Entity in Model

External Entity in Model is a presence in subsystem model of External Entity

Formalized By: External Entity.EE_ID

R10

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

External Entity can receive asynchronous communication via External Entity Event

External Entity Event is vehicle of communication for External Entity

Formalized By: External Entity.EE_ID

R11

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

External Entity can be accessed synchronously via External Entity Data Item

External Entity Data Item is data for External Entity

Formalized By: External Entity.EE_ID

R12

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

External Entity can asynchronously communicate via External Entity Event Data Item

External Entity Event Data Item is data for events of External Entity

Formalized By: External Entity.EE_ID

R13

Relationship Type: Associative

Multiplicity/Conditionality: 1-(Mc:Mc)

External Entity Event Data Item is carried via External Entity Event

External Entity Event may carry External Entity Event Data Item

Formalized By: External Entity Event.EE_ID, External Entity Event.EEevt_ID, External Entity Event Data Item.EEedi_ID, External Entity Event Data Item.EE_ID

R14

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

Domain contains defined Data Type

Data Type defines types within Domain

Formalized By: Domain.Dom_ID

R15

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

Data Type defines the type of External Entity Data Item

External Entity Data Item is defined by Data Type

Formalized By: Data Type.DT_ID

R16

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

Data Type defines the type of External Entity Event Data Item

External Entity Event Data Item is defined by Data Type

Formalized By: Data Type.DT_ID

R17

Relationship Type: Subtype/Supertype

Subtypes: User Data Type, Core Data Type

Formalized By: Data Type.DT_ID

R18

Relationship Type: Simple
Multiplicity/Conditionality: Mc:1
Core Data Type defines domain of User Data Type
User Data Type are defined within Core Data Type
Formalized By: Core Data Type.DT_ID

R19

Relationship Type: Simple
Multiplicity/Conditionality: Mc:1
External Entity uses Bridge
Bridge provides access to External Entity
Formalized By: External Entity.EE_ID

R20

Relationship Type: Simple
Multiplicity/Conditionality: Mc:1
Data Type defines the return value Bridge
Bridge return value defined by Data Type
Formalized By: Data Type.DT_ID

R21

Relationship Type: Simple
Multiplicity/Conditionality: Mc:1
Bridge is part of Bridge Parameter
Bridge Parameter contains Bridge
Formalized By: Bridge.Brg_ID

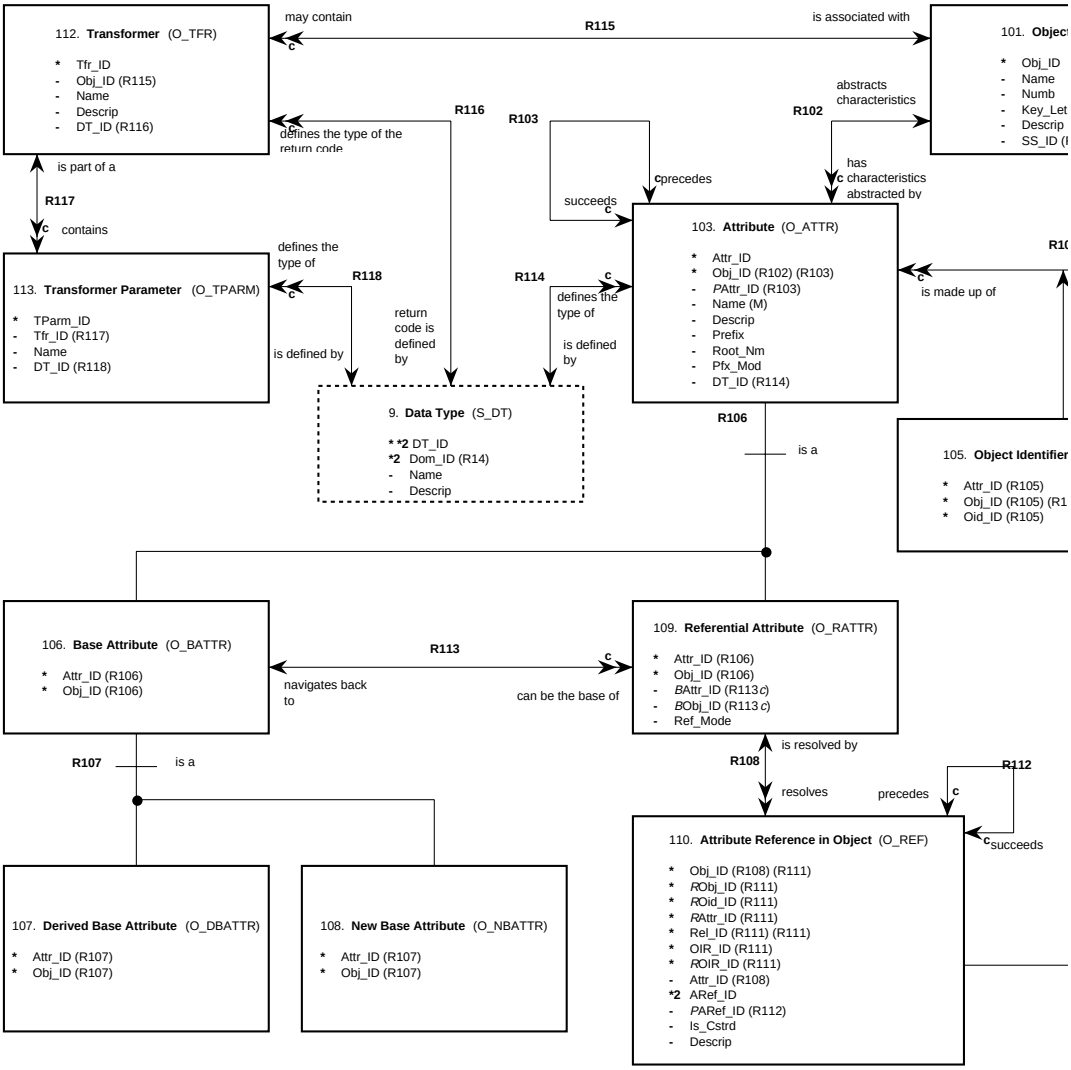
R22

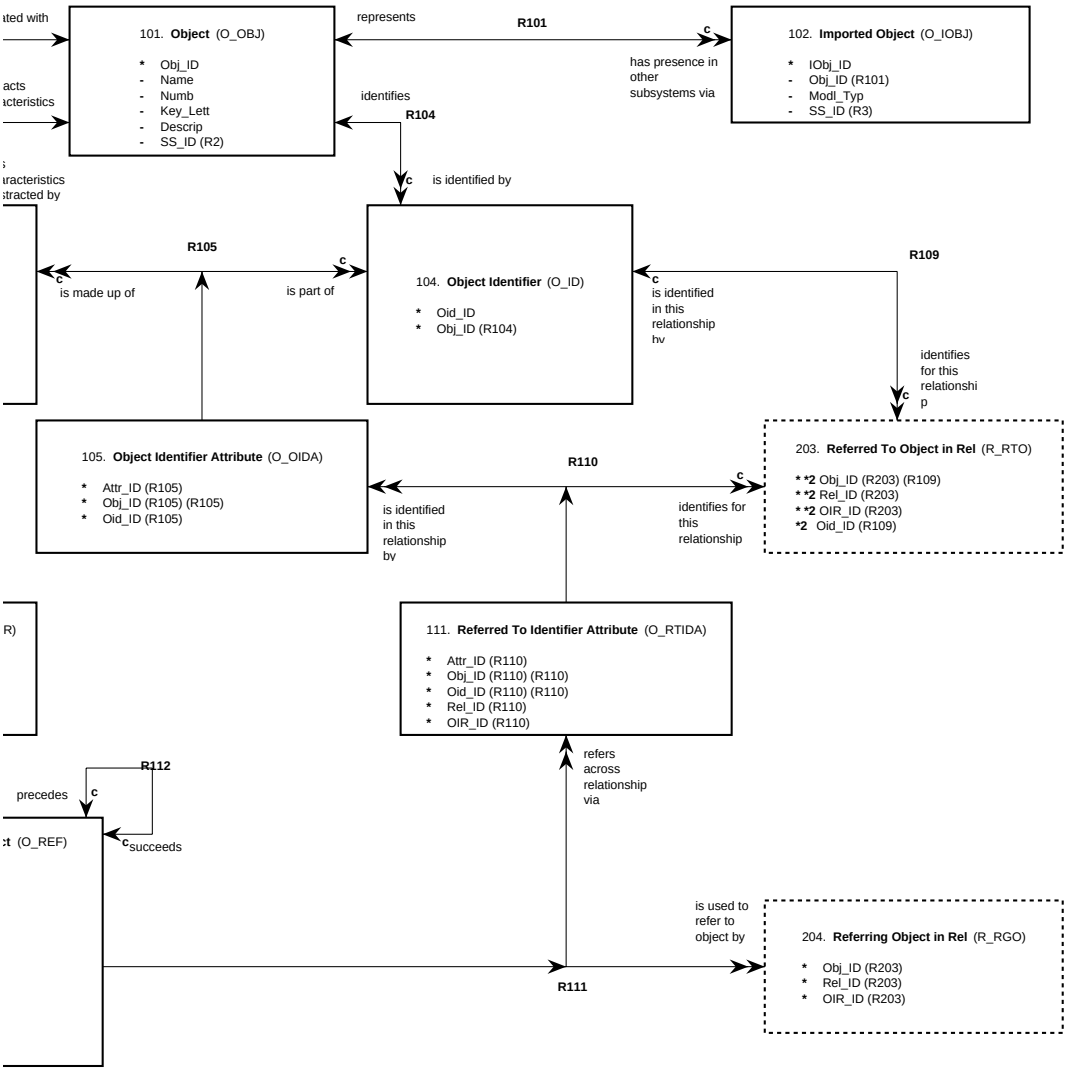
Relationship Type: Simple
Multiplicity/Conditionality: Mc:1

Data Type defines the type of Bridge Parameter
Bridge Parameter is defined by Data Type
Formalized By: Data Type.DT_ID

8.2.2 Subsystem ‘Object’

An Object is the abstraction of real world things that have the same characteristics and conform to a given set of rules. An Object is assigned to exactly one Subsystem. Objects fall into many categories, some of which are tangible things, roles, interactions and specifications. Objects that have interesting behavior are given a lifecycle which is modeled by a State Model


112. Transformer (O_TFR)
* Tfr_ID
- Obj_ID (R115)
- Name
- Descrip
- DT_ID (R116)
may contain
R115
is associated with
101. Objec
* Obj_ID
- Name
- Numb
- Key_Let
- Descrip
- SS_ID (
R116
defines the type of the return code
R103
R102
abstracts characteristics
has characteristics abstracted by
precedes
succeeds
is part of a
R117
contains
113. Transformer Parameter (O_TPARM)
* TParm_ID
- Tfr_ID (R117)
- Name
- DT_ID (R118)
defines the type of
R118
is defined by
return code is defined by
R114
defines the type of
is defined by
103. Attribute (O_ATTR)
* Attr_ID
* Obj_ID (R102) (R103)
- PAttr_ID (R103)
- Name (M)
- Descrip
- Prefix
- Root_Nm
- Pfx_Mod
- DT_ID (R114)
R10
is made up of
9. Data Type (S_DT)
* *2 DT_ID
*2 Dom_ID (R14)
- Name
- Descrip
R106
is a
105. Object Identifier
* Attr_ID (R105)
* Obj_ID (R105) (R1
* Oid_ID (R105)
106. Base Attribute (O_BATTR)
* Attr_ID (R106)
* Obj_ID (R106)
R113
navigates back to
can be the base of
109. Referential Attribute (O_RATTR)
* Attr_ID (R106)
* Obj_ID (R106)
- BAttr_ID (R113 c)
- BObj_ID (R113 c)
- Ref_Mode
R107
is a
is resolved by
R108
resolves
precedes
R112
succeeds
110. Attribute Reference in Object (O_REF)
* Obj_ID (R108) (R111)
* RObj_ID (R111)
* ROid_ID (R111)
* RAttr_ID (R111)
* Rel_ID (R111) (R111)
* OIR_ID (R111)
* ROIR_ID (R111)
- Attr_ID (R108)
*2 ARef_ID
- PARef_ID (R112)
- Is_Cstrd
- Descrip
107. Derived Base Attribute (O_DBATTR)
* Attr_ID (R107)
* Obj_ID (R107)
108. New Base Attribute (O_NBATTR)
* Attr_ID (R107)
* Obj_ID (R107)


101. Object (O_OBJ)
* Obj_ID
- Name
- Numb
- Key_Lett
- Descrip
- SS_ID (R2)
represents
R101
has presence in other subsystems via
102. Imported Object (O_IOBJ)
* IObj_ID
- Obj_ID (R101)
- Modl_Typ
- SS_ID (R3)
identifies
R104
is identified by
104. Object Identifier (O_ID)
* Oid_ID
* Obj_ID (R104)
R105
is made up of
is part of
R109
is identified in this relationship by
identifies for this relationshi p
105. Object Identifier Attribute (O_OIDA)
* Attr_ID (R105)
* Obj_ID (R105) (R105)
* Oid_ID (R105)
R110
is identified in this relationship by
identifies for this relationship
203. Referred To Object in Rel (R_RTO)
* *2 Obj_ID (R203) (R109)
* *2 Rel_ID (R203)
* *2 OIR_ID (R203)
*2 Oid_ID (R109)
111. Referred To Identifier Attribute (O_RTIDA)
* Attr_ID (R110)
* Obj_ID (R110) (R110)
* Oid_ID (R110) (R110)
* Rel_ID (R110)
* OIR_ID (R110)
R112
precedes
succeeds
refers across relationship via
is used to refer to object by
R111
204. Referring Object in Rel (R_RGO)
* Obj_ID (R203)
* Rel_ID (R203)
* OIR_ID (R203)

8.2.2.1 Object and Attribute Descriptions

101. Object (O_OBJ)

Object (Obj_ID, Name, Numb, Key_Lett, Descrip, SS_ID)

Identifier *: Obj_ID

Description: An Object represents an abstraction of a real world thing. All instances of an Object have the same characteristics and conform to the same set of rules. The characteristics of an Object are captured as attributes. Each Object with a Domain are assigned a unique names, numbers, and keyletters.

Object.Obj_ID

Full Name: Object Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

Object.Name

Full Name: Object Name

Attribute Type: Base Attribute

Data Domain: **`string`**

Object.Numb

Full Name: Object Number

Attribute Type: Base Attribute

Data Domain: **`integer`**

Object.Key_Lett

Full Name: Object Keyletters

Attribute Type: Base Attribute

Data Domain: **`string`**

Object.Descrip

Full Name: Object Description

Attribute Type: Base Attribute

Data Domain: **`string`**

Object.SS_ID

Attribute Type: Referential Attribute

Refers To: Subsystem.SS_ID (R2) (See Page 21)

102. Imported Object (O_IOBJ)

Imported Object (IObj_ID, Obj_ID, Modl_Typ, SS_ID)

Identifier *: IObj_ID

Description: Objects can have interactions with Objects in other Subsystems. In order to capture these spanning interactions, Objects can be *imported* into another subsystem. Spanning interactions can be relationships, event communications, or data accesses and are captured in the Object Information Model, Object Communication Model, and Object Access Model, respectively. Spanning interactions provide the data for derivation of the Subsystem Relationship Model, Subsystem Communication Model, and Subsystem Access Model.

Imported Object.IObj_ID

Full Name: Imported Object Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

Imported Object.Obj_ID

Attribute Type: Referential Attribute

Refers To: Object.Obj_ID (R101) (See Page 44)

Imported Object.Modl_Typ

Full Name: Model Type

Attribute Type: Base Attribute

Data Domain: **`integer`**

Description: Value indicates what type of model the Imported Object is in:

Value **`5`** indicates Object Information Model

Value **`6`** indicates Object Communication Model

Value **7** indicates Object Access Model

Imported Object.SS_ID

Attribute Type: Referential Attribute

Refers To: Subsystem.SS_ID (R3) (See Page 21)

103. Attribute (O_ATTR)

Attribute (Attr_ID, Obj_ID, PAttr_ID, Name, Descrip, Prefix, Root_Nam, Pfx_Mode, DT_ID)

Identifier *: Attr_ID, Obj_ID

Description: An Attribute is an abstraction of a single characteristic possessed by an Object. Usually Objects contain a set of attributes to completely capture all pertinent information. Each Attribute is given a unique name within an Object.

Attribute.Attr_ID

Full Name: Attribute Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

Attribute.Obj_ID

Attribute Type: Referential Attribute

Refers To: Object.Obj_ID (R102) (See Page 44)

Refers To: Attribute.Obj_ID (R103) (See Page 46)

Attribute.PAttr_ID

Attribute Type: Referential Attribute

Refers To: Attribute.Attr_ID (R103) (See Page 46)

Attribute.Name

Full Name: Attribute Name

Attribute Type: Base Attribute

Data Domain: **`string`**

Attribute.Descrip

Full Name: Attribute Description

Attribute Type: Base Attribute

Data Domain: **`string`**

Attribute.Prefix

Full Name: Attribute Name Prefix

Attribute Type: Base Attribute

Data Domain: **`string`**

Attribute.Root_Nam

Full Name: Attribute Name Root

Attribute Type: Base Attribute

Data Domain: **`string`**

Attribute.Pfx_Mode

Full Name: Attribute Name Prefix Mode

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = uses no prefix

1 = uses local prefix

2 = uses referred to prefix

Attribute.DT_ID

Attribute Type: Referential Attribute

Refers To: Data Type.DT_ID (R114) (See Page 29)

104. Object Identifier (O_ID)

Object Identifier (Oid_ID, Obj_ID)

Identifier *: Oid_ID, Obj_ID

Description: A set of one or more Attributes which uniquely distinguishes each instance of an object is an Object Identifier. An Object may have several Identifiers.

Object Identifier.Oid_ID

Full Name: Object Identifier Identifier

Attribute Type: Base Attribute

Data Domain: `integer`

Object Identifier.Obj_ID

Attribute Type: Referential Attribute

Refers To: Object.Obj_ID (R104) (See Page 44)

105. Object Identifier Attribute (O_OIDA)

Object Identifier Attribute (Attr_ID, Obj_ID, Oid_ID)

Identifier *: Attr_ID, Obj_ID, Oid_ID

Description: An Attribute that is part of an Object Identifier is an Object Identifier Attribute.

Object Identifier Attribute.Attr_ID

Attribute Type: Referential Attribute

Refers To: Attribute.Attr_ID (R105) (See Page 46)

Object Identifier Attribute.Obj_ID

Attribute Type: Referential Attribute

Refers To: Attribute.Obj_ID (R105) (See Page 46)

Refers To: Object Identifier.Obj_ID (R105) (See Page 48)

Object Identifier Attribute.Oid_ID

Attribute Type: Referential Attribute

Refers To: Object Identifier.Oid_ID (R105) (See Page 48)

106. Base Attribute (O_BATTR)

Base Attribute (Attr_ID, Obj_ID)

Identifier *: Attr_ID, Obj_ID

Description: A Base Attribute is a non-referential attribute.

Base Attribute.Attr_ID

Attribute Type: Referential Attribute

Refers To: Attribute.Attr_ID (R106) (See Page 46)

Base Attribute.Obj_ID

Attribute Type: Referential Attribute

Refers To: Attribute.Obj_ID (R106) (See Page 46)

107. Derived Base Attribute (O_DBATTR)

Derived Base Attribute (Attr_ID, Obj_ID)

Identifier *: Attr_ID, Obj_ID

Description: A Derived Attribute is the result of an algorithm used to derive the value.

Derived Base Attribute.Attr_ID

Attribute Type: Referential Attribute

Refers To: Base Attribute.Attr_ID (R107) (See Page 46)

Derived Base Attribute.Obj_ID

Attribute Type: Referential Attribute

Refers To: Base Attribute.Obj_ID (R107) (See Page 46)

108. New Base Attribute (O_NBATTR)

New Base Attribute (Attr_ID, Obj_ID)

Identifier *: Attr_ID, Obj_ID

Description: A New Base Attribute is a non-derived base attribute.

New Base Attribute.Attr_ID

Attribute Type: Referential Attribute

Refers To: Base Attribute.Attr_ID (R107) (See Page 46)

New Base Attribute.Obj_ID

Attribute Type: Referential Attribute

Refers To: Base Attribute.Obj_ID (R107) (See Page 46)

109. Referential Attribute (O_RATTR)

Referential Attribute (Attr_ID, Obj_ID, BAttr_ID, BObj_ID, Ref_Mode)

Identifier *: Attr_ID, Obj_ID

Description: A Referential Attribute captures the formalization of a relationship. A Referential Attribute refers to an Identifying Attribute in the Object at the other end of the relationship which it formalizes.

Referential Attribute.Attr_ID

Attribute Type: Referential Attribute

Refers To: Attribute.Attr_ID (R106) (See Page 46)

Referential Attribute.Obj_ID

Attribute Type: Referential Attribute

Refers To: Attribute.Obj_ID (R106) (See Page 46)

Referential Attribute.BAttr_ID

Attribute Type: Referential Attribute

Refers To: Base Attribute.Attr_ID (R113) (See Page 49)

Reference IS CONSTRAINED such that Base Attribute related across R113 is same Base Attribute which is found by navigating back through the referred to attributes until the Base Attribute is found.

Referential Attribute.BObj_ID

Attribute Type: Referential Attribute

Refers To: Base Attribute.Obj_ID (R113) (See Page 49)

Reference IS CONSTRAINED such that Base Attribute related across R113 is same Base Attribute which is found by navigating back through the referred to attributes until the Base Attribute is found.

Referential Attribute.Ref_Mode

Full Name: Referential Attribute Mode

Attribute Type: Base Attribute

Data Domain: `integer`

110. Attribute Reference in Object (O_REF)

Attribute Reference in Object (Obj_ID, RObj_ID, ROid_ID, RAttr_ID, Rel_ID, OIR_ID, ROIR_ID, Attr_ID, ARef_ID, PARef_ID, Is_Cstrd, Descrip)

Identifier *: Obj_ID, RObj_ID, ROid_ID, RAttr_ID, Rel_ID, OIR_ID, ROIR_ID

Identifier *2: ARef_ID

Description: The Object represents an R# which follows a referential attribute.

