Solution Deployment Descriptor Specification 1.0

Committee Draft 4

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sdd-dd=http://docs.oasis-open.org/sdd/ns/deploymentDescriptor

Abstract:

This specification defines schema for two XML document types: *Package Descriptors* and *Deployment Descriptors*. Package Descriptors define characteristics of a package used to deploy a solution. Deployment Descriptors define characteristics of the content of a solution package, including the requirements that are relevant for creation, configuration and maintenance of the solution content. The semantics of the descriptors are fully defined, allowing software

implementations to precisely understand the intent of the descriptor authors and to use the information provided in the descriptors to support solution deployment.

Status:

This document was last revised or approved by the OASIS Solution Deployment Descriptor (SDD) Technical Committee on the above date. The level of approval is also listed above. Check the “Latest Version” or “Latest Approved Version” location noted above for possible later revisions of this document.

Technical Committee members should send comments on this specification to the Technical Committee’s email list. Others should send comments to the Technical Committee by using the “Send A Comment” button on the Technical Committee’s web page at http://www.oasis-open.org/committees/sdd/.

For information on whether any patents have been disclosed that may be essential to implementing this specification, and any offers of patent licensing terms, please refer to the Intellectual Property Rights section of the Technical Committee web page (http://www.oasis-open.org/committees/sdd/ipr.php.

The non-normative errata page for this specification is located at http://www.oasis-open.org/committees/sdd/.

Notices

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1 Introduction

The *Solution Deployment Descriptor* (SDD) specification defines a standard, in the form of a schema for XML documents, called *Solution Deployment Descriptors*, or *SDDs*. SDDs define metadata that describes the packaging and deployment characteristics of resources that are relevant for their lifecycle management, including creation, configuration and maintenance.

A.1 Terminology

The following terms are used in this specification in a specialized sense that might differ from definitions elsewhere.

Artifact

Zero or more files and/or metadata used to perform a *deployment lifecycle* operation on a *resource*.

Deployment lifecycle

The stages marking maturation of a *solution*: develop, package, integrate, manufacture, install, configure, evaluate, deploy into production, upgrade and/or update, uninstall.

Host Resource

A resource that provides the execution environment for another resource.

Package

A set of artifacts used to perform *deployment lifecycle* operations on a group of related resources that make up a solution.

Resource

A particular element of a computing environment, such as a computer system, an operating system, a Web server, a software application, or a complex *solution*.

Solution

One or more interrelated *resources* on which *deployment lifecycle* operations can be performed.

Target Resource

A resource that processes *artifacts* to perform *deployment lifecycle* operations on another resource. The *host resource* often serves as the target resource.

Topology

The physical or logical layout of a *solution's resources*.

Update (n.)

A *package* that replaces a limited set of the *resources* in a *solution* instance. An update does not require migration.

Upgrade (n.)

A *package* that replaces all, or a significant portion of, the *resources* used in a *solution*. An upgrade might or might not require migration.

1.1 Purpose

The purpose of this document is to provide the normative specification of the SDD, including concepts, structure, syntax, semantics and usage.

1.2 Scope

This document is the specification for the SDD. It consists of both normative and non-normative prose, diagrams, schema and examples. The document is intended to facilitate an understanding of the SDD concepts, structure, syntax, semantics and usage. This document is not intended to be a tutorial.

This document is the full SDD specification, but it also is augmented with other documents produced by the SDD TC, including the SDD XML Schema and Examples (see Appendix [A]), **[SDDP]**, **[SDDSP]** and the set of SDD profiles (see section [5.3]), as well as documents produced by others (see section [5.3.1]).

1.3 Audience

This document is intended to assist those who require an understanding of the nature and details of the SDD. This includes architects, developers, solution integrators and service/support personnel who generate, consume, or otherwise use SDDs, as well as those who develop tooling and applications for constructing and deploying SDDs.

1.4 How to Read this Document

The various audiences of this specification might have different objectives and purposes when reading the document. You might wish to generally understand the SDD, or learn the details of the SDD to create or consume SDDs, or use the document as a reference.

- If your purpose is to understand the major capabilities and characteristics of the SDD and how they fit together, start by reading the Introductions to the major sections: [3], [4] and [4.1]–[4.14].
- If your purpose is to understand the major elements of the SDD and how they work together to accomplish the goals of this specification, read in addition to the above, the introductions to each of the type sections [3.1]–[3.13] and the type subsections within sections [4.2]–[4.14].
- If your purpose is to understand the syntax of the SDD, look at the tables in each of the Property Summary sections.
- If your purpose is to understand the semantics of the elements and attributes of the SDD, read the Property Usage Notes sections.
- If your purpose is to understand only the package descriptor, subset the above suggestions to focus on the sub-sections within section [3].
- If your purpose is to understand only the deployment descriptor, subset the above suggestions to focus on the sub-sections within section [4].