Attribute Reference in Object.Obj_ID

Attribute Type: Referential Attribute

Refers To: Referential Attribute.Obj_ID (R108) (See Page 50)

Refers To: Referring Object in Rel.Obj_ID (R111) (See Page 66)

Attribute Reference in Object.RObj_ID

Attribute Type: Referential Attribute

Refers To: Referred To Identifier Attribute.Obj_ID (R111) (See Page 53)

Attribute Reference in Object.ROid_ID

Attribute Type: Referential Attribute

Refers To: Referred To Identifier Attribute.Oid_ID (R111) (See Page 53)

Attribute Reference in Object.RAttr_ID

Attribute Type: Referential Attribute

Refers To: Referred To Identifier Attribute.Attr_ID (R111) (See Page 53)

Attribute Reference in Object.Rel_ID

Attribute Type: Referential Attribute

Refers To: Referring Object in Rel.Rel_ID (R111) (See Page 66)
Refers To: Referred To Identifier Attribute.Rel_ID (R111) (See Page 53)

Attribute Reference in Object.OIR_ID

Attribute Type: Referential Attribute
Refers To: Referring Object in Rel.OIR_ID (R111) (See Page 66)

Attribute Reference in Object.ROIR_ID

Attribute Type: Referential Attribute
Refers To: Referred To Identifier Attribute.OIR_ID (R111) (See Page 53)

Attribute Reference in Object.Attr_ID

Attribute Type: Referential Attribute
Refers To: Referential Attribute.Attr_ID (R108) (See Page 50)

Attribute Reference in Object.ARef_ID

Full Name: Object Identifier Identifier
Attribute Type: Base Attribute
Data Domain: **`unique_id`**

Attribute Reference in Object.PARef_ID

Attribute Type: Referential Attribute
Refers To: Attribute Reference in Object.ARef_ID (R112) (See Page 52)

Attribute Reference in Object.Is_Cstrd

Full Name: Attribute Reference in Object Is Constrained Flag
Attribute Type: Base Attribute
Data Domain: **`boolean`**

0 = not constrained
1 = constrained

Attribute Reference in Object.Descrip

Full Name: Attribute Reference in Object Description
Attribute Type: Base Attribute

Data Domain: `string`

111. Referred To Identifier Attribute (O_RTIDA)

Referred To Identifier Attribute (Attr_ID, Obj_ID, Oid_ID, Rel_ID, OIR_ID)

Identifier *: Obj_ID, Attr_ID, Oid_ID, Rel_ID, OIR_ID

Description: This object serves a linkage between the R# (Attribute Reference in Object) an the referred to Object Identifier Attribute.

Referred To Identifier Attribute.Attr_ID

Attribute Type: Referential Attribute

Refers To: Object Identifier Attribute.Attr_ID (R110) (See Page 48)

Referred To Identifier Attribute.Obj_ID

Attribute Type: Referential Attribute

Refers To: Object Identifier Attribute.Obj_ID (R110) (See Page 48)

Refers To: Referred To Object in Rel.Obj_ID (R110) (See Page 65)

Referred To Identifier Attribute.Oid_ID

Attribute Type: Referential Attribute

Refers To: Object Identifier Attribute.Oid_ID (R110) (See Page 48)

Refers To: Referred To Object in Rel.Obj_ID (R110) (See Page 66)

Referred To Identifier Attribute.Rel_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.Rel_ID (R110) (See Page 65)

Referred To Identifier Attribute.OIR_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.OIR_ID (R110) (See Page 66)

112. Transformer (O_TFR)

Transformer (Tfr_ID, Obj_ID, Name, Descrip, DT_ID)

Identifier *: Tfr_ID

Description: A Transformer is a method associated with an Object - transformers can be synchronously called from Action Specifications.

Transformer.Tfr_ID

Full Name: Transformer Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

Transformer.Obj_ID

Attribute Type: Referential Attribute

Refers To: Object.Obj_ID (R115) (See Page 44)

Transformer.Name

Full Name: Transformer Name

Attribute Type: Base Attribute

Data Domain: **`string`**

Transformer.Descrip

Full Name: Transformer Description

Attribute Type: Base Attribute

Data Domain: **`string`**

Transformer.DT_ID

Attribute Type: Referential Attribute

Refers To: Data Type.DT_ID (R116) (See Page 29)

113. Transformer Parameter (O_TPARM)

Transformer Parameter (TParm_ID, Tfr_ID, Name, DT_ID)

Identifier *: TParm_ID

Description: This object is a parameter to a transformer.

Transformer Parameter.TParm_ID

Full Name: Transformer Parameter Identifier
Attribute Type: Base Attribute
Data Domain: **`unique_id`**

Transformer Parameter.Tfr_ID

Attribute Type: Referential Attribute
Refers To: Transformer.Tfr_ID (R117) (See Page 54)

Transformer Parameter.Name

Full Name: Transformer Parameter Name
Attribute Type: Base Attribute
Data Domain: **`string`**

Transformer Parameter.DT_ID

Attribute Type: Referential Attribute
Refers To: Data Type.DT_ID (R118) (See Page 29)

8.2.2.2 Relationship Descriptions

R101

Relationship Type: Simple
Multiplicity/Conditionality: Mc:1
Object has presence in other subsystems via Imported Object
Imported Object represents Object
Formalized By: Object.Obj_ID

R102

Relationship Type: Simple
Multiplicity/Conditionality: Mc:1
Object has characteristics abstracted by Attribute
Attribute abstracts characteristics of Object
Formalized By: Object.Obj_ID

R103

Relationship Type: Simple
Multiplicity/Conditionality: 1c:1c
Attribute precedes Attribute
Attribute succeeds Attribute
Formalized By: Attribute.Attr_ID, Attribute.Obj_ID

R104

Relationship Type: Simple
Multiplicity/Conditionality: Mc:1
Object is identified by Object Identifier
Object Identifier identifies Object
Formalized By: Object.Obj_ID

R105

Relationship Type: Associative

Multiplicity/Conditionality: 1-(Mc:Mc)

Object Identifier is made up of Attribute

Attribute is part of Object Identifier

Formalized By: Attribute.Attr_ID, Attribute.Obj_ID, Object Identifier.Oid_ID, Object Identifier.Obj_ID

R106

Relationship Type: Subtype/Supertype

Subtypes: Base Attribute, Referential Attribute

Formalized By: Attribute.Attr_ID, Attribute.Obj_ID

R107

Relationship Type: Subtype/Supertype

Subtypes: Derived Base Attribute, New Base Attribute

Formalized By: Base Attribute.Attr_ID, Base Attribute.Obj_ID

R108

Relationship Type: Simple

Multiplicity/Conditionality: M:1

Referential Attribute resolves Attribute Reference in Object

Attribute Reference in Object is resolved by Referential Attribute

Formalized By: Referential Attribute.Attr_ID, Referential Attribute.Obj_ID

R109

Relationship Type: Simple

Multiplicity/Conditionality: 1c:Mc

Referred To Object in Rel is identified in this relationship by Object Identifier

Object Identifier identifies for this relationship Referred To Object in Rel

Formalized By: Object Identifier.Oid_ID, Object Identifier.Obj_ID

R110

Relationship Type: Associative

Multiplicity/Conditionality: 1-(M:Mc)

Referred To Object in Rel is identified in this relationship by Object Identifier Attribute

Object Identifier Attribute identifies for this relationship Referred To Object in Rel

Formalized By: Referred To Object in Rel.Obj_ID, Referred To Object in Rel.Rel_ID, Referred To Object in Rel.OIR_ID, Referred To Object in Rel.Oid_ID, Object Identifier Attribute.Attr_ID, Object Identifier Attribute.Obj_ID, Object Identifier Attribute.Oid_ID

R111

Relationship Type: Associative

Multiplicity/Conditionality: 1-(M:M)

Referring Object in Rel refers across relationship via Referred To Identifier Attribute

Referred To Identifier Attribute is referred to object by Referring Object in Rel

Formalized By: Referred To Identifier Attribute.Obj_ID, Referred To Identifier Attribute.Attr_ID, Referred To Identifier Attribute.Oid_ID, Referred To Identifier Attribute.Rel_ID, Referred To Identifier Attribute.OIR_ID, Referring Object in Rel.Obj_ID, Referring Object in Rel.Rel_ID, Referring Object in Rel.OIR_ID

R112

Relationship Type: Simple

Multiplicity/Conditionality: 1c:1c

Attribute Reference in Object succeeds Attribute Reference in Object

Attribute Reference in Object precedes Attribute Reference in Object

Formalized By: Attribute Reference in Object.ARef_ID

R113

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1
Base Attribute can be the base of Referential Attribute
Referential Attribute navigates back to Base Attribute
Formalized By: Base Attribute.Attr_ID, Base Attribute.Obj_ID

R114

Relationship Type: Simple
Multiplicity/Conditionality: Mc:1
Data Type defines the type of Attribute
Attribute is defined by Data Type
Formalized By: Data Type.DT_ID

R115

Relationship Type: Simple
Multiplicity/Conditionality: Mc:1
Object may contain Transformer
Transformer is associated with Object
Formalized By: Object.Obj_ID

R116

Relationship Type: Simple
Multiplicity/Conditionality: Mc:1
Data Type defines the type of the return code Transformer
Transformer return code is defined by Data Type
Formalized By: Data Type.DT_ID

R117

Relationship Type: Simple
Multiplicity/Conditionality: Mc:1
Transformer contains Transformer Parameter
Transformer Parameter is part of a Transformer

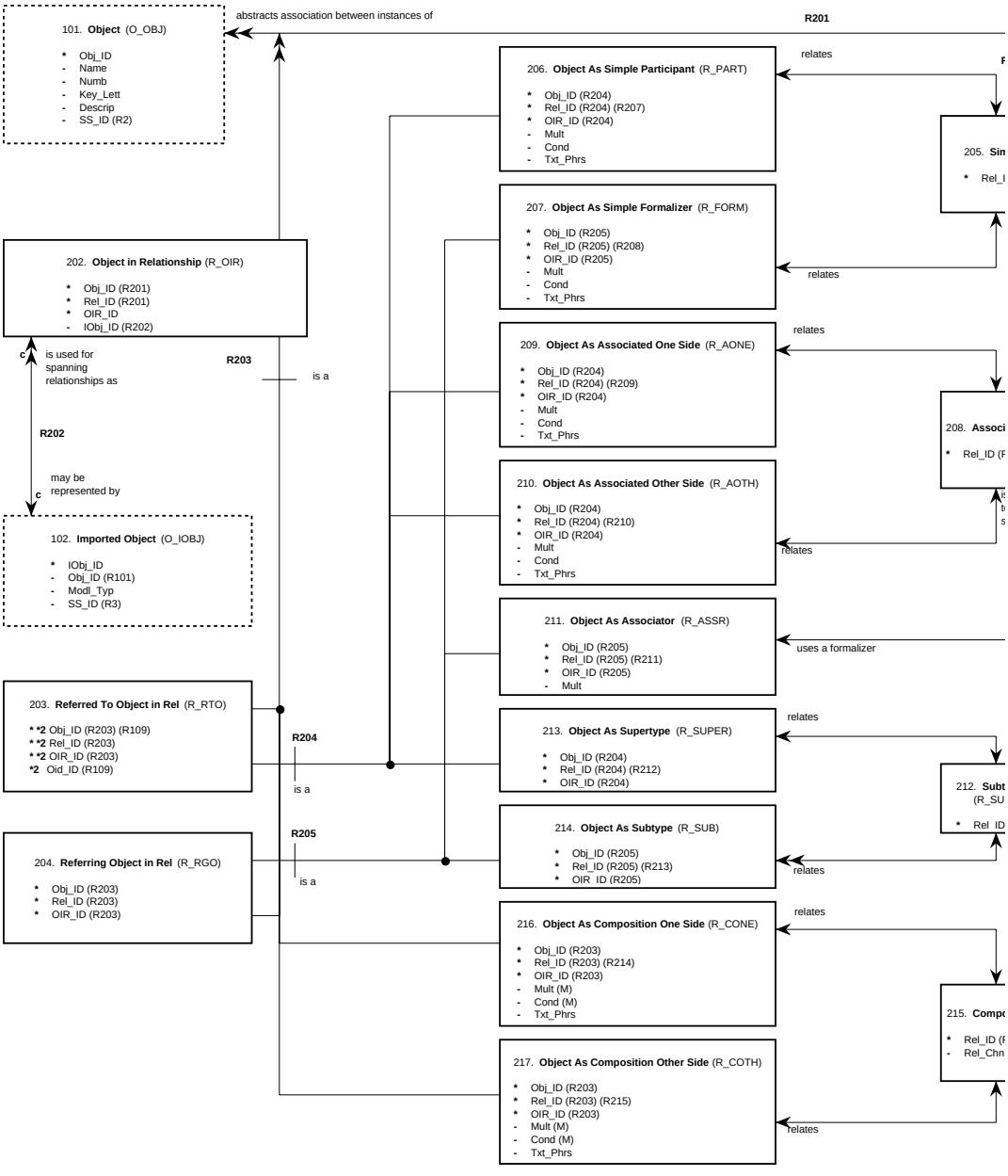
Formalized By: Transformer.Tfr_ID

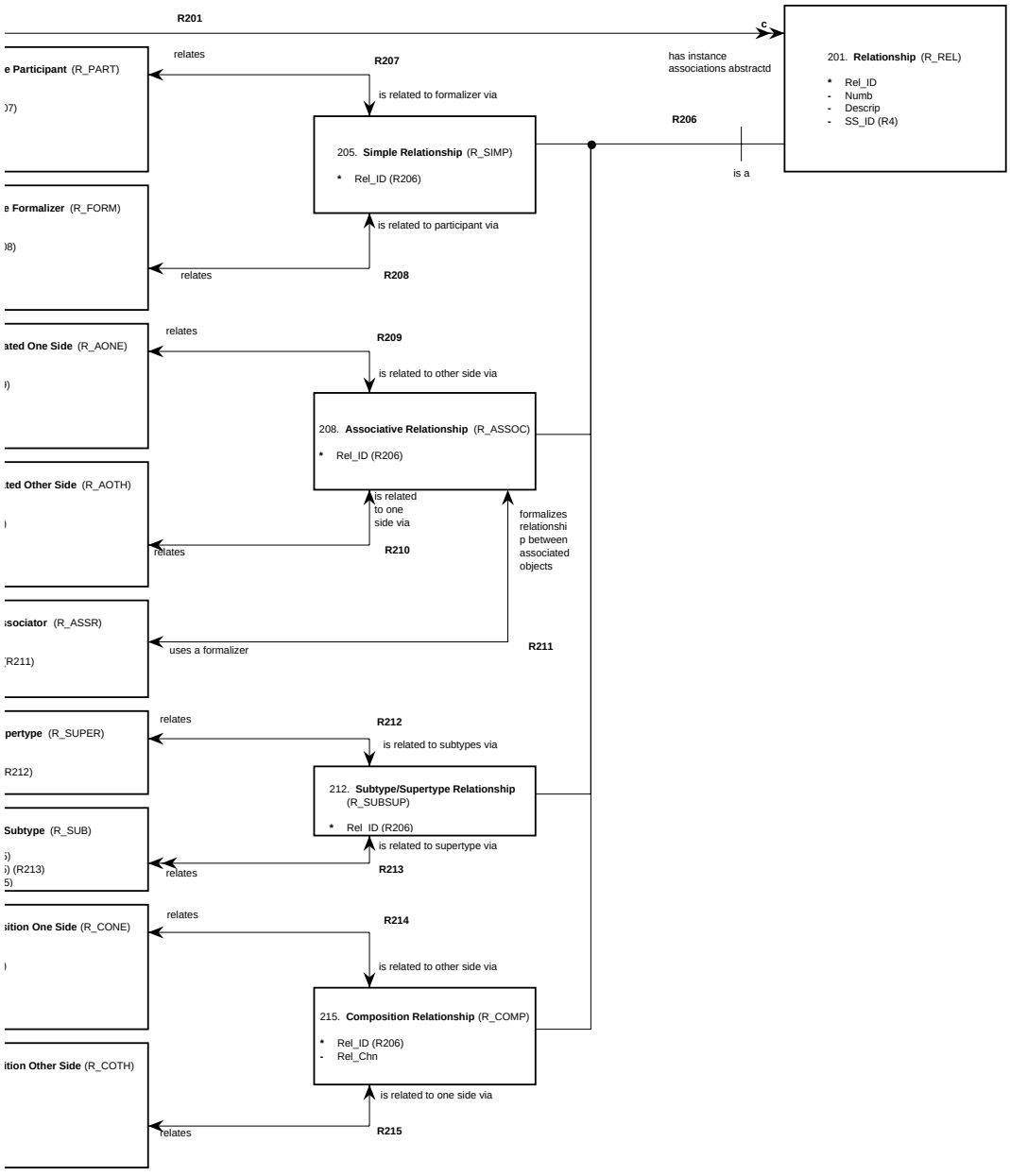
R118

Relationship Type: Simple
Multiplicity/Conditionality: Mc:1
Data Type defines the type of Transformer Parameter
Transformer Parameter is defined by Data Type
Formalized By: Data Type.DT_ID

8.2.3 Subsystem ‘Relationship’

A Relationship captures an association between things in the real world. A Relationship is stated in terms of the formal objects that model the real world entities participating in the association. There can be any number of Relationships between the same two objects and any object can participate in any number of Relationships with other objects.


101. Object (O_OBJ)
* Obj_ID
- Name
- Numb
- Key_Lett
- Descrip
- SS_ID (R2)
abstracts association between instances of
R201
relates
206. Object As Simple Participant (R_PART)
* Obj_ID (R204)
* Rel_ID (R204) (R207)
* OIR_ID (R204)
- Mult
- Cond
- Txt_Phrs
205. Sim
* Rel_I
207. Object As Simple Formalizer (R_FORM)
* Obj_ID (R205)
* Rel_ID (R205) (R208)
* OIR_ID (R205)
- Mult
- Cond
- Txt_Phrs
relates
202. Object in Relationship (R_OIR)
* Obj_ID (R201)
* Rel_ID (R201)
* OIR_ID
- IObj_ID (R202)
c
is used for spanning relationships as
R203
is a
R202
may be represented by
c
209. Object As Associated One Side (R_AONE)
* Obj_ID (R204)
* Rel_ID (R204) (R209)
* OIR_ID (R204)
- Mult
- Cond
- Txt_Phrs
relates
208. Associ
* Rel_ID (R
210. Object As Associated Other Side (R_AOTH)
* Obj_ID (R204)
* Rel_ID (R204) (R210)
* OIR_ID (R204)
- Mult
- Cond
- Txt_Phrs
relates
102. Imported Object (O_IOBJ)
* IObj_ID
- Obj_ID (R101)
- Modl_Typ
- SS_ID (R3)
211. Object As Associator (R_ASSR)
* Obj_ID (R205)
* Rel_ID (R205) (R211)
* OIR_ID (R205)
- Mult
uses a formalizer
203. Referred To Object in Rel (R_RTO)
*2 Obj_ID (R203) (R109)
*2 Rel_ID (R203)
*2 OIR_ID (R203)
*2 Oid_ID (R109)
R204
is a
213. Object As Supertype (R_SUPER)
* Obj_ID (R204)
* Rel_ID (R204) (R212)
* OIR_ID (R204)
relates
212. Subt
(R_SU
* Rel_ID
R205
is a
204. Referring Object in Rel (R_RGO)
* Obj_ID (R203)
* Rel_ID (R203)
* OIR_ID (R203)
214. Object As Subtype (R_SUB)
* Obj_ID (R205)
* Rel_ID (R205) (R213)
* OIR_ID (R205)
relates
216. Object As Composition One Side (R_CONE)
* Obj_ID (R203)
* Rel_ID (R203) (R214)
* OIR_ID (R203)
- Mult (M)
- Cond (M)
- Txt_Phrs
relates
215. Compo
* Rel_ID (R
- Rel_Chn
217. Object As Composition Other Side (R_COTH)
* Obj_ID (R203)
* Rel_ID (R203) (R215)
* OIR_ID (R203)
- Mult (M)
- Cond (M)
- Txt_Phrs
relates


R201
relates
e Participant (R_PART)
)7)
R207
is related to formalizer via
has instance associations abstractd
201. Relationship (R_REL)
* Rel_ID
- Numb
- Descrip
- SS_ID (R4)
R206
is a
205. Simple Relationship (R_SIMP)
* Rel_ID (R206)
e Formalizer (R_FORM)
)8)
is related to participant via
relates
R208
relates
ated One Side (R_AONE)
)
R209
is related to other side via
208. Associative Relationship (R_ASSOC)
* Rel_ID (R206)
ted Other Side (R_AOTH)
)
is related to one side via
relates
R210
formalizes relationship between associated objects
sociator (R_ASSR)
(R211)
uses a formalizer
R211
relates
pertype (R_SUPER)
R212)
R212
is related to subtypes via
212. Subtype/Supertype Relationship (R_SUBSUP)
* Rel ID (R206)
Subtype (R_SUB)
)
) (R213)
5)
is related to supertype via
relates
R213
relates
ition One Side (R_CONE)
)
R214
is related to other side via
215. Composition Relationship (R_COMP)
* Rel_ID (R206)
- Rel_Chn
ition Other Side (R_COTH)
is related to one side via
relates
R215

8.2.3.1 Object and Attribute Descriptions

201. Relationship (R_REL)

Relationship (Rel_ID, Numb, Descrip, SS_ID)

Identifier *: Rel_ID

Description: A Relationship captures an association that exists between things in the real world. A Relationship is stated in terms of the formal Objects that participate in the association.

Relationship.Rel_ID

Full Name: Relationship Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

Relationship.Numb

Full Name: Relationship Number

Attribute Type: Base Attribute

Data Domain: **`integer`**

Relationship.Descrip

Full Name: Relationship Description

Attribute Type: Base Attribute

Data Domain: **`string`**

Relationship.SS_ID

Attribute Type: Referential Attribute

Refers To: Subsystem.SS_ID (R4) (See Page 21)

202. Object in Relationship (R_OIR)

Object in Relationship (Obj_ID, Rel_ID, OIR_ID, IObj_ID)

Identifier *: Obj_ID, Rel_ID, OIR_ID

Description: An Object in Relationship captures the role which an object plays in participating in a relationship.

Object in Relationship.Obj_ID

Attribute Type: Referential Attribute

Refers To: Object.Obj_ID (R201) (See Page 44)

Object in Relationship.Rel_ID

Attribute Type: Referential Attribute

Refers To: Relationship.Rel_ID (R201) (See Page 64)

Object in Relationship.OIR_ID

Full Name: Object in Relationship Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

AObject in Relationship.IObj_ID

Attribute Type: Referential Attribute

Refers To: Imported Object.IObj_ID (R202) (See Page 45)

203. Referred To Object in Rel (R_RTO)

Referred To Object in Rel (Obj_ID, Rel_ID, OIR_ID, Oid_ID)

Identifier *: Obj_ID, Rel_ID, OIR_ID

Identifier *2: Obj_ID, Rel_ID, OIR_ID, Oid_ID

Description: A Referred To Object in Relationship is an object which contains identifier attributes which are referred to across the relationship.

Referred To Object in Rel.Obj_ID

Attribute Type: Referential Attribute

Refers To: Object in Relationship.Obj_ID (R203) (See Page 65)

Referred To Object in Rel.Rel_ID

Attribute Type: Referential Attribute

Refers To: Object in Relationship.Rel_ID (R203) (See Page 65)

Referred To Object in Rel.OIR_ID

Attribute Type: Referential Attribute

Refers To: Object in Relationship.OIR_ID (R203) (See Page 65)

Referred To Object in Rel.Oid_ID

Attribute Type: Referential Attribute

Refers To: Object Identifier.Oid_ID (R109) (See Page 48)

204. Referring Object in Rel (R_RGO)

Referring Object in Rel (Obj_ID, Rel_ID, OIR_ID)

Identifier *: Obj_ID, Rel_ID, OIR_ID

Description: A referring Object in Relationship is an object which contains referential attributes which refer to identifying attributes across the relationship.

Referring Object in Rel.Obj_ID

Attribute Type: Referential Attribute

Refers To: Object in Relationship.Obj_ID (R203) (See Page 65)

Referring Object in Rel.Rel_ID

Attribute Type: Referential Attribute

Refers To: Object in Relationship.Rel_ID (R203) (See Page 65)

Referring Object in Rel.OIR_ID

Attribute Type: Referential Attribute

Refers To: Object in Relationship.OIR_ID (R203) (See Page 65)

205. Simple Relationship (R_SIMP)

Simple Relationship (Rel_ID)

Identifier *: Rel_ID

Description: A Simple Relationship is a relationship between two objects which is formalized with referential attributes.

Simple Relationship.Rel_ID

Attribute Type: Referential Attribute

Refers To: Relationship.Rel_ID (R206) (See Page 64)

206. Object As Simple Participant (R_PART)

Object As Simple Participant (Obj_ID, Rel_ID, OIR_ID, Mult, Cond, Txt_Phrs)

Identifier *: Rel_ID, Obj_ID, OIR_ID

Description: An Object As Simple Participant is the referred to object in a simple relationship.

Object As Simple Participant.Obj_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.Obj_ID (R204) (See Page 65)

Object As Simple Participant.Rel_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.Rel_ID (R204) (See Page 65)

Object As Simple Participant.OIR_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.OIR_ID (R204) (See Page 66)

Object As Simple Participant.Mult

Full Name: Multiplicity

Attribute Type: Base Attribute

Data Domain: `integer`

0 = one

1 = many

Object As Simple Participant.Cond

Full Name: Conditionality

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = uncond

1 = cond

Object As Simple Participant.Txt_Phrs

Full Name: Text Phrase

Attribute Type: Base Attribute

Data Domain: **`string`**

207.Object As Simple Formalizer (R_FORM)

Object As Simple Formalizer (Obj_ID, Rel_ID, OIR_ID, Mult, Cond, Txt_Phrs)

Identifier *: Rel_ID, Obj_ID, OIR_ID

Description: An Object As Simple Formalizer is the referring object in a simple relationship.

Object As Simple Formalizer.Obj_ID

Attribute Type: Referential Attribute

Refers To: Referring Object in Rel.Obj_ID (R205) (See Page 66)

Object As Simple Formalizer.Rel_ID

Attribute Type: Referential Attribute

Refers To: Referring Object in Rel.Rel_ID (R205) (See Page 65)

Object As Simple Formalizer.OIR_ID

Attribute Type: Referential Attribute

Refers To: Referring Object in Rel.OIR_ID (R205) (See Page 66)

Object As Simple Formalizer.Mult

Full Name: Multiplicity

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = one

1 = many

Object As Simple Formalizer.Cond

Full Name: Conditionality

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = uncond

1 = cond

Object As Simple Formalizer.Txt_Phrs

Full Name: Text Phrase

Attribute Type: Base Attribute

Data Domain: **`string`**

208. Associative Relationship (R_ASSOC)

Associative Relationship (Rel_ID)

Identifier *: Rel_ID

Associative Relationship.Rel_ID

Attribute Type: Referential Attribute

Refers To: Relationship.Rel_ID (R206)

209. Object As Associated One Side (R_AONE)

Object As Associated One Side (Obj_ID, Rel_ID, OIR_ID, Mult, Cond, Txt_Phrs)

Identifier *: Rel_ID, Obj_ID, OIR_ID

Object As Associated One Side.Obj_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.Obj_ID (R204) (See Page 65)

Object As Associated One Side.Rel_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.Rel_ID (R204) (See Page 65)

Object As Associated One Side.OIR_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.OIR_ID (R204)

Object As Associated One Side.Mult

Full Name: Multiplicity

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = one

1 = many

Object As Associated One Side.Cond

Full Name: Conditionality

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = unconditional

1 = conditional

Object As Associated One Side.Txt_Phrs

Full Name: Text Phrase

Attribute Type: Base Attribute

Data Domain: **`string`**

210. Object As Associated Other Side (R_AOTH)

Object As Associated Other Side (Obj_ID, Rel_ID, OIR_ID, Mult, Cond, Txt_Phrs)

Identifier *: Rel_ID, Obj_ID, OIR_ID

Object As Associated Other Side.Obj_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.Obj_ID (R204) (See Page 65)

Object As Associated Other Side.Rel_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.Rel_ID (R204) (See Page 65)

Object As Associated Other Side.OIR_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.OIR_ID (R204) (See Page 66)

Object As Associated Other Side.Mult

Full Name: Multiplicity

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = one

1 = many

Object As Associated Other Side.Cond

Full Name: Conditionality

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = unconditional

1 = conditional

Object As Associated Other Side.Txt_Phrs

Full Name: Text Phrase

Attribute Type: Base Attribute

Data Domain: **`string`**

211. Object As Associator (R_ASSR)

Object As Associator (Obj_ID, Rel_ID, OIR_ID, Mult)

Identifier *: Rel_ID, Obj_ID, OIR_ID

Object As Associator.Obj_ID

Attribute Type: Referential Attribute

Refers To: Referring Object in Rel.Obj_ID (R205) (See Page 66)

Object As Associator.Rel_ID

Attribute Type: Referential Attribute

Refers To: Referring Object in Rel.Rel_ID (R205) (See Page 66)

Object As Associator.OIR_ID

Attribute Type: Referential Attribute

Refers To: Referring Object in Rel.OIR_ID (R205) (See Page 66)

Object As Associator.Mult

Full Name: Multiplicity

Attribute Type: Base Attribute

Data Domain: `integer`

0 = one

1 = many

212. Subtype/Supertype Relationship (R_SUBSUP)

Subtype/Supertype Relationship (Rel_ID)

Identifier *: Rel_ID

Subtype/Supertype Relationship.Rel_ID

Attribute Type: Referential Attribute

Refers To: Relationship.Rel_ID (R206) (See Page 64)

213. Object As Supertype (R_SUPER)

Object As Supertype (Obj_ID, Rel_ID, OIR_ID)

Identifier *: Rel_ID, Obj_ID, OIR_ID

Object As Supertype.Obj_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.Obj_ID (R204) (See Page 65)

Object As Supertype.Rel_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.Rel_ID (R204) (See Page 65)

Object As Supertype.OIR_ID

Attribute Type: Referential Attribute

Refers To: Referred To Object in Rel.OIR_ID (R204) (See Page 66)

214. Object As Subtype (R_SUB)

Object As Subtype (Obj_ID, Rel_ID, OIR_ID)

Identifier *: Rel_ID, Obj_ID, OIR_ID

Object As Subtype.Obj_ID

Attribute Type: Referential Attribute

Refers To: Referring Object in Rel.Obj_ID (R205) (See Page 66)

Object As Subtype.Rel_ID

Attribute Type: Referential Attribute

Refers To: Referring Object in Rel.Rel_ID (R205) (See Page 66)

Object As Subtype.OIR_ID

Attribute Type: Referential Attribute

Refers To: Referring Object in Rel.OIR_ID (R205) (See Page 66)

215. Composition Relationship (R_COMP)

Composition Relationship (Rel_ID, Rel_Chn)

Identifier *: Rel_ID

Composition Relationship.Rel_ID

Attribute Type: Referential Attribute

Refers To: Relationship.Rel_ID (R206) (See Page 64)

Composition Relationship.Rel_Chn

Full Name: Relationship Chain

Attribute Type: Base Attribute

Data Domain: **`string`**

216. Object As Composition One Side (R_CONE)

Object As Composition One Side (Obj_ID, Rel_ID, OIR_ID, Mult, Cond, Txt_Phrs)

Identifier *: Rel_ID, Obj_ID, OIR_ID

Object As Composition One Side.Obj_ID

Attribute Type: Referential Attribute

Refers To: Object in Relationship.Obj_ID (R203) (See Page 65)

Object As Composition One Side.Rel_ID

Attribute Type: Referential Attribute

Refers To: Object in Relationship.Rel_ID (R203) (See Page 65)

Object As Composition One Side.OIR_ID

Attribute Type: Referential Attribute

Refers To: Object in Relationship.OIR_ID (R203) (See Page 65)

Object As Composition One Side.Mult

Full Name: Multiplicity

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = one

1 = many

Object As Composition One Side.Cond

Full Name: Conditionality

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = unconditional

1 = conditional

Object As Composition One Side.Txt_Phrs

Full Name: Text Phrase

Attribute Type: Base Attribute

Data Domain: **`string`**

217. Object As Composition Other Side (R_COTH)

Object As Composition Other Side (Obj_ID, Rel_ID, OIR_ID, Mult, Cond, Txt_Phrs)

Identifier *: Rel_ID, Obj_ID, OIR_ID

Object As Composition Other Side.Obj_ID

Attribute Type: Referential Attribute

Refers To: Object in Relationship.Obj_ID (R203) (See Page 65)

Object As Composition Other Side.Rel_ID

Attribute Type: Referential Attribute

Refers To: Object in Relationship.Rel_ID (R203) (See Page 65)

Object As Composition Other Side.OIR_ID

Attribute Type: Referential Attribute

Refers To: Object in Relationship.OIR_ID (R203) (See Page 65)

Object As Composition Other Side.Mult

Full Name: Multiplicity

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = one

1 = many

Object As Composition Other Side.Cond

Full Name: Conditionality

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = unconditional

1 = conditional

Object As Composition Other Side.Txt_Phrs

Full Name: Text Phrase

Attribute Type: Base Attribute

Description: **`string`**

8.2.3.2 Relationship Descriptions

R201

Relationship Type: Associative

Multiplicity/Conditionality: M-(M:Mc)

Relationship abstracts association between instances of Object

Object has instance associations abstracted by Relationship

Formalized By: Object.Obj_ID, Relationship.Rel_ID

R202

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1c

Imported Object is used for spanning relationships as Object in Relationship

Object in Relationship may be represented by Imported Object

Formalized By: Imported Object.IObj_ID

R203

Relationship Type: Subtype/Supertype

Subtypes: Referred To Object in Rel, Referring Object in Rel, Object As Composition One Side, Object As Composition Other Side

Formalized By: Object in Relationship.Obj_ID, Object in Relationship.Rel_ID, Object in Relationship.OIR_ID

R204

Relationship Type: Subtype/Supertype

Subtypes: Object As Simple Participant, Object As Associated One Side, Object As Associated Other Side, Object As Supertype

Formalized By: Referred To Object in Rel.Obj_ID, Referred To Object in Rel.Rel_ID, Referred To Object in Rel.OIR_ID

R205

Relationship Type: Subtype/Supertype

Subtypes: Object As Simple Formalizer, Object As Associator, Object As Subtype

Formalized By: Referring Object in Rel.Obj_ID, Referring Object in Rel.Rel_ID, Referring Object in Rel.OIR_ID

R206

Relationship Type: Subtype/Supertype

Subtypes: Simple Relationship, Associative Relationship, Subtype/ Supertype Relationship, Composition Relationship

Formalized By: Relationship.Rel_ID

R207

Relationship Type: Simple

Multiplicity/Conditionality: 1:1

Simple Relationship relates Object As Simple Participant

Object As Simple Participant is related to formalizer via Simple Relationship

Formalized By: Simple Relationship.Rel_ID

R208

Relationship Type: Simple

Multiplicity/Conditionality: 1:1

Simple Relationship relates Object As Simple Formalizer

Object As Simple Formalizer is related to participant via Simple Relationship

Formalized By: Simple Relationship.Rel_ID

R209

Relationship Type: Simple

Multiplicity/Conditionality: 1:1

Associative Relationship relates Object As Associated One Side

Object As Associated One Side is related to other side via Associative Relationship

Formalized By: Associative Relationship.Rel_ID

R210

Relationship Type: Simple

Multiplicity/Conditionality: 1:1

Associative Relationship relates Object As Associated Other Side

Object As Associated Other Side is related to one side via Associative Relationship

Formalized By: Associative Relationship.Rel_ID

R211

Relationship Type: Simple

Multiplicity/Conditionality: 1:1

Associative Relationship uses a formalizer Object As Associator

Object As Associator formalizes relationship between associated objects Associative Relationship

Formalized By: Associative Relationship.Rel_ID

R212

Relationship Type: Simple

Multiplicity/Conditionality: 1:1

Subtype/Supertype Relationship relates Object As Supertype

Object As Supertype is related to subtypes via Subtype/Supertype Relationship

Formalized By: Subtype/Supertype Relationship.Rel_ID

R213

Relationship Type: Simple

Multiplicity/Conditionality: M:1

Subtype/Supertype Relationship relates Object As Subtype

Object As Subtype is related to supertype via Subtype/Supertype Relationship

Formalized By: Subtype/Supertype Relationship.Rel_ID

R214

Relationship Type: Simple

Multiplicity/Conditionality: 1:1

Composition Relationship relates Object As Composition One Side

Object As Composition One Side is related to other side via Composition Relationship

Formalized By: Composition Relationship.Rel_ID

R215

Relationship Type: Simple

Multiplicity/Conditionality: 1:1

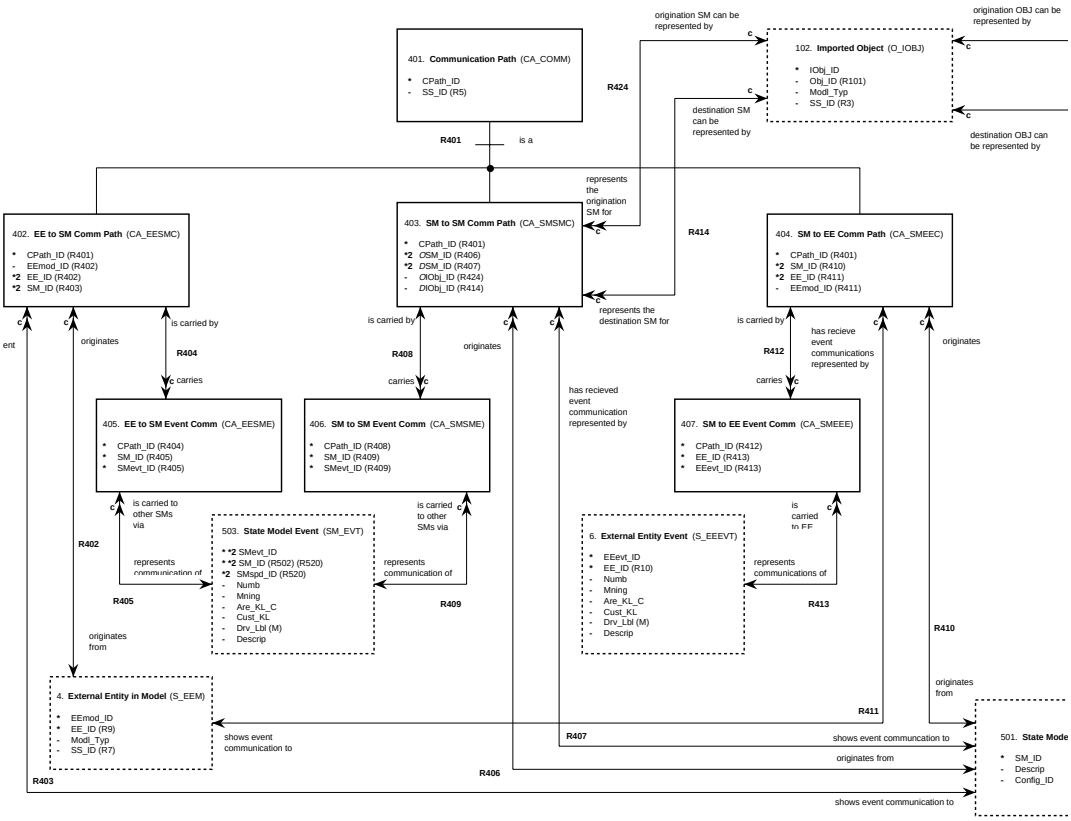
Composition Relationship relates Object As Composition Other Side

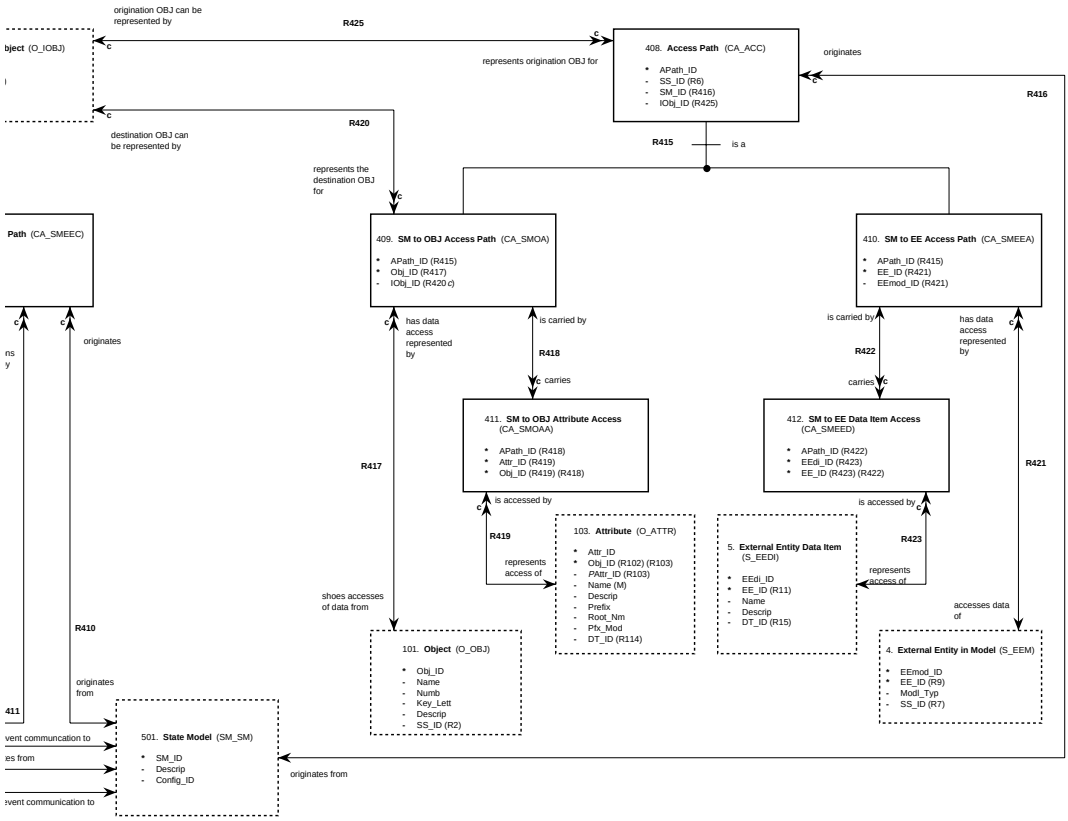
Object As Composition Other Side is related to one side via Composition Relationship

Formalized By: Composition Relationship.Rel_ID

8.2.4 Subsystem ‘Communication & Access’

Interactions between Objects is modeled by Communication and Access Paths. Communication Paths model Active Objects that interact via events. Access Paths model Objects that interact by accessing another Object’s attributes. An Access Path must originate from an Active Object. Objects also may interact with entities outside of the Domain being modeled. Such interactions are show with Communication and Access Paths between Objects and External Entities. Communication and Access Paths may also cross Subsystem boundaries.