1.5 Motivation

The motivation for producing this specification is best expressed in this excerpt from the SDD Technical Committee’s charter:

> *Deployment and lifecycle management of a set of interrelated software, hereinafter referred to as a solution, is a predominantly manual operation because there is currently no standardized way to express installation packaging for a multi-platform environment. Each hosting platform or operating system has its own format for expressing packaging of a single installable unit but, even on these homogeneous platforms, there is no standardized way to combine packages into a single aggregated unit without significant re-creation of the dependency and installation instructions. The problem is compounded when the solution is to be deployed across multiple, heterogeneous, platforms. A standard for describing the packaging and mechanism to express dependencies and various lifecycle management operations within the package would alleviate these problems and subsequently enable automation of these highly manual and error-prone tasks.*
>
> *The purpose of this Technical Committee is to define XML schema to describe the characteristics of an installable unit (IU) of software that are relevant for core aspects of its deployment, configuration and maintenance. This document will be referred to as the Solution Deployment Descriptor (SDD).*

SDDs will benefit member companies and the industry in general by providing a consistent model and semantics to address the needs of all aspects of the IT industry dealing with software deployment, configuration and lifecycle management. The benefits of this work include:

- *ability to describe software solution packages for both single and multi-platform heterogeneous environments.*
- *ability to describe software solution packages independent of the software installation technology or supplier.*
- *ability to provide information necessary to permit full lifecycle maintenance of software solutions.*

1.6 Requirements

A summary of requirements satisfied by this SDD specification follows. Detailed requirements that support approved use cases are available at the SDD TC Web page, http://www.oasis-open.org/committees/sdd.

Solution lifecycle management

The SDD must provide information to support the complete lifecycle of a software solution. Certain key requirements are applicable to all phases of deployment lifecycle operation: planning, installation, configuration, maintenance, upgrade, migration and uninstallation.

Solution requirements for environment to perform lifecycle management tasks

A deployment lifecycle operation on a target resource is often dependent on a certain set of conditions that must exist on the target. This set of pre-existing conditions is known as the *environment*. If successful deployment lifecycle operations are dependent on a certain set of pre-existing conditions (environment), then the SDD specification must support the ability to specify the required environment.

Projected changes to environment

The SDD specification must support the definition of environment changes that become effective once the lifecycle operation is complete.

Solution instance variability

The SDD specification must support the definition of the appropriate information for a runtime to vary the ways in which the solution can be deployed. This information is also needed to enable an integrator to control the variability according to the needs of their higher-level solution.

This variability includes the information to control (1) the subset of capability that can be deployed; (2) setting the initial configuration of the solution; and (3) varying the topology in which the solution can be deployed.

Solution composition

The SDD specification must support the ability for the author to compose solution packages from multiple components, products, or solutions.

Solution and packaging identity

The SDD specification must support the definition of identity information for the solution package, resources that make up the solution, and solution itself to support use cases including asset management, license management, support/update entitlement, component reuse during development, reports and queries from a package repository, identifying associated documentation, solution lifecycle management, traceability to build/development environment and problem management systems, correlation into the hosting environment, component reuse, and maintenance history. Also, the SDD specification must support the definition of the identity description information used by a runtime to assist a user in making correct decisions about solution installation. The SDD specification must support the definition of the information that uniquely identifies the SDD descriptor and the ability to identify the version of the SDD. The customer should be able to identify the solution packages with consistent names.

Physical packaging

Physical packaging information should be contained in a separate media descriptor. The deployment model for a solution should be decoupled from the details of physical packaging. The format and structure of the physical packaging is outside the scope of SDD v1.0.

Interoperability with existing software packaging technologies

The SDD specification must support the ability for the author to compose solutions from existing software packages that do not have an SDD. This means that the SDD should be able to describe existing software packages.

Conform to external standards

The SDD specification must provide for alternative descriptive text to be defined for any images, animations, or audio information contained in the descriptor.

Decision support

Requirements to perform lifecycle management operations within various target environments may not be satisfied in the target's current state but might be able to be satisfied with additional operations. For example, successful deployment of a set of Java™[1] components is dependent on the existence of a Java runtime environment that is not included with the solution. The SDD should have the ability to specify information that will assist lifecycle management tools in planning for, accessing and installing these external requirements.

Specification organization

The SDD specification must provide the semantic behavior expected by producers and consumers of SDDs. This information allows for the producers to ensure that the consumers of their SDDs will provide the support intended.