401. Communication Path (CA_COMM)
* CPath_ID
- SS_ID (R5)
R401
is a
R424
origination SM can be represented by
destination SM can be represented by
102. Imported Object (O_IOBJ)
* IObj_ID
- Obj_ID (R101)
- Modl_Typ
- SS_ID (R3)
origination OBJ can be represented by
destination OBJ can be represented by
represents the origination SM for
represents the destination SM for
402. EE to SM Comm Path (CA_EESMC)
* CPath_ID (R401)
- EEmod_ID (R402)
*2 EE_ID (R402)
*2 SM_ID (R403)
403. SM to SM Comm Path (CA_SMSMC)
* CPath_ID (R401)
*2 OSM_ID (R406)
*2 DSM_ID (R407)
- OIObj_ID (R424)
- DIObj_ID (R414)
R414
404. SM to EE Comm Path (CA_SMEEC)
* CPath_ID (R401)
*2 SM_ID (R410)
*2 EE_ID (R411)
- EEmod_ID (R411)
is carried by
originates
R404
carries
R408
R412
has recieve event communications represented by
has recieved event communication represented by
405. EE to SM Event Comm (CA_EESME)
* CPath_ID (R404)
* SM_ID (R405)
* SMevt_ID (R405)
406. SM to SM Event Comm (CA_SMSME)
* CPath_ID (R408)
* SM_ID (R409)
* SMevt_ID (R409)
407. SM to EE Event Comm (CA_SMEEE)
* CPath_ID (R412)
* EE_ID (R413)
* EEevt_ID (R413)
is carried to other SMs via
R402
represents communication of
R405
503. State Model Event (SM_EVT)
* *2 SMevt_ID
* *2 SM_ID (R502) (R520)
*2 SMspd_ID (R520)
- Numb
- Mning
- Are_KL_C
- Cust_KL
- Drv_Lbl (M)
- Descrip
R409
6. External Entity Event (S_EEEVT)
* EEevt_ID
* EE_ID (R10)
- Numb
- Mning
- Are_KL_C
- Cust_KL
- Drv_Lbl (M)
- Descrip
R413
R410
originates from
4. External Entity in Model (S_EEM)
* EEmod_ID
* EE_ID (R9)
- Modl_Typ
- SS_ID (R7)
shows event communication to
R411
R407
R406
R403
501. State Mode
* SM_ID
- Descrip
- Config_ID


origination OBJ can be represented by
R425
represents origination OBJ for
408. Access Path (CA_ACC)
* APath_ID
- SS_ID (R6)
- SM_ID (R416)
- IObj_ID (R425)
originates
R416
R420
destination OBJ can be represented by
R415
is a
represents the destination OBJ for
409. SM to OBJ Access Path (CA_SMOA)
* APath_ID (R415)
* Obj_ID (R417)
- IObj_ID (R420 c)
410. SM to EE Access Path (CA_SMEEA)
* APath_ID (R415)
* EE_ID (R421)
- EEmod_ID (R421)
has data access represented by
is carried by
R418
carries
411. SM to OBJ Attribute Access (CA_SMOAA)
* APath_ID (R418)
* Attr_ID (R419)
* Obj_ID (R419) (R418)
R422
412. SM to EE Data Item Access (CA_SMEED)
* APath_ID (R422)
* EEdi_ID (R423)
* EE_ID (R423) (R422)
R417
R421
is accessed by
R419
103. Attribute (O_ATTR)
* Attr_ID
* Obj_ID (R102) (R103)
- PAttr_ID (R103)
- Name (M)
- Descrip
- Prefix
- Root_Nm
- Pfx_Mod
- DT_ID (R114)
represents access of
5. External Entity Data Item (S_EEDI)
* EEdi_ID
* EE_ID (R11)
- Name
- Descrip
- DT_ID (R15)
R423
shoes accesses of data from
accesses data of
101. Object (O_OBJ)
* Obj_ID
- Name
- Numb
- Key_Lett
- Descrip
- SS_ID (R2)
4. External Entity in Model (S_EEM)
* EEmod_ID
* EE_ID (R9)
- Modl_Typ
- SS_ID (R7)
R410
originates from
501. State Model (SM_SM)
* SM_ID
- Descrip
- Config_ID
originates from

8.2.4.1 Object and Attribute Descriptions

401. Communication Path (CA_COMM)

Communication Path (CPath_ID, SS_ID)
Identifier *: CPath_ID

Communication Path.CPath_ID

Full Name: Communication Path Identifier
Attribute Type: Base Attribute
Data Domain: `unique_id`

Communication Path.SS_ID

Attribute Type: Referential Attribute
Refers To: Subsystem.SS_ID (R5) (See Page 21)

402. EE to SM Comm Path (CA_EESMC)

EE to SM Comm Path (CPath_ID, EEmod_ID, EE_ID, SM_ID)
Identifier *: CPath_ID
Identifier *2: EE_ID, SM_ID

EE to SM Comm Path.CPath_ID

Attribute Type: Referential Attribute
Refers To: Communication Path.CPath_ID (R401) (See Page 84)

EE to SM Comm Path.EEmod_ID

Attribute Type: Referential Attribute
Refers To: External Entity in Model.EEmod_ID (R402) (See Page 24)

EE to SM Comm Path.EE_ID

Attribute Type: Referential Attribute
Refers To: External Entity in Model.EE_ID (R402) (See Page 24)

EE to SM Comm Path.SM_ID

Attribute Type: Referential Attribute

Refers To: State Model.SM_ID (R403) (See Page 100)

403. SM to SM Comm Path (CA_SMSMC)

SM to SM Comm Path (CPath_ID, OSM_ID, DSM_ID, OIObj_ID, DIObj_ID)

Identifier *: CPath_ID

Identifier *2: OSM_ID, DSM_ID

SM to SM Comm Path.CPath_ID

Attribute Type: Referential Attribute

Refers To: Communication Path.CPath_ID (R401) (See Page 84)

SM to SM Comm Path.OSM_ID

Attribute Type: Referential Attribute

Refers To: State Model.SM_ID (R406) (See Page 100)

SM to SM Comm Path.DSM_ID

Attribute Type: Referential Attribute

Refers To: State Model.SM_ID (R407) (See Page 100)

SM to SM Comm Path.OIObj_ID

Attribute Type: Referential Attribute

Refers To: Imported Object.IObj_ID (R424) (See Page 45)

SM to SM Comm Path.DIObj_ID

Attribute Type: Referential Attribute

Refers To: Imported Object.IObj_ID (R414) (See Page 45)

404. SM to EE Comm Path (CA_SMEEC)

SM to EE Comm Path (CPath_ID, SM_ID, EE_ID, EEmod_ID)

Identifier *: CPath_ID
Identifier *2: SM_ID, EE_ID

SM to EE Comm Path.CPath_ID

Attribute Type: Referential Attribute
Refers To: Communication Path.CPath_ID (R401) (See Page 84)

SM to EE Comm Path.SM_ID

Attribute Type: Referential Attribute
Refers To: State Model.SM_ID (R410) (See Page 100)

SM to EE Comm Path.EE_ID

Attribute Type: Referential Attribute
Refers To: External Entity in Model.EE_ID (R411) (See Page 24)

SM to EE Comm Path.EEmod_ID

Attribute Type: Referential Attribute
Refers To: External Entity in Model.EEmod_ID (R411) (See Page 24)

405. EE to SM Event Comm (CA_EESME)

EE to SM Event Comm (CPath_ID, SM_ID, SMevt_ID)
Identifier *: SM_ID, SMevt_ID, CPath_ID

EE to SM Event Comm.CPath_ID

Attribute Type: Referential Attribute
Refers To: EE to SM Comm Path.CPath_ID (R404) (See Page 84)

EE to SM Event Comm.SM_ID

Attribute Type: Referential Attribute
Refers To: State Model Event.SM_ID (R405) (See Page 102)

EE to SM Event Comm.SMevt_ID

Attribute Type: Referential Attribute

Refers To: State Model Event.SMevt_ID (R405) (See Page 102)

406.SM to SM Event Comm (CA_SMSME)

SM to SM Event Comm (CPath_ID, SM_ID, SMevt_ID)
Identifier *: SM_ID, SMevt_ID, CPath_ID

SM to SM Event Comm.CPath_ID

Attribute Type: Referential Attribute
Refers To: SM to SM Comm Path.CPath_ID (R408) (See Page 85)

SM to SM Event Comm.SM_ID

Attribute Type: Referential Attribute
Refers To: State Model Event.SM_ID (R409) (See Page 102)

SM to SM Event Comm.SMevt_ID

Attribute Type: Referential Attribute
Refers To: State Model Event.SMevt_ID (R409) (See Page 102)

407. SM to EE Event Comm (CA_SMEEE)

SM to EE Event Comm (CPath_ID, EE_ID, EEevt_ID)
Identifier *: EE_ID, EEevt_ID, CPath_ID

SM to EE Event Comm.CPath_ID

Attribute Type: Referential Attribute
Refers To: SM to EE Comm Path.CPath_ID (R412) (See Page 86)

SM to EE Event Comm.EE_ID

Attribute Type: Referential Attribute
Refers To: External Entity Event.EE_ID (R413) (See Page 26)

SM to EE Event Comm.EEevt_ID

Attribute Type: Referential Attribute

Refers To: External Entity Event.EEevt_ID (R413) (See Page 25)

408. Access Path (CA_ACC)

Access Path (APath_ID, SS_ID, SM_ID, IObj_ID)
Identifier *: APath_ID

Access Path.APath_ID

Full Name: Access Path Identifier
Attribute Type: Base Attribute
Data Domain: **`unique_id`**

Access Path.SS_ID

Attribute Type: Referential Attribute
Refers To: Subsystem.SS_ID (R6) (See Page 21)

Access Path.SM_ID

Attribute Type: Referential Attribute
Refers To: State Model.SM_ID (R416) (See Page 101)

Access Path.IObj_ID

Attribute Type: Referential Attribute
Refers To: Imported Object.IObj_ID (R425) (See Page 45)

409. SM to OBJ Access Path (CA_SMOA)

SM to OBJ Access Path (APath_ID, Obj_ID, IObj_ID)
Identifier *: APath_ID, Obj_ID

SM to OBJ Access Path.APath_ID

Attribute Type: Referential Attribute
Refers To: Access Path.APath_ID (R415) (See Page 88)

SM to OBJ Access Path.Obj_ID

Attribute Type: Referential Attribute

Refers To: Object.Obj_ID (R417) (See Page 44)

SM to OBJ Access Path.IObj_ID

Attribute Type: Referential Attribute

Refers To: Imported Object.IObj_ID (R420) (See Page 45)

410. SM to EE Access Path (CA_SMEEA)

SM to EE Access Path (APath_ID, EE_ID, EEmod_ID)

Identifier *: APath_ID, EE_ID

SM to EE Access Path.APath_ID

Attribute Type: Referential Attribute

Refers To: Access Path.APath_ID (R415) (See Page 88)

SM to EE Access Path.EE_ID

Attribute Type: Referential Attribute

Refers To: External Entity in Model.EE_ID (R421) (See Page 24)

SM to EE Access Path.EEmod_ID

Attribute Type: Referential Attribute

Refers To: External Entity in Model.EEmod_ID (R421) (See Page 24)

411. SM to OBJ Attribute Access (CA_SMOAA)

SM to OBJ Attribute Access (APath_ID, Attr_ID, Obj_ID)

Identifier *: Obj_ID, Attr_ID, APath_ID

ASM to OBJ Attribute Access.APath_ID

Attribute Type: Referential Attribute

Refers To: SM to OBJ Access Path.APath_ID (R418) (See Page 88)

SM to OBJ Attribute Access.Attr_ID

Attribute Type: Referential Attribute
Refers To: Attribute.Attr_ID (R419) (See Page 46)

SM to OBJ Attribute Access.Obj_ID

Attribute Type: Referential Attribute
Refers To: SM to OBJ Access Path.Obj_ID (R418) (See Page 89)
Refers To: Attribute.Obj_ID (R419) (See Page 46)
Refers To: SM to OBJ Access Path.Obj_ID (R418) (See Page 89)

412. SM to EE Data Item Access (CA_SMEED)

SM to EE Data Item Access (APath_ID, EEdi_ID, EE_ID)
Identifier *: EE_ID, EEdi_ID, APath_ID

SM to EE Data Item Access.APath_ID

Attribute Type: Referential Attribute
Refers To: SM to EE Access Path.APath_ID (R422) (See Page 89)

SM to EE Data Item Access.EEdi_ID

Attribute Type: Referential Attribute
Refers To: External Entity Data Item.EEdi_ID (R423) (See Page 25)

SM to EE Data Item Access.EE_ID

Attribute Type: Referential Attribute
Refers To: External Entity Data Item.EE_ID (R423) (See Page 25)
Refers To: SM to EE Access Path.EE_ID (R422) (See Page 89)

8.2.4.2 Relationship Descriptions

R401

Relationship Type: Subtype/Supertype

Subtypes: EE to SM Comm Path, SM to SM Comm Path, SM to EE Comm Path

Formalized By: Communication Path.CPath_ID

R402

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

External Entity in Model originates EE to SM Comm Path

EE to SM Comm Path originates from External Entity in Model

Formalized By: External Entity in Model.EE_ID, External Entity in Model.EEmod_ID

R403

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model has received event communication represented by EE to SM Comm Path

EE to SM Comm Path shows event communication to State Model

Formalized By: State Model.SM_ID

R404

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

EE to SM Comm Path carries EE to SM Event Comm

EE to SM Event Comm is carried by EE to SM Comm Path

Formalized By: EE to SM Comm Path.CPath_ID

R405

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model Event is carried to other SMs via EE to SM Event Comm

EE to SM Event Comm represents communication of State Model Event

Formalized By: State Model Event.SM_ID, State Model Event.SMevt_ID

R406

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model originates SM to SM Comm Path

SM to SM Comm Path originates from State Model

Formalized By: State Model.SM_ID

R407

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model has received event communication represented by SM to SM Comm Path

SM to SM Comm Path shows event communication to State Model

Formalized By: State Model.SM_ID

R408

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

SM to SM Comm Path carries SM to SM Event Comm

SM to SM Event Comm is carried by SM to SM Comm Path

Formalized By: SM to SM Comm Path.CPath_ID

R409

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model Event is carried to other SMs via SM to SM Event Comm

SM to SM Event Comm represents communication of State Model Event

Formalized By: State Model Event.SM_ID, State Model Event.SMevt_ID

R410

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model originates SM to EE Comm Path

SM to EE Comm Path originates from State Model

Formalized By: State Model.SM_ID

R411

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

External Entity in Model has receive event communications represented by SM to EE Comm Path

SM to EE Comm Path shows event communication to External Entity in Model

Formalized By: External Entity in Model.EE_ID, External Entity in Model.EEmod_ID

R412

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

SM to EE Comm Path carries SM to EE Event Comm

SM to EE Event Comm is carried by SM to EE Comm Path

Formalized By: SM to EE Comm Path.CPath_ID

R413

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

External Entity Event is carried to EE via SM to EE Event Comm

SM to EE Event Comm represents communications of External Entity Event

Formalized By: External Entity Event.EE_ID, External Entity Event.EEevt_ID

R414

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1c

Imported Object represents the destination SM for SM to SM Comm Path

SM to SM Comm Path destination SM can be represented by Imported Object

Formalized By: Imported Object.IObj_ID

R415

Relationship Type: Subtype/Supertype

Subtypes: SM to OBJ Access Path, SM to EE Access Path

Formalized By: Access Path.APath_ID

R416

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model originates Access Path

Access Path originates from State Model

Formalized By: State Model.SM_ID

R417

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

Object has data access represented by SM to OBJ Access Path

SM to OBJ Access Path shoes accesses of data from Object

Formalized By: Object.Obj_ID

R418

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

SM to OBJ Access Path carries SM to OBJ Attribute Access

SM to OBJ Attribute Access is carried by SM to OBJ Access Path

Formalized By: SM to OBJ Access Path.APath_ID, SM to OBJ Access Path.Obj_ID

R419

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

Attribute is accessed by SM to OBJ Attribute Access

SM to OBJ Attribute Access represents access of Attribute

Formalized By: Attribute.Attr_ID, Attribute.Obj_ID

Description: None

R420

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1c

Imported Object represents the destination OBJ for SM to OBJ Access Path

SM to OBJ Access Path destination OBJ can be represented by Imported Object

Formalized By: Imported Object.IObj_ID

R421

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

External Entity in Model has data access represented by SM to EE Access Path

SM to EE Access Path accesses data of External Entity in Model

Formalized By: External Entity in Model.EE_ID, External Entity in Model.EEmod_ID

R422

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

SM to EE Access Path carries SM to EE Data Item Access

SM to EE Data Item Access is carried by SM to EE Access Path

Formalized By: SM to EE Access Path.APath_ID, SM to EE Access Path.EE_ID

R423

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

External Entity Data Item is accessed by SM to EE Data Item Access

SM to EE Data Item Access represents access of External Entity Data Item

Formalized By: External Entity Data Item.EE_ID, External Entity Data Item.EEdi_ID

R424

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1c

Imported Object represents the origination SM for SM to SM Communication Path

SM to SM Communication Path origination SM can be represented by Imported Object

Formalized By: Imported Object.IObj_ID

R425

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1c

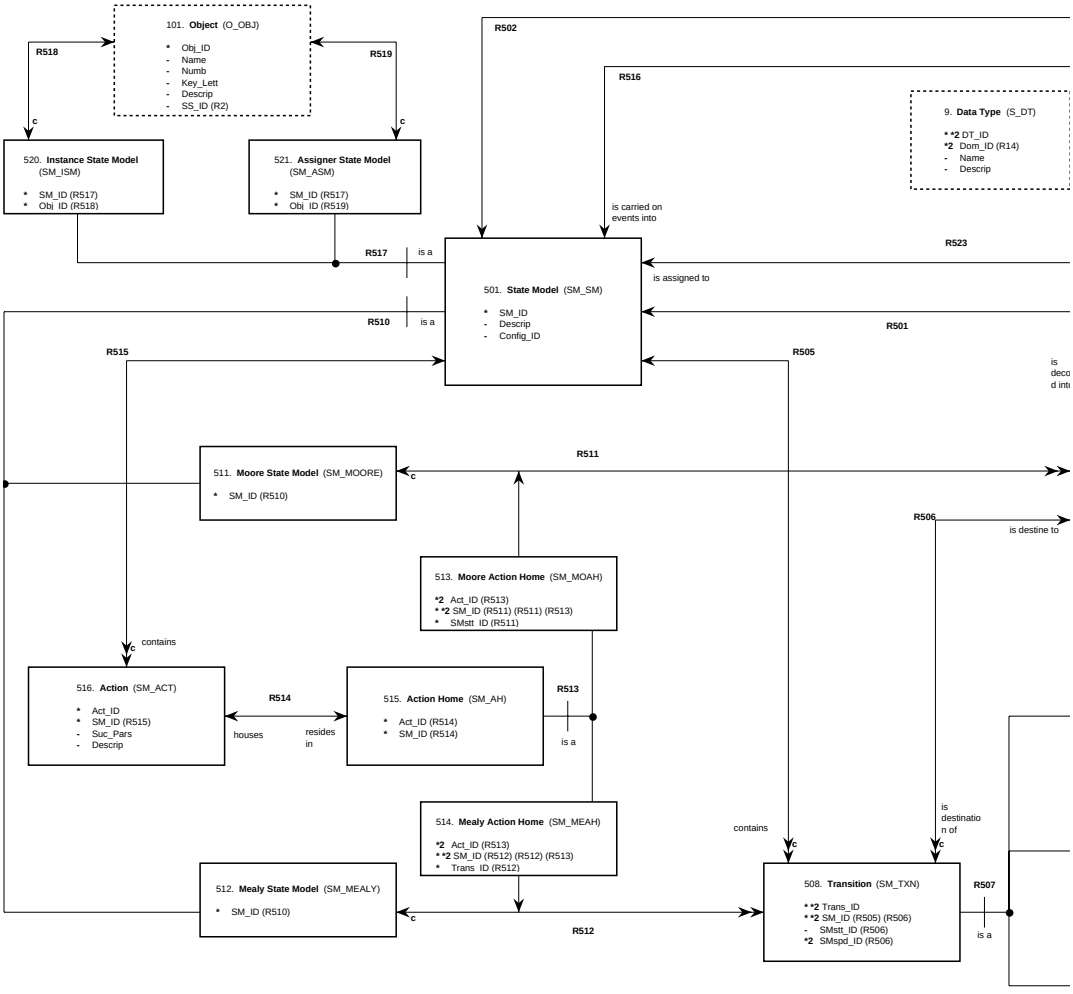
Imported Object represents the origination OBJ for Access Path

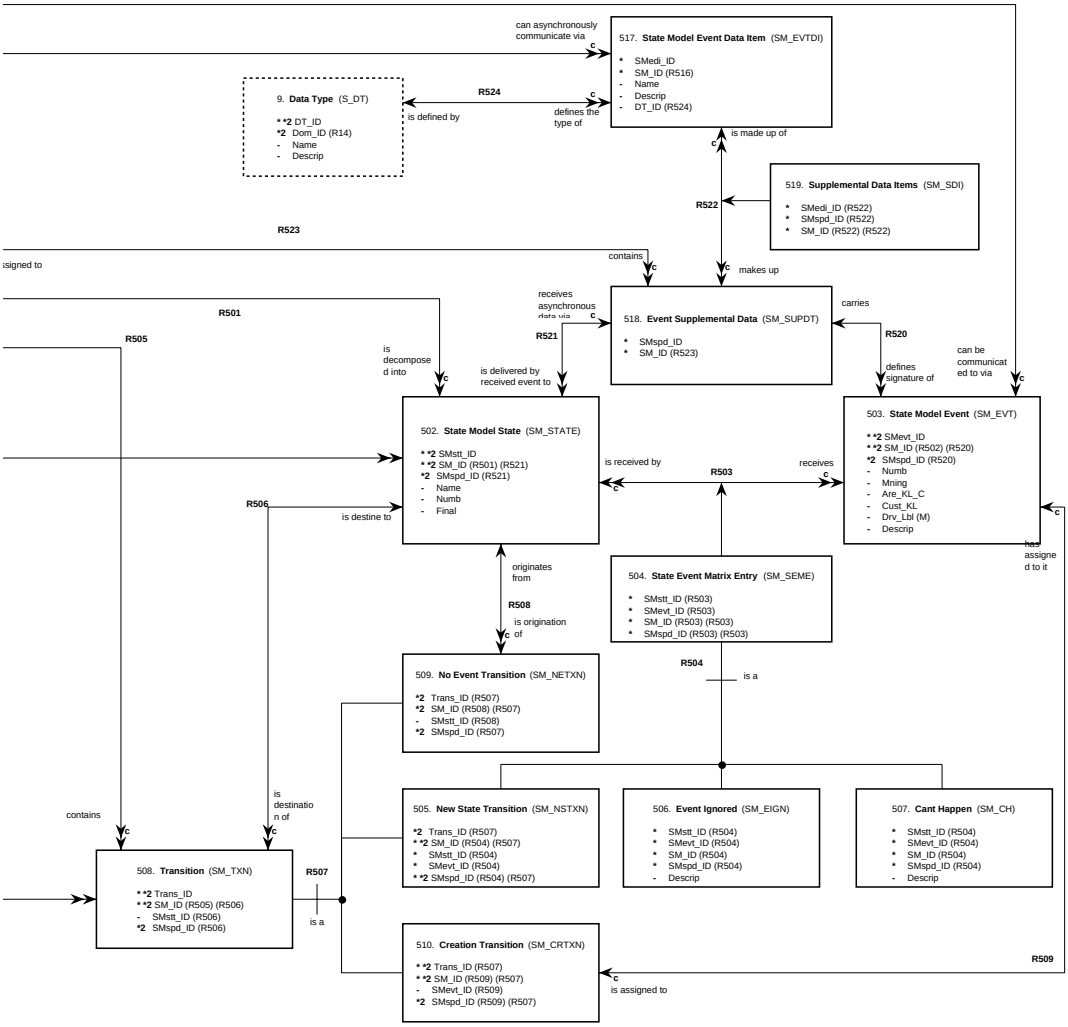
Access Path origination OBJ can be represented by Imported Object

Formalized By: Imported Object.IObj_ID

8.2.5 Subsystem ‘State Model’

Objects that have interesting behavior are given lifecycles. These lifecycles are described using State Models. A State Model consists of states, events, transactions and state actions. The State Model exists for each instance of the Object to which it is assigned. A State Model can also be an Assigner State Model of which only one can exists for all Object instances. The purpose of the Assigner State Model is to act as a single point of control through which competing requests are serialized.


101. Object (O_OBJ)
* Obj_ID
- Name
- Numb
- Key_Lett
- Descrip
- SS_ID (R2)
R518
R519
R502
R516
9. Data Type (S_DT)
* *2 DT_ID
*2 Dom_ID (R14)
- Name
- Descrip
520. Instance State Model (SM_ISM)
* SM_ID (R517)
* Obj_ID (R518)
521. Assigner State Model (SM_ASM)
* SM_ID (R517)
* Obj_ID (R519)
is carried on
events into
R517
is a
501. State Model (SM_SM)
* SM_ID
- Descrip
- Config_ID
R523
is assigned to
R510
is a
R501
R515
R505
511. Moore State Model (SM_MOORE)
* SM_ID (R510)
R511
R506
is destine to
513. Moore Action Home (SM_MOAH)
*2 Act_ID (R513)
* *2 SM_ID (R511) (R511) (R513)
* SMstt_ID (R511)
contains
516. Action (SM_ACT)
* Act_ID
* SM_ID (R515)
- Suc_Pars
- Descrip
R514
houses
resides
in
515. Action Home (SM_AH)
* Act_ID (R514)
* SM_ID (R514)
R513
is a
514. Mealy Action Home (SM_MEAH)
*2 Act_ID (R513)
* *2 SM_ID (R512) (R512) (R513)
* Trans_ID (R512)
contains
is
destinatio
n of
512. Mealy State Model (SM_MEALY)
* SM_ID (R510)
R512
508. Transition (SM_TXN)
* *2 Trans_ID
* *2 SM_ID (R505) (R506)
- SMstt_ID (R506)
*2 SMspd_ID (R506)
R507
is a


can asynchronously communicate via
517. State Model Event Data Item (SM_EVTDI)
* SMedi_ID
* SM_ID (R516)
- Name
- Descrip
- DT_ID (R524)
9. Data Type (S_DT)
* *2 DT_ID
*2 Dom_ID (R14)
- Name
- Descrip
R524
is defined by
defines the type of
is made up of
519. Supplemental Data Items (SM_SDI)
* SMedi_ID (R522)
* SMspd_ID (R522)
* SM_ID (R522) (R522)
R522
R523
contains
makes up
receives asynchronous data via
518. Event Supplemental Data (SM_SUPDT)
* SMspd_ID
* SM_ID (R523)
carries
R520
R521
R501
R505
is decomposed into
is delivered by received event to
defines signature of
can be communicated to via
502. State Model State (SM_STATE)
* *2 SMstt_ID
* *2 SM_ID (R501) (R521)
*2 SMspd_ID (R521)
- Name
- Numb
- Final
503. State Model Event (SM_EVT)
* *2 SMevt_ID
* *2 SM_ID (R502) (R520)
*2 SMspd_ID (R520)
- Numb
- Mning
- Are_KL_C
- Cust_KL
- Drv_Lbl (M)
- Descrip
is received by
receives
R503
R506
is destine to
has assigned to it
originates from
R508
is origination of
504. State Event Matrix Entry (SM_SEME)
* SMstt_ID (R503)
* SMevt_ID (R503)
* SM_ID (R503) (R503)
* SMspd_ID (R503) (R503)
R504
is a
509. No Event Transition (SM_NETXN)
*2 Trans_ID (R507)
*2 SM_ID (R508) (R507)
- SMstt_ID (R508)
*2 SMspd_ID (R507)
contains
is destination of
505. New State Transition (SM_NSTXN)
*2 Trans_ID (R507)
* *2 SM_ID (R504) (R507)
* SMstt_ID (R504)
* SMevt_ID (R504)
* *2 SMspd_ID (R504) (R507)
506. Event Ignored (SM_EIGN)
* SMstt_ID (R504)
* SMevt_ID (R504)
* SM_ID (R504)
* SMspd_ID (R504)
- Descrip
507. Cant Happen (SM_CH)
* SMstt_ID (R504)
* SMevt_ID (R504)
* SM_ID (R504)
* SMspd_ID (R504)
- Descrip
508. Transition (SM_TXN)
* *2 Trans_ID
* *2 SM_ID (R505) (R506)
- SMstt_ID (R506)
*2 SMspd_ID (R506)
R507
is a
510. Creation Transition (SM_CRTXN)
* *2 Trans_ID (R507)
* *2 SM_ID (R509) (R507)
- SMevt_ID (R509)
*2 SMspd_ID (R509) (R507)
R509
is assigned to

8.2.5.1 Object and Attribute Descriptions

501. State Model (SM_SM)

State Model (SM_ID, Descrip, Config_ID)

Identifier *: SM_ID

State Model.SM_ID

Full Name: State Model Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

State Model.Descrip

Full Name: State Model Description

Attribute Type: Base Attribute

Data Domain: **`string`**

State Model.Config_ID

Full Name: Configuration Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

Description: The Configuration ID of the version management configuration which the state model is a part of (See Page 57 of BridgePoint Tool Guide). This ID can be used to access the V_CONFIG record corresponding to the State Model/Action Configuration.

502. State Model State (SM_STATE)

State Model State (SMstt_ID, SM_ID, SMspd_ID, Name, Numb, Final)

Identifier *: SM_ID, SMstt_ID

Identifier *2: SMspd_ID, SM_ID, SMstt_ID

State Model State.SMstt_ID

Full Name: State Model State Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

State Model State.SM_ID

Attribute Type: Referential Attribute

Refers To: State Model.SM_ID (R501) (See Page 100)

State Model State.SMspd_ID

Attribute Type: Referential Attribute

Refers To: Event Supplemental Data.SMspd_ID (R521) (See Page 112)

State Model State.Name

Full Name: State Name

Attribute Type: Base Attribute

Data Domain: **`string`**

State Model State.Numb

Full Name: State Number

Attribute Type: Base Attribute

Data Domain: **`integer`**

State Model State.Final

Full Name: Is Deletion Final State Flag

Attribute Type: Base Attribute

Data Domain: **`integer`**

0 = Not Deletion Final State

1 = Deletion Final State

503. State Model Event (SM_EVT)

State Model Event (SMevt_ID, SM_ID, SMspd_ID, Numb, Mning, Are_KL_C, Cust_KL, Drv_Lbl, Descrip)

Identifier *: SM_ID, SMevt_ID

Identifier *2: SMspd_ID, SM_ID, SMevt_ID

State Model Event.SMevt_ID

Full Name: State Model Event Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

State Model Event.SM_ID

Attribute Type: Referential Attribute

Refers To: State Model.SM_ID (R502) (See Page 100)

State Model Event.SMspd_ID

Attribute Type: Referential Attribute

Refers To: Event Supplemental Data.SMspd_ID (R520) (See Page 112)

State Model Event.Numb

Full Name: Event Number

Attribute Type: Base Attribute

Data Domain: **`integer`**

State Model Event.Mning

Full Name: Event Meaning

Attribute Type: Base Attribute

Data Domain: **`string`**

State Model Event.Are_KL_C

Full Name: Are Keyletters Custom Flag

Attribute Type: Base Attribute

Data Domain: **`integer`**

Description: This is a flag that indicates whether custom label keyletters are used for the External Entity Event.
Value 0 indicates custom label keyletters are used.
Value 1 indicates External Entity keyletters are used.

State Model Event.Cust_KL

Full Name: Custom Event Keyletters

Attribute Type: Base Attribute

Data Domain: **`string`**

Description: Holds the event label - derived by concatenating the keyletters and the event number.

If the Are_KL_C attribute is 0, then the value of the Object.Keyletter attribute is concatenated with the State Model Event .Numb attribute.

If the Are_KL_C attribute is 1, then the value of the State Model Event.Cust_KL attribute is concatenated with the State Model Event.Numb attribute.

State Model Event.Drv_Lbl

Full Name: Derived Label

Attribute Type: Base Attribute

Data Domain: **`string`**

State Model Event.Descrip

Full Name: Event Description

Attribute Type: Base Attribute

Data Domain: **`string`**

504. State Event Matrix Entry (SM_SEME)

State Event Matrix Entry (SMstt_ID, SMevt_ID, SM_ID, SMspd_ID)

Identifier *: SMevt_ID, SM_ID, SMspd_ID, SMstt_ID

State Event Matrix Entry.SMstt_ID

Attribute Type: Referential Attribute

Refers To: State Model State.SMstt_ID (R503) (See Page 100)

State Event Matrix Entry.SMevt_ID

Attribute Type: Referential Attribute

Refers To: State Model Event.SMevt_ID (R503) (See Page 103)

State Event Matrix Entry.SM_ID

Attribute Type: Referential Attribute

Refers To: State Model Event.SM_ID (R503) (See Page 101)

State Event Matrix Entry.SMspd_ID

Attribute Type: Referential Attribute

Refers To: State Model Event.SMspd_ID (R503) (See Page 102)

505. New State Transition (SM_NSTXN)

New State Transition (Trans_ID, SM_ID, SMstt_ID, SMevt_ID, SMspd_ID)

Identifier *: SM_ID, SMevt_ID, SMstt_ID, SMspd_ID

Identifier *2: Trans_ID, SM_ID, SMspd_ID

New State Transition.Trans_ID

Attribute Type: Referential Attribute

Refers To: Transition.Trans_ID (R507) (See Page 106)

New State Transition.SM_ID

Attribute Type: Referential Attribute

Refers To: State Event Matrix Entry.SM_ID (R504) (See Page 103)

New State Transition.SMstt_ID

Attribute Type: Referential Attribute

Refers To: State Event Matrix Entry.SMstt_ID (R504) (See Page 103)

New State Transition.SMevt_ID

Attribute Type: Referential Attribute

Refers To: State Event Matrix Entry.SMevt_ID (R504) (See Page 103)

New State Transition.SMspd_ID

Attribute Type: Referential Attribute

Refers To: State Event Matrix Entry.SMspd_ID (R504) (See Page 104)

506. Event Ignored (SM_EIGN)

Event Ignored (SMstt_ID, SMevt_ID, SM_ID, SMspd_ID, Descrip)
Identifier *: SMevt_ID, SM_ID, SMstt_ID, SMspd_ID

Event Ignored.SMstt_ID

Attribute Type: Referential Attribute
Refers To: State Event Matrix Entry.SMstt_ID (R504) (See Page 103)

Event Ignored.SMevt_ID

Attribute Type: Referential Attribute
Refers To: State Event Matrix Entry.SMevt_ID (R504) (See Page 103)

Event Ignored.SM_ID

Attribute Type: Referential Attribute
Refers To: State Event Matrix Entry.SM_ID (R504) (See Page 103)

Event Ignored.SMspd_ID

Attribute Type: Referential Attribute
Refers To: State Event Matrix Entry.SMspd_ID (R504) (See Page 104)

Event Ignored.Descrip

Full Name: Event Ignored Description
Attribute Type: Base Attribute
Data Domain: `string`

507. Cant Happen (SM_CH)

Cant Happen (SMstt_ID, SMevt_ID, SM_ID, SMspd_ID, Descrip)
Identifier *: SMevt_ID, SM_ID, SMstt_ID, SMspd_ID

Cant Happen.SMstt_ID

Attribute Type: Referential Attribute
Refers To: State Event Matrix Entry.SMstt_ID (R504) (See Page 103)

Cant Happen.SMevt_ID

Attribute Type: Referential Attribute

Refers To: State Event Matrix Entry.SMevt_ID (R504) (See Page 103)

Cant Happen.SM_ID

Attribute Type: Referential Attribute

Refers To: State Event Matrix Entry.SM_ID (R504) (See Page 103)

Cant Happen.SMspd_ID

Attribute Type: Referential Attribute

Refers To: State Event Matrix Entry.SMspd_ID (R504) (See Page 104)

Cant Happen.Descrip

Full Name: Cant Happen Description

Attribute Type: Base Attribute

Data Domain: **`string`**

508. Transition (SM_TXN)

Transition (Trans_ID, SM_ID, SMstt_ID, SMspd_ID)

Identifier *: Trans_ID, SM_ID

Identifier *2: Trans_ID, SM_ID, SMspd_ID

Transition.Trans_ID

Full Name: Transition Identifier

Attribute Type: Base Attribute

Data Domain: **`unique_id`**

Transition.SM_ID

Attribute Type: Referential Attribute

Refers To: State Model.SM_ID (R505) (See Page 100)

Transition.SMstt_ID

Attribute Type: Referential Attribute

Refers To: State Model State.SMstt_ID (R506) (See Page 100)

Transition.SMspd_ID

Attribute Type: Referential Attribute

Refers To: State Model State.SMspd_ID (R506) (See Page 101)

509. No Event Transition (SM_NETXN)

No Event Transition (Trans_ID, SM_ID, SMstt_ID, SMspd_ID)

Identifier *2: Trans_ID, SM_ID, SMspd_ID

No Event Transition.Trans_ID

Attribute Type: Referential Attribute

Refers To: Transition.Trans_ID (R507) (See Page 106)

No Event Transition.SM_ID

Attribute Type: Referential Attribute

Refers To: State Model State.SM_ID (R508) (See Page 101)

No Event Transition.SMstt_ID

Attribute Type: Referential Attribute

Refers To: State Model State.SMstt_ID (R508) (See Page 100)

No Event Transition.SMspd_ID

Attribute Type: Referential Attribute

Refers To: Transition.SMspd_ID (R507) (See Page 107)

510. Creation Transition (SM_CRTXN)

Creation Transition (Trans_ID, SM_ID, SMevt_ID, SMspd_ID)

Identifier *: SM_ID, Trans_ID

Identifier *2: Trans_ID, SM_ID, SMspd_ID

Creation Transition.Trans_ID

Attribute Type: Referential Attribute

Refers To: Transition.Trans_ID (R507) (See Page 106)

Creation Transition.SM_ID

Attribute Type: Referential Attribute

Refers To: State Model Event.SM_ID (R509) (See Page 102)

Creation Transition.SMevt_ID

Attribute Type: Referential Attribute

Refers To: State Model Event.SMevt_ID (R509) (See Page 102)

Creation Transition.SMspd_ID

Attribute Type: Referential Attribute

Refers To: State Model Event.SMspd_ID (R509) (See Page 102)

511. Moore State Model (SM_MOORE)

Moore State Model (SM_ID)

Identifier *: SM_ID

Moore State Model.SM_ID

Attribute Type: Referential Attribute

Refers To: State Model.SM_ID (R510) (See Page 100)

512. Mealy State Model (SM_MEALY)

Mealy State Model (SM_ID)

Identifier *: SM_ID

Mealy State Model.SM_ID

Attribute Type: Referential Attribute

Refers To: State Model.SM_ID (R510) (See Page 100)

513.Moore Action Home (SM_MOAH)

Moore Action Home (Act_ID, SM_ID, SMstt_ID)
Identifier *: SM_ID, SMstt_ID
Identifier *2: SM_ID, Act_ID

Moore Action Home.Act_ID

Attribute Type: Referential Attribute
Refers To: Action Home.Act_ID (R513) (See Page 110)

Moore Action Home.SM_ID

Attribute Type: Referential Attribute
Refers To: Moore State Model.SM_ID (R511) (See Page 108)

Moore Action Home.SMstt_ID

Attribute Type: Referential Attribute
Refers To: State Model State.SMstt_ID (R511) (See Page 100)

514. Mealy Action Home (SM_MEAH)

Mealy Action Home (Act_ID, SM_ID, Trans_ID)
Identifier *: SM_ID, Trans_ID
Identifier *2: SM_ID, Act_ID

Mealy Action Home.Act_ID

Attribute Type: Referential Attribute
Refers To: Action Home.Act_ID (R513) (See Page 110)

Mealy Action Home.SM_ID

Attribute Type: Referential Attribute
Refers To: Mealy State Model.SM_ID (R512) (See Page 108)

Mealy Action Home.Trans_ID

Attribute Type: Referential Attribute
Refers To: Transition.Trans_ID (R512) (See Page 106)

515.Action Home (SM_AH)

Action Home (Act_ID, SM_ID)
Identifier *: SM_ID, Act_ID

Action Home.Act_ID

Attribute Type: Referential Attribute
Refers To: Action.Act_ID (R514) (See Page 110)

Action Home.SM_ID

Attribute Type: Referential Attribute
Refers To: Action.SM_ID (R514) (See Page 110)

516. Action (SM_ACT)

Action (Act_ID, SM_ID, Suc_Pars, Descrip)
Identifier *: SM_ID, Act_ID

Action.Act_ID

Full Name: Action Identifier
Attribute Type: Base Attribute
Data Domain: **`unique_id`**

Action.SM_ID

Attribute Type: Referential Attribute
Refers To: State Model.SM_ID (R515) (See Page 100)

Action.Suc_Pars

Full Name: Action Successfully Parsed
Attribute Type: Base Attribute
Data Domain: **`integer`**

0 = NOT Successfully Parsed
1 = Successfully Parsed

Action.Descrip

Full Name: Action Description
Attribute Type: Base Attribute
Data Domain: **`string`**

517. State Model Event Data Item (SM_EVTDI)

State Model Event Data Item (SMedi_ID, SM_ID, Name, Descrip, DT_ID)
Identifier *: SMedi_ID, SM_ID

State Model Event Data Item.SMedi_ID

Full Name: State Model Event Data Item Identifier
Attribute Type: Base Attribute
Data Domain: **`unique_id`**

State Model Event Data Item.SM_ID

Attribute Type: Referential Attribute
Refers To: State Model.SM_ID (R516) (See Page 100)

State Model Event Data Item.Name

Full Name: Event Data Item Name
Attribute Type: Base Attribute
Data Domain: **`string`**

State Model Event Data Item.Descrip

Full Name: Description
Attribute Type: Base Attribute
Data Domain: **`string`**

State Model Event Data Item.DT_ID

Attribute Type: Referential Attribute
Refers To: Data Type.DT_ID (R524) (See Page 29)

518. Event Supplemental Data (SM_SUPDT)

Event Supplemental Data (SMspd_ID, SM_ID)
Identifier *: SMspd_ID, SM_ID

Event Supplemental Data.SMspd_ID

Full Name: Event Supplemental Data Identifier
Attribute Type: Base Attribute
Data Domain: `unique_id`

Event Supplemental Data.SM_ID

Attribute Type: Referential Attribute
Refers To: State Model.SM_ID (R523) (See Page 100)

519. Supplemental Data Items (SM_SDI)

Supplemental Data Items (SMedi_ID, SMspd_ID, SM_ID)
Identifier *: SMedi_ID, SM_ID, SMspd_ID

Supplemental Data Items.SMedi_ID

Attribute Type: Referential Attribute
Refers To: State Model Event Data Item.SMedi_ID (R522) (See Page 111)

Supplemental Data Items.SMspd_ID

Attribute Type: Referential Attribute
Refers To: Event Supplemental Data.SMspd_ID (R522) (See Page 112)

Supplemental Data Items.SM_ID

Attribute Type: Referential Attribute
Refers To: State Model Event Data Item.SM_ID (R522) (See Page 111)

520. Instance State Model (SM_ISM)

Instance State Model (SM_ID, Obj_ID)
Identifier *: SM_ID, Obj_ID

Instance State Model.SM_ID

Attribute Type: Referential Attribute
Refers To: State Model.SM_ID (R517) (See Page 100)

Instance State Model.Obj_ID

Attribute Type: Referential Attribute
Refers To: Object.Obj_ID (R518) (See Page 44)

521. Assigner State Model (SM_ASM)

Assigner State Model (SM_ID, Obj_ID)
Identifier *: SM_ID, Obj_ID

Assigner State Model.SM_ID

Attribute Type: Referential Attribute
Refers To: State Model.SM_ID (R517) (See Page 100)

Assigner State Model.Obj_ID

Attribute Type: Referential Attribute
Refers To: Object.Obj_ID (R519) (See Page 44)

8.2.5.2 Relationship Descriptions

R501

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model is decomposed into State Model State

State Model State ... State Model

Formalized By: State Model.SM_ID

R502

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model can be communicated to via State Model Event

State Model Event ... State Model

Formalized By: State Model.SM_ID

R503

Relationship Type: Associative

Multiplicity/Conditionality: 1-(Mc:Mc)

State Model Event is received by State Model State

State Model State receives State Model Event

Formalized By: State Model State.SMspd_ID, State Model State.SM_ID, State Model State.SMstt_ID, State Model Event.SMspd_ID, State Model Event.SM_ID, State Model Event.SMevt_ID

R504

Relationship Type: Subtype/Supertype

Subtypes: Event Ignored, Cant Happen, New State Transition

Formalized By: State Event Matrix Entry.SMevt_ID, State Event Matrix Entry.SM_ID, State Event Matrix Entry.SMspd_ID, State Event Matrix Entry.SMstt_ID

R505

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model contains Transition

Transition ... State Model

Formalized By: State Model.SM_ID

R506

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model State is destination of Transition

Transition is destine to State Model State

Formalized By: State Model State.SMspd_ID, State Model State.SM_ID, State Model State.SMstt_ID

R507

Relationship Type: Subtype/Supertype

Subtypes: No Event Transition, Creation Transition, New State Transition

Formalized By: Transition.Trans_ID, Transition.SM_ID, Transition.SMspd_ID

R508

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model State is origination of No Event Transition

No Event Transition originates from State Model State

Formalized By: State Model State.SM_ID, State Model State.SMstt_ID

R509

Relationship Type: Simple

Multiplicity/Conditionality: 1c:1c

State Model Event is assigned to Creation Transition

Creation Transition has assigned to it State Model Event

Formalized By: State Model Event.SMspd_ID, State Model Event.SM_ID, State Model Event.SMevt_ID

R510

Relationship Type: Subtype/Supertype

Subtypes: Mealy State Model, Moore State Model

Formalized By: State Model.SM_ID

R511

Relationship Type: Associative

Multiplicity/Conditionality: 1-(1c:Mc)

State Model State ... Moore State Model

Moore State Model ... State Model State

Formalized By: Moore State Model.SM_ID, State Model State.SM_ID, State Model State.SMstt_ID

R512

Relationship Type: Associative

Multiplicity/Conditionality: 1-(1c:Mc)

Transition ... Mealy State Model

Mealy State Model ... Transition

Formalized By: Mealy State Model.SM_ID, Transition.Trans_ID, Transition.SM_ID

R513

Relationship Type: Subtype/Supertype

Subtypes: Moore Action Home, Mealy Action Home

Formalized By: Action Home.SM_ID, Action Home.Act_ID

R514

Relationship Type: Simple

Multiplicity/Conditionality: 1:1

Action resides in Action Home

Action Home houses Action

Formalized By: Action.SM_ID, Action.Act_ID

R515

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model contains Action

Action ... State Model

Formalized By: State Model.SM_ID

R516

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model can asynchronously communicate via State Model Event Data Item

State Model Event Data Item is carried on events into State Model

Formalized By: State Model.SM_ID

R517

Relationship Type: Subtype/Supertype

Subtypes: Instance State Model, Assigner State Model

Formalized By: State Model.SM_ID

R518

Relationship Type: Simple

Multiplicity/Conditionality: 1c:1

Object ... Instance State Model

Instance State Model ... Object

Formalized By: Object.Obj_ID

R519

Relationship Type: Simple

Multiplicity/Conditionality: 1c:1

Object ... Assigner State Model

Assigner State Model ... Object

Formalized By: Object.Obj_ID

R520

Relationship Type: Simple

Multiplicity/Conditionality: M:1

Event Supplemental Data defines signature of State Model Event

State Model Event carries Event Supplemental Data

Formalized By: Event Supplemental Data.SMspd_ID, Event Supplemental Data.SM_ID

R521

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1c

Event Supplemental Data is delivered by received event to State Model State

State Model State receives asynchronous data via Event Supplemental Data

Formalized By: Event Supplemental Data.SMspd_ID, Event Supplemental Data.SM_ID

R522

Relationship Type: Associative

Multiplicity/Conditionality: 1-(Mc:Mc)

State Model Event Data Item makes up Event Supplemental Data

Event Supplemental Data is made up of State Model Event Data Item

Formalized By: Event Supplemental Data.SMspd_ID, Event Supplemental Data.SM_ID, State Model Event Data Item.SMedi_ID, State Model Event Data Item.SM_ID

R523

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

State Model contains Event Supplemental Data

Event Supplemental Data is assigned to State Model

Formalized By: State Model.SM_ID

R524

Relationship Type: Simple

Multiplicity/Conditionality: Mc:1

Data Type defines the type of State Model Event Data Item

State Model Event Data Item is defined by Data Type

Formalized By: Data Type.DT_ID

TASK

SW Arch Implementation

STEP 9

Develop Structural Archetypes

9.1 Method

An Archetype File is used as input into the Archetype Interpreter (e.g., BridgePoint Gen) - it acts as a specification of the rules by which to automatically create one or more text files. The Archetype Language controls

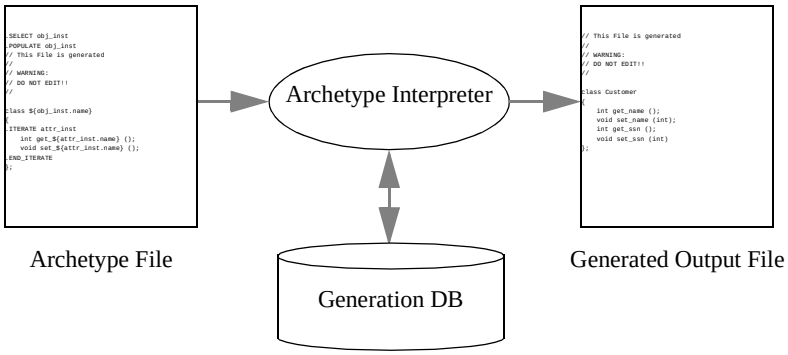


Figure 9.1.0.1. File Generation

how the file is generated. The Archetype Language is a mix of:

- literal text,
- control statements,
- and substitution variables.

The literal text is passed straight through to the output files; the control statements are used to select and iterate over data in the Generation Database; and the substitution variables are used to access from the Generation Database and format the data for the output files.

Literal Text, Control Statements, and Substitution Variables are explained in the following sections.

9.1.1 General Language Attributes

1. Execution is sequential.
2. All transient variables are *implicitly* declared upon the first assignment - any subsequent assignments simply re-assign the *same* variable. A re-assignment of a variable to a different type is not allowed.
3. A stack execution model is assumed - variables are pushed on the stack as they are implicitly declared and are popped off the stack as they fall out of scope. Any variable implicitly declared inside of the **`If - Elif - Else - End if`** or **`For - End for`** falls out of scope when the **`End if / Elif / Else / End for`** is encountered in execution.
4. White space is treated as a token delimiter.
5. Statements are intended to be readable as a sentence so keywords are used in groups to provide verb phrases or prepositional phrases when combined with variables and OOA element references.
6. Key words may be all lower-case, all upper-case, or first character uppercase and all other characters lower-case.
7. Variables must adhere to the constrained names:
   - Names can be made up any alpha (a-z, A-Z) or numeric (0-9) characters or underscore (_) character.
   - Names cannot begin with a numeric (0-9) character.
   - Names cannot conflict with keywords from the Archetype Language.
8. Objects in the OOA of OOA are specified by using the object keyletters.

9.1.1.1 Syntax Notation

In the syntax notation used in this manual:

- Key words and characters (operator symbols...) are in **`courier bold`** type
- OOA element references are indicated by ***`courier italic`*** type
- Variables are indicated by *Palatino italic* type

9.1.2 Literal Text

Literal text is passed straight through from the Archetype File to the generated files.

Any line in the Archetype File which is not a Control Statement is a Literal Text Line. Any line beginning with a '**.**' character as the *first* non-white space character is a Control Statement Line except those lines which begin with the '**..**' character sequence.

A Literal Text Line with the '**..**' character sequence as the *first* non-white space characters will result in the '**.**' character in the generated output line. The '**.**' character anywhere else in the Literal Text Line will result in a '**.**' character in the generated output line (no special treatment).

Literal Text Lines can contain Substitution Variables (see "Substitution Variables" on page 151). Substitution Variables are denoted with the '**${***variable***}**' character sequence. This means that the '**$**' character is a special character which denotes the beginning of a Substitution Variable. The '**$$**' character sequence anywhere in a literal text line will result in one '**$**' character in the generated output line.

Newline characters at the end of a Literal Text Line are passed through to the generated output. If you do not want a newline at the end of a generated output line (presumably due to control statement constraints), then place a '****' character as the *last* character of the Literal Text Line. The '****' character sequence as the last two characters of the Literal Text Line will result in one '****' character and one newline character as the last characters of a generated output line. The '****' character sequence as the last three characters of the Literal Text Line will result in one '****' character as the last character of a generated output line with no newline character.

TABLE 9.1 Summary of Special Characters in Literal Text Lines

Character	Position	To Generate Character at Position Use
.	First Non-White Space	**..**
$	Any	**$$**
****	Last	****

9.1.3 Data Access Control Statements

The Data Access Control Statements can be any of the following:

- Instance Selection - selecting object instances from the Generation Database.
- Instance Set Iteration
- Object Attribute Access - the reading or writing of Object Attributes.

9.1.3.1 Instance Selection

Instance Selection makes direct use of chains of related object instances in the OOA of OOA Object Information Model.

The Control Language statement which supports Instance Selection is the **`.Select`** statement:

```
.Select one <inst_ref_var> related by <inst_chain>
      [ where (<condition>) ]
.Select any <inst_ref_var> related by <inst_chain>
      [ where (<condition>) ]
.Select many <inst_ref_set_var> related by <inst_chain>
      [ where (<condition>) ]
.Select any <inst_ref_var> from instances of
      <obj_keyletters> [ where (<condition>) ]
.Select many <inst_ref_set_var> from instances of
      <obj_keyletters> [ where (<condition>) ]
```

where:

<inst_ref_var>	**::=** reference to 0 or 1 object instances
<inst_ref_set_var>	**::=** reference to 0, 1, or more object instances
<inst_chain>	**::=** list of object, relationship, object... which form an unbroken path through a series of related object instances
<obj_keyletters>	**::=** keyletters of an object
<condition>	**::=** expression with **`boolean`** result (see “Expressions” on page 145)

Here are some examples:

To select all instances of objects from the OOA:

```
.Select many obj_set from instances of O_OBJ
```

To select all attribute instances related to an object instance obj_inst:

```
.Select many attr_set related by obj_inst->O_ATTR[R102]
```

To select all relationships which an object instances is involved in:

```
.Select many rel_set related by obj_inst->R_OIR[R201]-
   >R_REL[R201]
```

Note that the navigation through the associative relationship R201 was in 2 steps - first to the associative object and then to the other side of the associative relationship.

The resulting <inst_ref_var> /<inst_ref_set_var> is a transient variable which follows the implicit declaration rule. When the resulting <inst_ref_var> / <inst_ref_set_var> is being implicitly declared (used for the first time), the referred to object of the transient variable is set according to the result of the **`.Select`**. When the resulting <inst_ref_var> /<inst_ref_set_var> is being reassigned, the referred to object of the new selection must match that of the transient variable.

9.1.3.2 Instance Chains

The **`related by`** form of the **`.Select`** statement uses an *instance chain* to specify a path through the related instances. An *instance chain* is simply a chain of object instances which are related through the specified relationships - the eventual result is 0, 1, or more instances of the last object of the chain. The syntax of the *instance chain* places the focus on the objects of the chain (specified by the object keyletters) because the instances of the chain are object instances. The **`[]`** syntax is intended to indicate access into a table of that object's instances . The contents of the **`[]`** is a specification of which instances are being accessed - since the instances are accessed via a relationship, the contents of the **`[]`** is the *relationship traversal specification*.

The relationship traversal specification can be specified as:

R<number>

or

R<number>**.**<direction>

where:

R<number>	**::=** reference to relationship
<direction>	**::=** specification of the direction of the traversal - **IR** for ID side to Referential side and **RI** for Referential side to ID side.

It is suggested that you use the simplest expression of the relationship traversal direction which does not lead to ambiguity.

The <direction> is needed when traversing *reflexive* relationships, i.e., relationship where objects are related to themselves, since reflexive relationships can be traversed in each direction. Examples of reflexive relationships in the OOA of OOA are R103 (to specify order of attributes) and R112 (to specify order of R#'s). For example:

```
.Select one prev_attr_inst related by curr_attr_inst-
   >O_ATTR[R103.RI]
```

Selects the previous attribute instance - the reason **RI** is used is because **PAttr_ID** (Previous Attribute ID) is used to formalize the relationship **R103** - this means that the selection will find the instance of O_ATTR in which **selected.Attr_ID** is equal to `curr_attr_inst.PAttr_ID` which is the previous attribute in respect to **curr_attr_inst**.

9.1.3.3 Chain Multiplicity & Conditionality

The multiplicity of an instance chain is zero or one (**one**) if the starting instance variable has multiplicity zero or one and all relationship traversals in the chain result have multiplicity zero or one. Otherwise, the multiplicity of the instance chain is zero, one, or more (**many**).

One can only be used with an instance chain of multiplicity zero or one, whereas **any** and **many** can only be used with an instance chain of multiplicity zero, one, or many.

The conditionality of an instance chain is unconditional if all relationship traversals in the chain are unconditional; otherwise, the instance chain is conditional.

9.1.3.4 Where Clause

The **`where (<`**condition**`>)`** can be used to efficiently filter out a subset of the instances selected through the **`from instances of`** or **`related by`** constructs. The <condition> is applied separately to each object instance selected through the **`from instances of`** or **`related by`** constructs - the instances for which <condition> is TRUE are selected - the instances for which <condition> is FALSE are not selected.

<condition> is a boolean expression (see “Expressions” on page 145) - the current instance being selected is referred to by the keyword **`selected`**. Here are some examples.

To select all attributes named Id:

```
.Select many attr_set from instances of O_ATTR
      where (selected.name == "Id")
```

To select all attributes in objects with keyletters DOG:

```
.Select many attr_set from instances of O_ATTR
      where ("${selected ->O_OBJ[R102]}.key_lett"
  == "DOG")
```

Note: The preceding example uses an instance substitution variable in a quoted string (see “Quoted Strings” on page 144) and an instance chain within the substitution variable (see “Substitution Variables” on page 151).

9.1.3.5 Instance Set Iteration

Once a set of instances has been selected, the template designer may want to specify statements to be carried out on each one of the instances of the set. The Control Statement which supports this is:

```
.For each <inst_ref_var> in <inst_ref_set_var>
      <stmt_blck>
.End for
```

where:

<inst_ref_var>	**::=** reference to 1 object instance
<inst_ref_set_var>	**::=** reference to 0, 1, or more object instances
<stmt_blck**>**	**::=** block of Archetype Language statements

The statements in the **.For** structure are executed once for each instance in the set. The iterations are sequential in a repeatable order, i.e., the order of the instances in a set are consistent from one execution to another. For example:

```
Start
.Select many obj_set from instances of O_OBJ
.For each obj_inst in obj_set
   Object name is ${obj_inst.name}
.End for
Finish
```

will result in the name of each object being printed on a separate line in the generated output. Each time the above example is executed, the order of the object names will be the same.

Note: When instances are added to the generation database, the order of elements is implementation specific when the order is compared to the order before the instances where added.

The variable <inst_ref_var> is scoped within the <stmt_blck>, i.e., it out of scope after the **.End for**. However, if the scope of <inst_ref_var> needs to extend beyond the **.End for**, then define <inst_ref_var> prior to the **.For** statement. In the previous example, **obj_inst** is out of scope (and no longer on the stack) when the '**Finish**' Literal Text Line is encountered. In the following example, **obj_inst** is still in scope (and still on the stack) when the '**Finish**' Literal Text Line is encountered:

```
Start
.Select any obj_inst from instances of O_OBJ
```

```
.Select many obj_set from instances of O_OBJ
.For each obj_inst in obj_set
   Object name is ${obj_inst.name}
.End for
Object name is ${obj_inst.name}
Finish
```

Since all instances are ordered and therefore, iteration through instance sets is sequential, the following statement is provided to break out of the iteration through the ordered set, presumably because you have found what you were looking for:

```
.Break for
```

9.1.3.6 While

The `while` statement provides a general purpose iteration mechanism. This complements the other iteration mechanism, the `for each` statement. The `for each` statement is a specific purpose iteration mechanism to iterate through an object instance reference set. The `while` statement is a general purpose iteration mechanism to iterate until the `while` condition is `false`. The syntax of the `while` statement is:

```
.while (<boolean expression>)
        <statement>
        <statement>
        ...
        <statement>
    .end while
```

The statements between the `while` and `end while` will be executed in sequence until the <boolean expression> is `false`. The condition is checked before the first iteration.

A `break while` statement is available, providing an alternative technique to end the iteration. The syntax of the `break while` statement is:

```
.while (<boolean expression>)
        <statement>
        <statement>
        .break while
        ...
        <statement>
    .end while
```

When executed, the `break while` statement will cause control to be transferred to the statement after the `end while` corresponding to the innermost executing `while` statement. For example:

```
.assign count = 1
    .while (count < 10)            //  while1
        .while (1 == 1)            //  while2
            .if (<condition>)
                .break while        //  break2
            .end if
        .end while                  //  endwhile2
        .if (<condition2>)
            .break while            //  break1
        .end if
    .end while                      //  endwhile1
```

Execution of 'break2' will cause control to transfer to the statement following 'endwhile2'. Execution of 'break1' will cause control to transfer to the statement following 'endwhile1'.

9.1.3.7 Object Attribute Access

The form of an Attribute Access in the Archetype Language is:

<obj_inst_ref_var>**.**<attribute>

where:

<obj_inst_ref_var**>**	**::=** variable holding a handle to 1 object instance
<attribute**>**	**::=** name of object attribute

Great care should be taken when writing object attributes. Writing an object attribute will permanently affect the value for all future uses of the attribute... - the new value of the attribute is stored persistently in the generation database.

9.1.4 Transformer Control Statements

The transformer provides for computational logic.

9.1.4.1 Assign Statement

The **.Assign** statement makes use of Expressions (See “Expressions” on page 145).

The **.Assign** statement has the following syntax:

.Assign <variable> **=** <expression>

where:

<variable**>**	**::=** data item, e.g., object attribute, fragment attribute, or transient variable.
<expression**>**	**::=** expression - usually a calculation using object attribute access, literal values, ...

When <variable> is an object attribute, the data type of <expression> must be compatible with the data type of <variable> (See Table 9.2 below).

If <variable > is a transient variable, then that transient variable follows the implicit declaration rule. When a transient variable is being implicitly declared (assigned for the first time), the data type of the transient variable is set to be the same as the data type of the <expression>. When a transient variable is being re-assigned, the data type of <expression> must be compatible with the data type of the <variable> (See Table 9.2 below).

TABLE 9.2 Compatible Assignment Data Types

<variable> **Data Type**	<expression> **Data Type**	**Note**
boolean	**boolean**	
integer	**integer**	
real	**real**	
integer	**real**	Truncates all digits after the decimal point.
real	**integer**	
string	**string**	
inst_ref<Object>	**inst_ref<Object>**	
inst_ref_set<Object>	**inst_ref_set<Object>**	
frag_ref	**frag_ref**	

If <variable> is of data type **inst_ref<Object>**, **inst_ref_set<Object>**, or **frag_ref<Object>**, then <expression> may be one of the following:

- Transient Variable
- Fragment Attribute

Here are some examples:

```
.Assign obj_inst = prev_obj_inst
.Assign obj_set = next_obj_set
.Assign attr_inst = base_attr_frag.base_attr_inst
.Assign data_type_frag = attr_data_type_frag
```

9.1.5 Tester Control Statements

Testers are supported in the Archetype Language with the **.If** statement:

.If (<condition>**)**
    <stmt_blck>
[**.elif (**<condition>**)**
    <stmt_blck>]
[**.else**
    <stmt_blck>]
.end if

where:

<condition**>**	**::=** expression with **boolean** result (see "Expressions" on page 145)
<stmt_blck**>**	**::=** block of Archetype Language statements

Many **elif** (else if) constructs may be present in the same **if** construct.

Here are some examples:

```
.If (obj_inst.numb < 100)
   literal text...
.elif ((obj_inst.numb >= 200) && (obj_inst.numb < 300))
   literal text...
.else
   literal text...
.end if
```

```
.If ("${obj_inst.descrip:TASK}" == "CLIENT")
   source code for client...
.elif ("${obj_inst.descrip:TASK}" == "SERVER")
```

```
   source code for server...
.else
   .print "Error in specification of
   obj_inst.descrip:TYPE"
   .exit 1
.end if



.Assign min_state_num = 999999
.Select any min_state_num_inst from instances of SM_STATE
.Select many state_set related by sm_inst->SM_STATE[R501]
.For each state_inst in state_set
   .If (state_inst.numb == min_state_num)
                  .print "OOA Data NOT Audited - 2
   states with same numb"
   .else if (state_inst.numb < min_state_num)
                  .Assign min_state_num_inst =
   state_inst
   .end if
.end for
```

9.1.6 Function Control Statements

Functions are supported in the Archetype Language to allow reuse of blocks of Archetype Language Statements. Functions always return a *fragment* - a fragment is a small piece of generated output. The intent of functions is to use them to build fragments which can be plugged into larger fragments and eventually into the whole generated file.

To define a function, use the **`.Function`** statement:

`.Function` <function_name>
[**`.Param`** <param_type> <param_name>
`.Param` <param_type> <param_name>

```
...]
    <stmt_blck>]
.end function
```

where:

<function_name**>**	**::=**	the name of the function
<param_type**>**	**::=**	the type of the parameter - allowed types are: **boolean** **integer** **real** **string** **inst_ref** **inst_ref_set** **frag_ref**
<param_name**>**	**::=**	the name of the parameter
<stmt_blck**>**	**::=**	block of Archetype Language statements - includes Literal Text, Control Statements, and Substitution Variables

To invoke a function, use the **.Invoke** statement:

```
.Invoke [ <frag_ref_var> =] <function_name>
    (<actual_param>, <actual_param>...)
```

where:

<frag_ref_var**>**	**::=**	a transient variable which holds a reference to a fragment
<function_name**>**	**::=**	the name of the function being invoked
<actual_param**>**	**::=**	actual parameter (See Table 9.3 below)

9.1.6.1 Fragment Attributes

Attributes may be defined for a fragment when the fragment is formed with the function invocation. The attribute **body** is always defined - after invocation of

TABLE 9.3 Actual Parameter Forms

Parameter Type	Actual Parameter Forms Allowed
boolean	Rvalue of type **boolean**
integer	Rvalue of type **integer**
real	Rvalue of type **real**
string	Rvalue of type **string**
inst_ref	<transient_var> of type **inst_ref**
inst_ref_set	<transient_var> of type **inst_set_ref**
frag_ref	<transient_var> of type **frag_ref**

a function, body will contain the output generated from the Literal Text Lines in the function.

Additional attributes are defined by declaring transient variables inside the function of the form:

attr_*xxx*

For example:

```
.Function get_attr_type
.Param inst_ref p_attr_inst
   .Assign attr_type = "${p_attr_inst.descrip:TYPE}"
.End function
```

will result in the variable **type** being available for use through the fragment reference returned from the invocation of the function:

```
.Select any dog_inst from instances of O_OBJ where
   (selected.name == "Dog")
.Select any dog_attr_inst related by dog_inst-
   >O_ATTR[R012]
.Invoke dog_attr_type = get_attr_type (dog_attr_inst)
The type of the attribute
   ${dog_inst.name}.${dog_attr_inst.name}
   is ${dog_attr_type.type}.
```

Be careful to make sure the **attr**_xxx variables are in scope when the **.End function** is reached. For example:

```
.Function get_attr_type
.Param integer p_value
.If (p_value < 100)
   .Assign attr_new_value = 22
.else
   .Assign attr_new_value = 2000;
.end if
.End function
```

results in the transient variable **`attr_new_value`** NOT to become a fragment attribute since it falls out of scope with the **`.If`** statement and therefore, is not on the stack when the **`.End function`** is encountered. A way to handle this case is:

```
.Function get_attr_type
.Param integer p_value
.Assign attr_new_value = 0
.If (p_value < 100)
   .Assign attr_new_value = 22
.else
   .Assign attr_new_value = 2000;
.end if
.End function
```

9.1.7 File Control Statements

File Control Statements in Archetype Language allow management of the Archetype Files.

9.1.7.1 Emitting Generated Output

All generated output is buffered as it is generated from interpretation of Literal Text Lines. To transfer the output from the buffer to a file, use:

.Emit to file "<file_name>**"**

The **.Emit** also clears the buffer's contents. For example:

```
.Emit to file "/source_code/$_{ss_inst.name}/
   $_{obj_inst.name}.cpp"
```

will result in a file being generated in a directory based on the subsystem name with a name based on the object name.

If a generated file is emitted and a file of the same name already exists, then the newly generated file is compared to the existing file - if the files are the same, then the existing file is left undisturbed (so that modification times... are left intact) - if the files are different, then the existing file is replaced with the newly generated file.

To clear the contents of the buffer without emitting the contents to a file, use:

.Clear

9.1.7.2 Comments

To add a comment in the Archetype File, use:

.Comment <user_comment>
or
.// <user_comment>

At least one white space character must follow the **.Comment** keyword.

A white space character does not need to follow the **.//** keyword.

All text to the end of the line after the comment keyword is ignored.

9.1.7.3 Include

To include another Archetype File, use:

.Include "<file_name>**"**

When a file is included, a marker is placed on the stack and the interpreter begins interpretation on the first line of the included file. When all lines in the included file have been processed, then all variables pushed on the stack since the include marker was pushed on the stack are considered out of scope (and therefore popped from the stack) - the interpreter then resumes interpretation on the line following the **.Include** statement.

9.1.7.4 Handling Errors

In handling errors from your Archetype Files, use:

.Print "<error_message>**"**

to print a message to stderr about the problem which was found and use:

.Exit <exit_status>

to stop the interpreter with integer value <exit_status>.

9.1.8 Rvalues

An *Rvalue* is a specification of a literal value or the specification of a variable.

9.1.8.1 Literals as Rvalues

Literal values must be able to be entered for the Core Data Types. Table 9.4 below uses example specifications to illustrate how the literal values are specified.

TABLE 9.4 Literal Specification for Core Data Types

Core Data Type	Literal Specification Examples
`boolean`	TRUE FALSE
`integer`	0 256 -10 13
`real`	0.0 256.44 -10.3 3.1415
`string`	“Hello World”
`inst_ref<Object>`	*Not Allowed*
`{inst_ref<Object>}`	*Not Allowed*
`frag_ref`	*Not Allowed*

9.1.8.2 Quoted Strings

Quoted strings get special handling in the Archetype Language - each Quoted String is treated as a Literal Text Line and is run through the variable substituter. For example:

```
.Assign name = dog_inst.name
```

and

```
.Assign name = "${dog_inst.name}"
```

are equivalent. Treating Quoted Strings as Literal Text Lines adds flexibility in concisely specifying the string value. For example, the following shows Substitution Variables used in the **.if** statement and **.emit** statement:

```
.Select many obj_set from instances of O_OBJ
.For each obj_inst in obj_set
      .if ("${obj_inst.descrip:CLIENT_SERVER}" ==
"CLIENT")
            Output statements for client here...
      .end if
      .emit to file "$_{obj_inst.key_lett}.cc"
.end for
```

Since the Quoted Strings get run through the Literal Text Substituter, use **$$** to yield one **$** character.

In addition, use **""** to yield one **"** character.

9.1.8.3 Variables as Rvalues

The variables of the following types may be used as values:

- <transient_variable> of type **boolean**, **integer**, **real**, **or string**
- <inst_ref_var>**.**<attribute> where <attribute> is of type **boolean**, **integer**, **real**, **or string**
- <frag_ref_var>**.**<attribute> where <attribute> is of type **boolean**, **integer**, **real**, **or string**

9.1.9 Expressions

The Archetype Language supports *simple* expressions and *compound* expressions.

9.1.9.1 Simple Expressions

Simple expressions are single unary or binary operations:

(<unary_operator> <operand>**)**

(<operand> <binary_operator> <operand>**)**

where:

<unary_operator**>**	**::=** unary operator
<binary_operator**>**	**::=** binary operator
<operand**>**	**::=** operand, e.g., literal value, object attribute, or transient variable

Here are some examples:

```
.if (empty obj_inst)
.assign number_selected = cardinality obj_set
.if (obj_inst.numb >= 100)
.assign attr_decl = "${attr_inst.descrip:TYPE}
   $cr{attr_inst.name};"
```

9.1.9.2 Compound Expressions

Simple expressions can be combined to form a compound expressions:

(<unary_operator> <expression>**)**

(<expression> <binary_operator> <operand>**)**

(<operand> <binary_operator> <expression>**)**

(<expression> <binary_operator> <expression>**)**

where:

<unary_operator**>**	**::=** unary operator
<binary_operator**>**	**::=** binary operator
<operand**>**	**::=** operand, e.g., literal value, object attribute, or transient variable
<expression**>**	**::=** expression - either a simple expression or a compound expression

Note the ***required*** use of the **(** and **)** characters to delimit expressions in a compound expression. This takes away the issues surrounding precedence and associativity of operators.

Here are some examples:

```
.if ((x > 1) AND (x < 10))
.assign full_name = ((first_name + middle_name) +
   last_name)
.select many processor1_objs from instances of O_OBJ
   where (("${selected.descrip:TASK}" == "TASK1") OR
   ("${selected.descrip:TASK}" == "TASK4"))
```

9.1.9.3 Operations

TABLE 9.5 Core Unary Operators

Operator	Description
not	Logical Negation
empty	**inst_ref<Object>** or **{inst_ref<Object>}** test for empty set
not_empty	**inst_ref<Object>** or **{inst_ref<Object>}** test for not empty set
first	Test if the **{inst_ref<Object>}** internal cursor is on the first in the set
not_first	Test if the **{inst_ref<Object>}** internal cursor is not on the first in the set
last	Test if the **{inst_ref<Object>}** internal cursor is on the last in the set
not_last	Test if the **{inst_ref<Object>}** internal cursor is not on the last in the set
cardinality	Count of items in **{inst_ref<Object>}**

TABLE 9.6 Core Binary Operators

Operator	Description
`and`	Logical And
`or`	Logical Inclusive Or
`+`	Arithmetic Addition (`integer` & `real`) or Concatenation (`string`)
`-`	Arithmetic Subtraction
`*`	Arithmetic Multiplication
`/`	Quotient from Arithmetic Division
`%`	Remainder from Arithmetic Division
`<`	Less-than
`<=`	Less-than or Equal-to
`==`	Equal-to
`!=`	Not-equal-to
`>=`	Greater-than or Equal-to
`>`	Greater-than

TABLE 9.7 Core Unary Operations

Operator	Operand	Result
`not`	`boolean`	`boolean`
`empty` `not_empty`	`inst_ref<Object>`	`boolean`

`empty`
`not_empty`
`first`
`not_first`
`last`
`not_last`
	`{inst_ref<Object>}`	`boolean`

`cardinality`	`{inst_ref<Object>}`	`integer`

TABLE 9.8 Core Binary Operations

Left Operand	Operator	Right Operand	Result
boolean	and or == !=	boolean	boolean
integer	+ - * / %	integer	integer
integer	< <= == != >= >	integer	boolean
integer	+ - * /	real	real
integer	< <= == != >= >	real	boolean
real	+ - * /	integer	real
real	< <= == != >= >	integer	boolean
real	+ - * /	real	real
real	< <= == != >= >	real	boolean
string	+	string	string
string	< <= == != >= >	string	boolean

TABLE 9.9 Set Operations

Left Operand	Operator	Right Operand	Result
<inst_ref>	|	<inst_ref>	<inst_ref_set>
<inst_ref>	&	<inst_ref>	<inst_ref_set>
<inst_ref>	-	<inst_ref>	<inst_ref_set>
<inst_ref>	==	<inst_ref>	<inst_ref_set>
<inst_ref>	!=	<inst_ref>	<inst_ref_set>
<inst_ref>	|	<inst_ref_set>	<inst_ref_set>
<inst_ref>	&	<inst_ref_set>	<inst_ref_set>
<inst_ref>	-	<inst_ref_set>	<inst_ref_set>
<inst_ref_set>	|	<inst_ref>	<inst_ref_set>
<inst_ref_set>	&	<inst_ref>	<inst_ref_set>
<inst_ref_set>	-	<inst_ref>	<inst_ref_set>
<inst_ref_set>	|	<inst_ref_set>	<inst_ref_set>

TABLE 9.9 Set Operations

Left Operand	Operator	Right Operand	Result
`<inst_ref_set>`	`&`	`<inst_ref_set>`	`<inst_ref_set>`
`<inst_ref_set>`	`-`	`<inst_ref_set>`	`<inst_ref_set>`
`<inst_ref_set>`	`==`	`<inst_ref_set>`	`<inst_ref_set>`
`<inst_ref_set>`	`!=`	`<inst_ref_set>`	`<inst_ref_set>`

9.1.10 Substitution Variables

Literal text lines can contain substitution variables which allow information to be pulled out of the Generation Database and be placed into the generated files.

A substitution variable takes on the following form:

```
$ <format> { <inst_ref_var> . <attribute> [ : <parse_keyword> ] }
or
$ <format> { <inst_chain> . <attribute> [ : <parse_keyword> ] }
or
$ <format> { <frag_ref_var> . <attribute> }
or
$ <format> { <transient_var> }
```

where:

<format**>**	**::=**	represents instructions on how to format the string which is substituted into the generated file
<inst_ref_var**>**	**::=**	reference to an object instance from the OOA of OOA
<inst_chain**>**	**::=**	an instance chain which results in **one** instance (see “Instance Chains” on page 129)
<frag_ref_var**>**	**::=**	reference to a fragment which has been returned from a function
<attribute**>**	**::=**	attribute of the object referred to by <inst_ref_var> or attribute of the fragment referred to by <frag_ref_var>
<parse_keyword**>**	**::=**	represents a keyword which can be parsed for in the string which is substituted into the generated file

Here are some examples:

```
${obj_inst.name}
$_{ss_inst.name}
${dt_inst.descrip:TYPE}
${attr_inst->O_OBJ[R102].key_lett}
$_{rattr_inst->O_BATTR[R113]->O_ATTR[R106].name}
```

9.1.10.1 Format

<format**>** is needed to allow the legal names in OOA to be transformed into legal names in the generated file. For example, spaces are allowed in object names in OOA but are not allowed in class names in C++ - if the object name from the OOA is to be used as the class name in a generated C++ file, then the object name must be transformed into a legal C++ name.

The **<**format**>** characters allowed are listed in Table 9.10 below.

TABLE 9.10 Substitution Variable Format Characters

Format Character	Format Affect
U or **u**	Upper - make all characters upper case
C or **c**	Capitalize - make the first character of each word capitalized and all other characters of a word lower case
L or **l**	Lower - make all characters lower case
_	Underscore - change all white space characters to underscore characters
R or **r**	Remove - remove all white space Note: The removal of white space will occur after the capitalization has taken place in the case of the **CR** or **RC** combination.

Here are some examples:

Input	Format	Output
Objective Spectrum	u	**OBJECTIVE SPECTRUM**
Objective Spectrum	u_	**OBJECTIVE_SPECTRUM**
Objective Spectrum	ur	**OBJECTIVESPECTRUM**
ObjecTIVE SpecTRum	c	**Objective Spectrum**
ObjecTIVE SpecTRum	c_	**Objective_Spectrum**
ObjecTIVE SpecTRum	cr	**ObjectiveSpectrum**
ObjecTIVE SpecTRum	l	**objective spectrum**
ObjecTIVE SpecTRum	l_	**objective_spectrum**
ObjecTIVE SpecTRum	lr	**objectivespectrum**

9.1.10.2 Parse Keyword

The *parse-keyword* is used to facilitate simplified file generation through avoiding ‘expanding’ the OOA of OOA. Rather than adding ‘expansion’ objects which are related to OOA of OOA objects to capture design information, the *parse-keyword* can be placed directly in the OOA capture and what follows the *parse-keyword* until the next new-line character is available with the **$***format***{***instance-ref***.***attribute***:***parse-keyword***}** construct. For example, if an object description contains:

```
This attribute captures the name of the quick brown fox
   who jumped over the lazy brown dog.
TYPE: String
LENGTH: 64
```

then type TYPE can be pulled out with:

```
${attr_inst.descrip:TYPE}
```

and the LENGTH can be pulled out with:

```
${attr_inst.descrip:LENGTH}
```

Note that the above example explicitly places *design/implementation* information into the *analysis* - this has ramifications on the reusability of the analysis across different designs and implementation technologies. Use with care!

9.1.10.3 Information Substitution Variables

There are some special substitution variables available which can be used anywhere:

${info.date}
${info.user_id}
${info.arch_file_name}
${info.arch_file_line}

```
${info.interpreter_version}
${info.interpreter_platform}
${info.unique_num}
```

Obviously, **`info`** is a keyword and can not be used as a transient variable name.

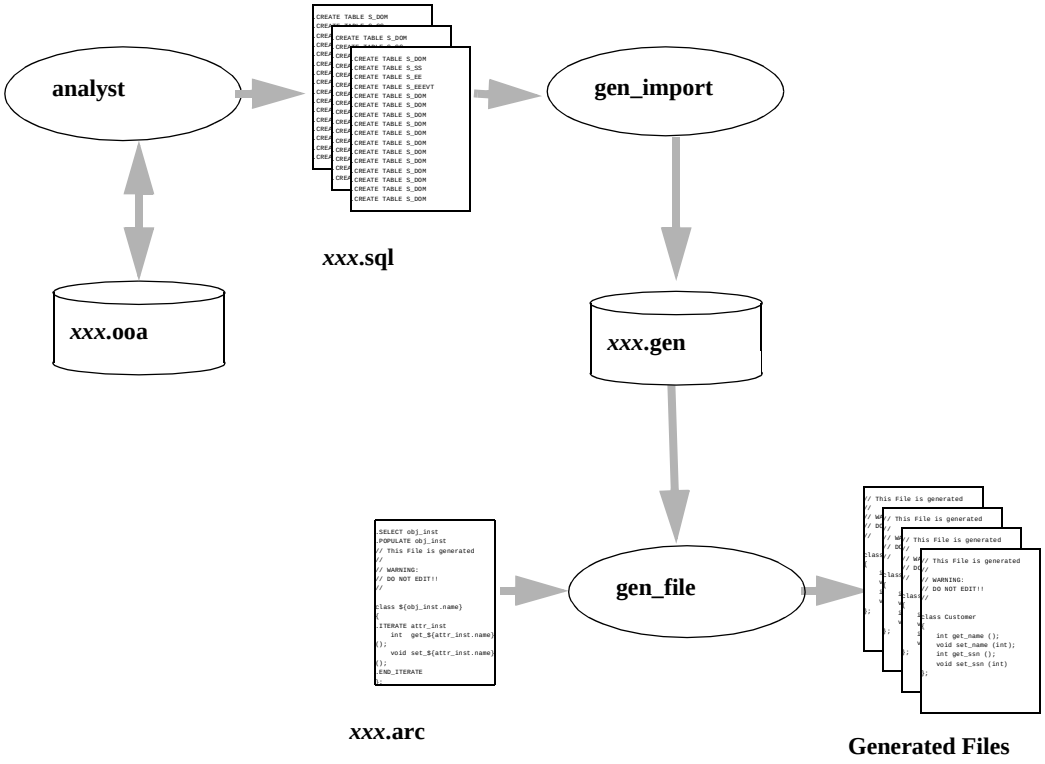
`${info.unique_num}` generates a unique integer each time it is referenced. For example, the first time it is referenced, it may produce 1, the next time 2, the next time 3... The order of the unique numbers generated will be exactly the same from one invocation of the Archetype Interpreter to the next.

9.2 Automation

9.2.1 Overview

Files can be automatically generated by using an archetype file and an archetype interpreter as shown in Figure 9.2.1.1

Figure 9.2.1.1. Archetype Interpretation Architecture



An archetype file is used as input into the archetype interpreter - it acts as a specification of the rules by which to automatically create one or more text files. The archetype language controls how the file is generated. The archetype language is a mix of literal text, control statements, and substitution variables.

Generally, one file archetype file exists for each type of file which is generated. For example, for C++ code generation, one file archetype file exists for header files, one for the source files, and one for make files.

The ***xxx*.gen** file is a generation database being built by the *gen_import* command. Note that the ***xxx*.gen** file must reside physically on the BridgePoint server similar to analyst **.ooa** files.

9.2.2 Running *gen_import*

gen_import must be run at least twice to create the generation database for translation. The first run of *gen_import* will be with provided **ooa_schema.sql** file to build all the necessary TABLES to support accessing data from any object in the OOA of OOA or accessing data via any relationship in the OOA of OOA. The format of the first gen_import command is:

gen_import *database*.**gen ooa_schema.sql**

The second run of *gen_import* will populate the generation database with the data from the application OOA. You must export data from analyst using the **Export-SQL** option into a file ending with the **.sql** suffix. Do not leave the **Include Graphical Data** check box checked. Graphical data has no role in most translation you are trying to translate the graphical data into another form. The format of the second gen_import is:

gen_import [-d num] *database*.**gen** *data_file*.**sql**

Note that the ***-d*** option is for specifying domain code between 0-15 inclusive; if domain code is not provided, a unique one will be chosen/allocated for this import.

You are now ready to generate code.

9.2.3 Running *gen_file*

The *database*.**gen** file is the generation database created by the *gen_import* command. The *archetype*.**arc** file contains the archetype for a portion of the target architecture.

There are several options on the gen_file command.

The "**-#** *num*" allows the generation of a specified number of output files for the archetype. For example, if an archetype specifies the generation of one file per object, potentially many files are generated from one archetype. This option allows control in order to generate a limited number during a development phase.

The "**-q**" option will cause *gen_file* to quit after the first error. Without this option, an incorrectly specified **.arc** can iteratively generate errors.

The "**-f** *file*" allows the generation of a specific file.

The "**-l**" option specifies that the output will be directed to a file with the name database.gen_log.

The usage of *gen_file* is:

gen_file [-# *num* **] [-l] [-q] [-f** *file* **]** *database***.gen** *archetype***.arc**

You simply write an archetype file and run it through the gen_file process and it generates files per the instructions!

9.2.4 Using Makefiles

Invocations of **gen_import** and **gen_file** can be placed in makefiles to fully automate the process of File Generation. Here are some tips:

- The exit status of **gen_import** and **gen_file** is the number of errors which have occurred during execution. Make runs smoothly as long as the exit status of each command is 0 - if the exit status of a command is not 0, then make stops execution of the commands for that rule... Therefore, your make will respond when the errors have occurred during execution of **gen_import** or **gen_file**.
- In **gen_file**, the Control Statement '**.exit** <exit_status>' causes the **gen_file** to exit with the exit status <exit_status> - this can allow the user to get make to respond upon errors found in the generation.

STEP 10

Develop Action Archetypes

10.1 Method

Action Specifications are specified in the Action Language within the Application & Service OOAs. The Actions must be converted to the Target Source Code. This is accomplished through Action Generation.

Action Source Code is generated using a technique very similar to that used by a compiler to produce machine code from a high level language. However, one major difference exists: the last step of the Action Generation is done through a set of user-specified Fragment Generation Functions so that the user has complete control over the process of generation and therefore can generate source code in any Programming Language (C, C++, Smalltalk, Fortran, COBOL, Lisp, Assembler, 4GL...) and any Software Architecture.

The process is of Action Generation is:

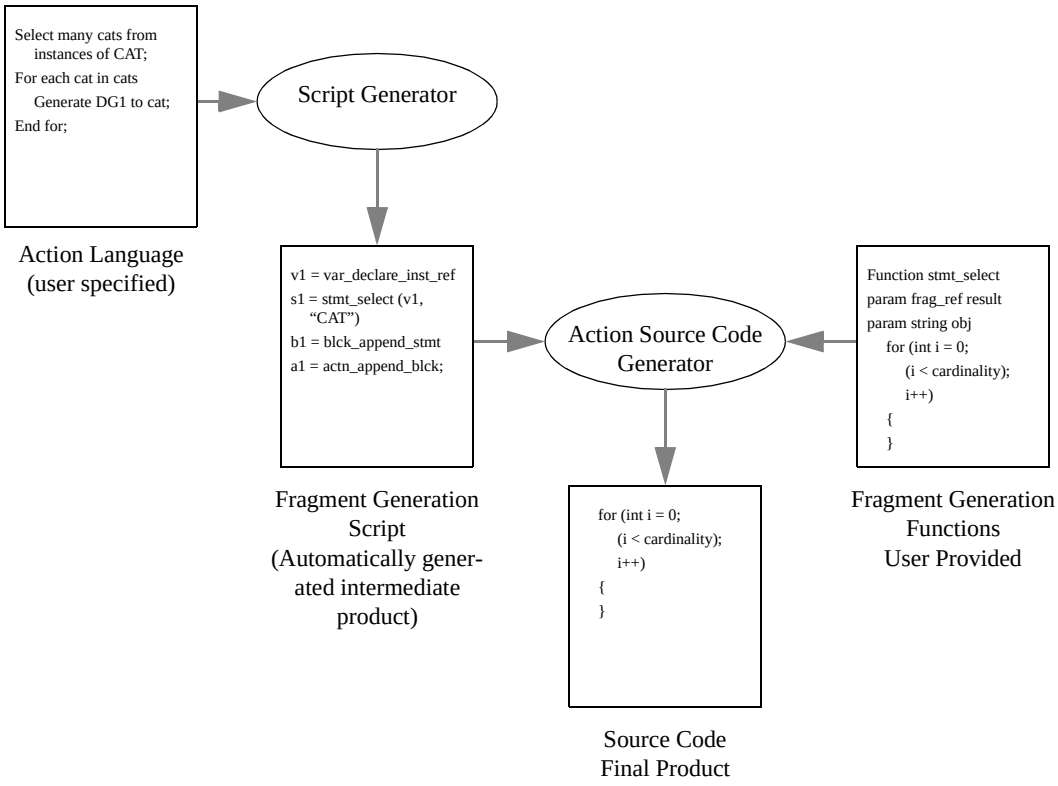


Figure 10.1.0.1. Action Generation Process

The steps of the process are:

1. Script Generation - break Action Language into fundamental components - fragments - from the inside out... - build smallest fragments first, combine into larger fragments, finally yield one resulting fragment.

2. Action Source Code Generation - plug in user definitions for each fragment - will generate small fragments of Target Source Code, combine the small fragments into Larger fragments of Target Source Code, and finally yield the resulting Target Action Source Code.

10.1.1 Invoking Fragment Generation

For Script Generation only:

.AL_xlate <action_location> <action_inst_ref> **script to file** **"**<file_name>**"**

where:

<action_location>	**::=**	keyword either **instance_sm** or **assigner_sm**..
<action_inst_ref>	**::=**	Variable of type **inst_ref** which holds a reference to the an instance of the OOA of OOA object SM_ACT.
<file_name>	**::=**	Specification of file for output of Fragment Generation Script

For Script Interpretation:

.Include "<file_name>**"**

where:

<file_name>	**::=**	Specification of file for output of Fragment Generation Script

For both Script Generation and Script Interpretation:

.AL_xlate <action_location> <action_inst_ref>

where:

<action_location>	**::=**	keyword either **instance_sm** or **assigner_sm**..
<action_inst_ref>	**::=**	Variable of type **inst_ref** which holds a reference to the an instance of the OOA of OOA object SM_ACT.

For example,. a simple File Archetype using Action Generation may look like:

```
Include “Frag-gen.arc”

Select many state_models from instances of SM_ISM

For each state_model in state_models

   Select many states related by state_model -> SM_SM
   [R517] ->
      SM_STATE [R301]

   For each state in states

      OS_${state.name} ()

      {

      Select one action related by state -> SM_MOAH
   [R511] -> SM
         ->SM_AH [R513] ->SM_ACT [R514]

      AL_xlate instance_sm action

      }

   End for

   Emit to file “{$state_model.name}.cpp”

End for
```

10.1.2 Fragment Generation Script

The strategy behind fragment generation is to begin with the innermost statement components and convert them to Target Source Code, and then move to combining small fragments into larger fragments... until a statement is formed - statements are combined into blocks & blocks into actions...

For example, lets examine the following Action Language statement and generation of equivalent C code:

```
Assign x = rcvd_evt.a + 2;
```

We begin by building a fragment for **`rcvd_evt.a`**:

```
get_evt_data_item_a ()
```

Next, build a fragment for the literal integer value 2:

```
2
```

Next, combine the `rcvd_evt`.a fragment with the 2 fragment with the binary addition operator:

```
get_evt_data_item_a () + 2
```

Finally, build an assignment statement from the binary operation:

```
x = get_evt_data_item_a () + 2;
```

We extend this approach to all statement components in the Action Language.

A script can be generated to allow the user to furnish each fragment as it is needed - the script used for conversion of:

```
Assign x = rcvd_evt.a + 2;
```

is made up of a series of calls to fragment generation functions (see Section 2.2.1.2) and would look like:

```
.Invoke a001 = actn_begin (actn_inst)
.Invoke b001 = blck_begin ()
.Invoke v001 = var_declare_self (actn_inst)
.Invoke r001 = rval_read_rcvd_evt_di (actn_inst, “a”)
.Invoke r002 = rval_literal_integer (“2”)
.Invoke r003 = rval_binary_op (r001, “+”, r002)
.Invoke v002 = var_declare (“x”)
.Invoke s001 = stmt_assign_transient_var (v002, TRUE,
   r003)
.Invoke b002 = blck_append_stmt (b001, s001)
```

```
.Invoke b003 = blck_var_out_of_scope (b002, v002)
.Invoke b004 = blck_var_out_of_scope (b003, v001)
.Invoke b005 = blck_end (b004)
.Invoke a002 = actn_append_blck (a001, b005)
.Invoke a003 = actn_end (a002)
${a003.body}
```

Notice that the script begins by requesting a fragment for the the innermost statement component and passes that fragment into requests for larger fragments which eventually result in the whole statement converted to source code.

10.1.3 Fragment Generation Functions

A Fragment Generation Function exists for each Action Language Statement Component as well as the Action Language Statements, Statement Blocks, and the Action itself. The role of some Fragment Generation Functions is to build a fragment from scratch, i.e., from string parameters and Generation Database lookups. The role of other Fragment Generation Functions are to assemble small fragments into larger fragments.

Generator functions have been grouped into the following categories:

- Action
- Statement Block
- Statement
- Rvalue
- Instance Chain
- Parameter List

Each type of Generator Function will be discussed in the following sections.

10.1.3.1 Action Generator Functions

An action is really a block - however, special handling may be required, e.g., declaration statements may need to be output at the beginning of the action only. So, the Action Generator Functions provide the mechanism for this potential special handling.

TABLE 10.11 Action Generator Functions

Generator Function Name	Parameter Name	Param Type
actn_begin	p_actn_obj_inst	inst_ref<SM_ACT>
actn_append_blck	p_actn p_blck	frag_ref <actn> frag_ref<blck>
actn_end	p_actn	frag_ref<actn>

10.1.3.2 Statement Block Generator Functions

These Generator Functions are similar to the Action Generator Functions only they operate on a block of Action Language Statements.

TABLE 10.12 Statement Block Generator Functions

Generator Function Name	Parameter Name	Param Type
blck_begin		
blck_append_stmt	p_blck p_stmt	frag_ref<blck> frag_ref<stmt>
blck_var_out_of_scope	p_blck p_var	frag_ref<blck> frag_ref<var>
blck_end	p_blck	frag_ref<blck>

10.1.3.3 Statement Generator Functions

These Generator Functions correspond directly to the Action Language Statements - some Action Language Statements may have more than one Generator Function because of differing variations in that statement.

TABLE 10.13 Statement Generator Functions

Generator Function Name	Parameter Name	Param Type
stmt_select_related_by	p_cardinality p_select_var p_is_implicit_decl p_chain	string (“ONE”, “ANY”, “MANY”) frag_ref<var> boolean frag_ref<chain>
stmt_select_from_instances_of	p_cardinality p_select_var p_is_implicit_decl p_obj_keyletters	string (“ANY”, “MANY”) frag_ref<var> boolean string
stmt_for	p_inst_ref_var p_is_implicit_decl p_inst_ref_set_var p_for_blck	frag_ref<var> boolean frag_ref<var> frag_ref<blck>
stmt_create_obj_inst_no_var	p_obj_keyletters	string
stmt_create_obj_inst	p_inst_ref_var p_is_implicit_decl p_obj_keyletters	frag_ref<var> boolean string
stmt_delete_obj_inst	p_inst_ref_var	frag_ref<var>
stmt_relate	p_inst_ref_1_var p_inst_ref_2_var p_Rnum p_rel_phrase	frag_ref<var> frag_ref<var> integer
stmt_relate_using	p_inst_ref_1_var p_inst_ref_2_var p_Rnum p_assoc_inst_ref_var p_rel_phrase	frag_ref<var> frag_ref<var> integer frag_ref<var>

TABLE 10.13 Statement Generator Functions

Generator Function Name	Parameter Name	Param Type
stmt_unrelate	p_inst_ref_1_var p_inst_ref_2_var p_Rnum p_rel_phrase	frag_ref<var> frag_ref<var> integer
stmt_unrelate_using	p_inst_ref_1_var p_inst_ref_2_var p_Rnum p_assoc_inst_ref_var p_rel_phrase	frag_ref<var> frag_ref<var> integer frag_ref<var>
stmt_generate_obj_inst	p_evt_label p_param p_inst_ref_var	string frag_ref<param> frag_ref<var>
stmt_generate_assigner	p_evt_label_str p_param p_obj_keyletters	string frag_ref<param> string
stmt_generate_creation	p_evt_label p_evt_frag p_obj_kl	
stmt_generate_ext_entity	p_evt_label p_param p_ext_entity_keyletters	string frag_ref<param> string
stmt_generate_ext_inst	p_evt_inst_var_frag	
stmt_create_evt_obj_inst	p_evt_inst_var p_is_implicit_decl p_evt_label p_param p_obj_inst_ref_var	string boolean string frag_ref<param> frag_ref<var>
stmt_assign_obj_attr	p_inst_ref_var p_attr_name p_expression_rval	frag_ref<var> string frag_ref<rval>

TABLE 10.13 Statement Generator Functions

Generator Function Name	Parameter Name	Param Type
stmt_assign_transient_var	p_transient_var p_is_implicit_decl p_expression_rval	frag_ref<var> boolean frag_ref<rval>
stmt_transform_void	p_obj_keyletters p_method_name p_param	string string frag_ref<param>
stmt_if	p_condition_rval p_if_blck	frag_ref<rval> frag_ref<blck>
stmt_else	p_else_blck	frag_ref<blck>
stmt_bridge_void	p_ext_entity_keyletters p_method_name p_param	string string frag_ref<param>

10.1.3.4 Rvalue Generator Functions

These Generator Functions are to handle expressions which contain calculations and tests.

TABLE 10.14 Rvalue Generator Functions

Generator Function Name	Parameter Name	Param Type
rval_literal_boolean	p_boolean_value	string (“TRUE”, “FALSE”)
rval_literal_integer	p_integer_value	string
rval_literal_real	p_real_value	string
rval_literal_string	p_string_value	string
rval_read_rcvd_evt_di	p_actn_obj_inst p_evt_di_name	inst_ref<SM_ACT> string
rval_read_obj_attr	p_inst_ref_var p_attr_name	frag_ref<var> string
rval_read_transient_var	p_transient_var	frag_ref<var>

TABLE 10.14 Rvalue Generator Functions

Generator Function Name	Parameter Name	Param Type
rval_transform	p_obj_keyletters p_method_name p_param	string string frag_ref<param>
rval_bridge	p_ext_entity_keyletters p_method_name p_param	string string frag_ref<param>
rval_unary_op	p_operator p_operand_rval	string frag_ref<rval>
rval_binary_op	p_left_operand_rval p_operator p_right_operand_rval	frag_ref<rval> string frag_ref<rval>

10.1.3.5 Instance Chain Generator Functions

These Generator Functions support conversion of the instance chains in select statements to source code.

TABLE 10.15 Instance Chain Generator Functions

Generator Function Name	Parameter Name	Param Type
chain_begin	p_cardinality p_begin_inst_ref_var	string (“ONE”, “ANY”, “MANY”) string
chain_add_link	p_chain p_obj_keyletters p_Rnum p_rel_phrase	frag_ref<chain> string integer string
chain_end	p_chain	frag_ref<chain>

10.1.3.6 Parameter List Generator Functions

TABLE 10.16 Parameter List Generator Functions

Generator Function Name	Parameter Name	Param Type
param_begin_evt_obj_inst	p_evt_label	string
param_begin_evt_assigner	p_evt_label	string
param_begin_evt_creation	p_evt_label	
param_begin_evt_ext_entity	p_evt_label	string
param_begin_transform	p_obj_keyletters p_method_name	string string
param_begin_bridge	p_ext_entity_keyletters p_method_name	string string
param_add	p_param p_param_name p_param_rval	frag_ref<param> string frag_ref<rval>
param_end	p_param	frag_ref<param>

10.1.3.7 Variable Generator Functions

TABLE 10.17 Variable Generator Functions

Generator Function Name	Parameter Name	Param Type
var_declare_self_obj_inst_ref	p_actn_obj_inst	inst_ref<SM_ACT>
var_declare_obj_inst_ref	p_var_name p_obj_keyletters	string string
var_declare_obj_inst_ref_set	p_var_name p_obj_keyletters	string string
var_declare_evt_inst	p_var_name p_obj_keyletters	string string
var_declare	p_var_name	string

10.2 Automation

10.2.1 Overview

Action Source Code is generated using a technique very similar to that used by a compiler to produce machine code from a high level language. However, one major difference exists: the last step of the Action Generation is done through a set of user-specified Fragment Generation Functions so that the user has complete control over the process of generation and therefore can generate source code in any Programming Language (C, C++, Smalltalk, Fortran, COBOL, Lisp, Assembler, 4GL...) and any Software Architecture.

Figure 10.2.1.1. Archetype Interpretation Architecture

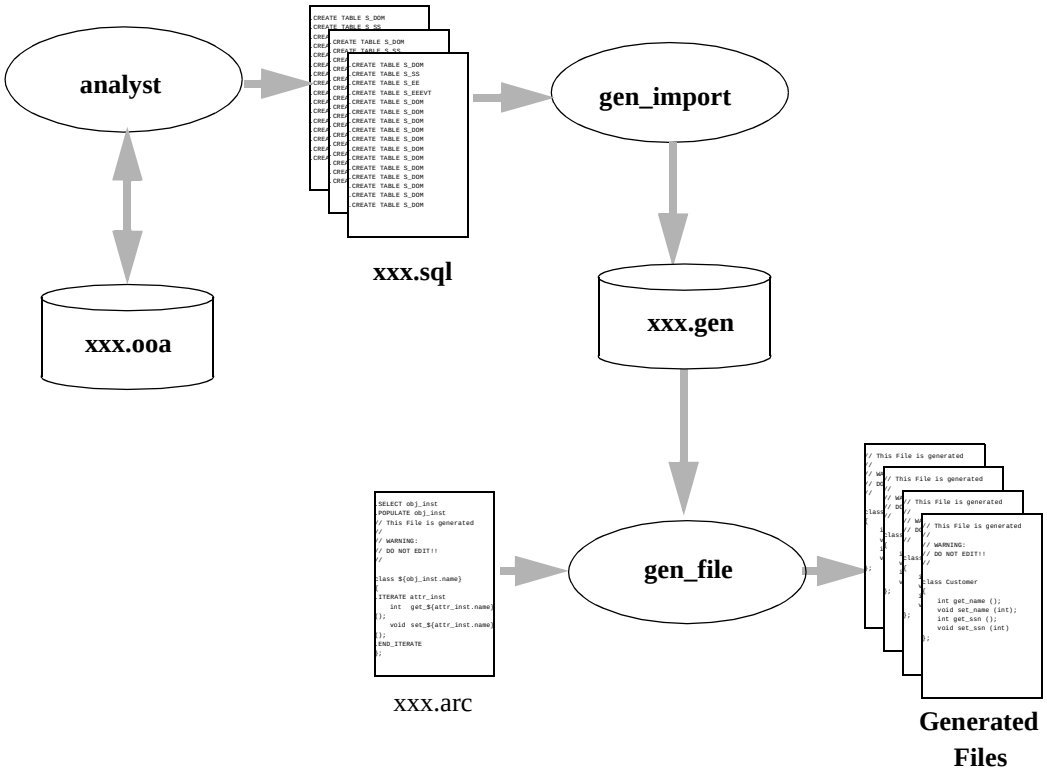


Figure 10.2.1.2. Action Source Code Generation.

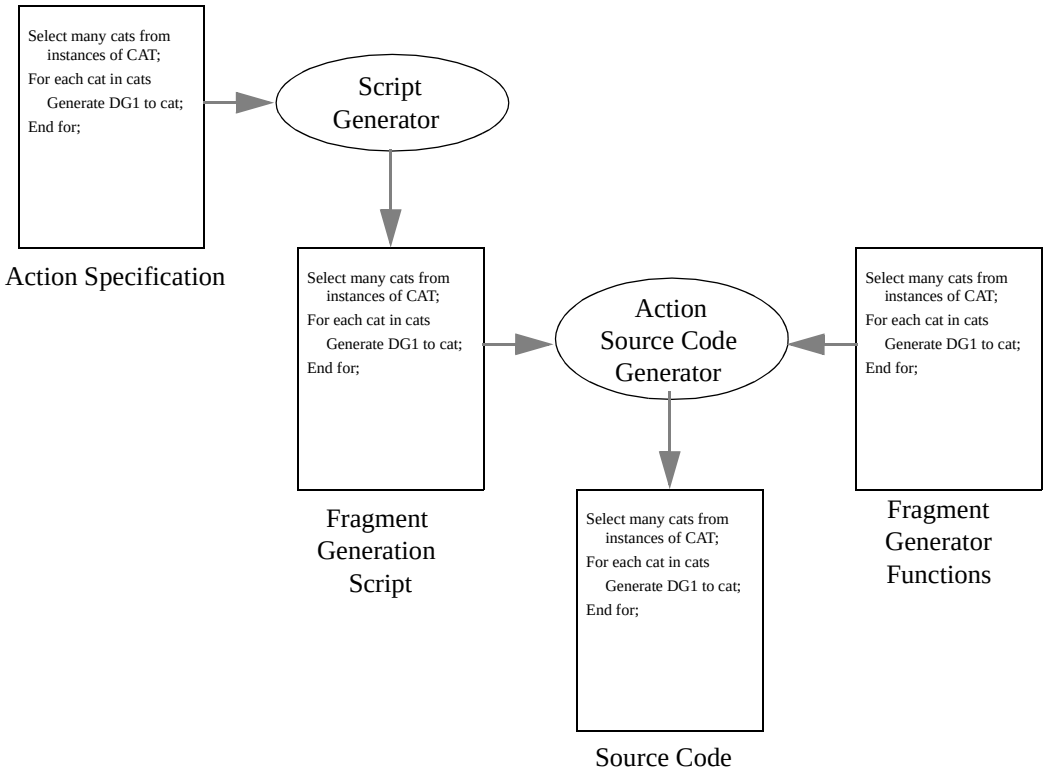


Figure 10.2.1.2 shows the steps involved in Action Generation

Figure 10.2.1.3. Action Generation Process

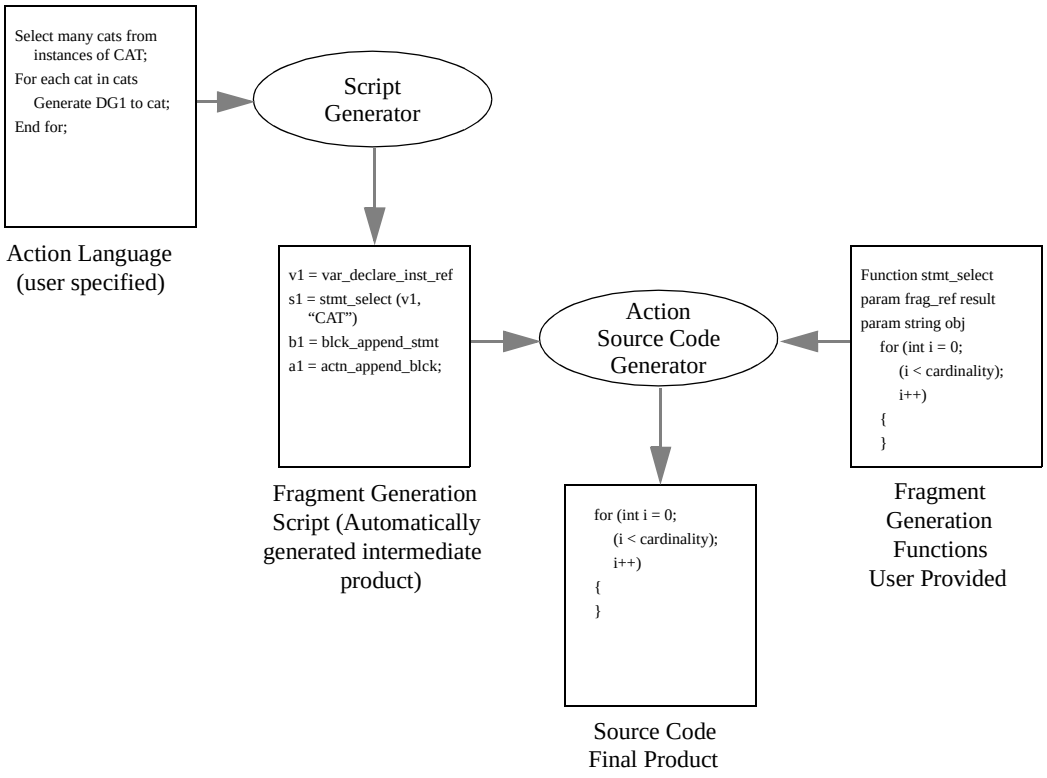


Figure 10.2.1.3 shows the Action Generation Process.

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