Solution metadata

The SDD metadata may not encompass all of the information about the solution in all contexts in which the solution can be deployed. Additional metadata that is outside of the scope of the SDD is available at the SDD TC Web page, http://www.oasis-open.org/committees/sdd.

Globalization

For all content in the SDD that would be displayed to a user, the specification must support the definition of strings for multiple locales; for example, this content must be localizable.

Align with other standards bodies

Satisfying all the requirements listed here calls for extensive standardization in specific areas. The requirements should thus be aligned with other appropriate standards bodies. The SDD reuses existing OASIS and other standards where appropriate and aligns with other standards bodies (for example, **[OGF-ACS]**) that are developing standards in the same domain as SDD.

[1] Java is a trademark or registered trademark of Sun Microsystems, Inc. in the United States and other countries.

1.7 XML Namespaces

The XML namespaces defined as part of this specification are:

- **sdd-pd**: stands for the package descriptor portion of the SDD namespace.
- **sdd-dd**: stands for the deployment descriptor portion of the SDD namespace.
- **sdd-common**: stands for the common (shared) types, elements and groups of the SDD namespace.

For XML namespaces not defined as part of this specification, conventional XML namespace prefixes are used as follows, regardless of whether a namespace declaration is present in the example:

- The prefix **xsd:** stands for the W3C XML Schema namespace **[XSD]**.
- The prefix **ds:** stands for the digital signature namespace **[XMLDSIG-CORE]**.

1.8 Notational Conventions

Everything in the specification, including the Appendices, is considered normative except for the abstract, examples and any sections or other material marked as non-normative.

The keywords “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY” and “OPTIONAL” in this document are to be interpreted as described in **[RFC2119]**.

These keywords are capitalized when used unambiguously to specify requirements or application features and behavior. When these words are not capitalized, they are meant in their natural-language sense.

1.9 General Document Conventions

In describing XML elements and attributes of the SDD schema, this document contains many cross-references. Such references appear as the referenced section number inside square brackets, for example, [4.5]. In electronic versions of this specification, the cross-references can act as links the target section.

The following property naming convention is used in the schema: Element and type names begin with an uppercase letter and attribute names begin with a lowercase letter.

Italics are used to identify element and attribute names, type names and enumerated values defined by an SDD type.

In describing the XML schema, each section typically contains the following subsections:

- A diagram illustrating the element, group, or type that is specified in the section.
- Property Summary: A table listing the schema elements and attributes, along with the data type, cardinality and description for each one.

  When specified, extension points are listed in the tables with no name and a type of `xsd:any` for element extensions and `xsd:anyAttribute` for attribute extensions. Cardinality is also provided.

  When a type is an extension of another type, the extended type is listed in the table with no name and prefixed with **[extends]**. The extended type’s properties can be referenced from the appropriate section listed in the description column.

  When the schema specifies a default or fixed attribute value, that value is prefixed with two asterisks, as in ****default value=“true”**.
- Property Usage Notes: A list of the elements and attributes, along with more detailed prose descriptions of the properties and how they fit into the schema as a whole.
- Not all sections contain every one of the preceding subsections.

1.10 Diagram Conventions

Sections 3 and 4 of this specification contain diagrams that illustrate the structure of elements, data types and groups used throughout the SDD schema. Figure 1 is an example of this type of diagram.

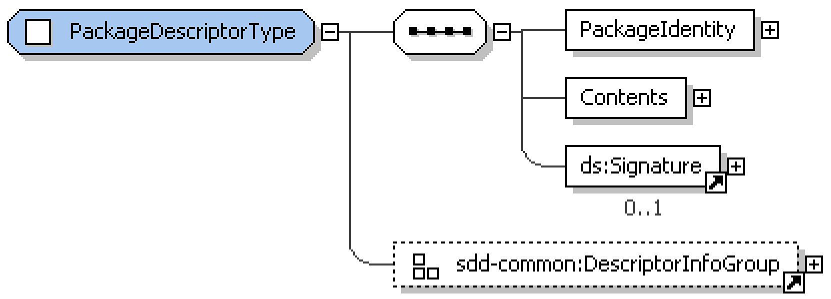
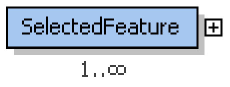


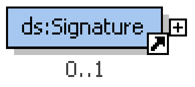
Figure 1: Sample XML structure diagram.

Elements are represented by the element name inside a rectangle. A rectangle with a solid border denotes an element.

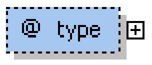
Where appropriate, the cardinality of an element is indicated by a rectangle with the cardinality listed underneath, using the form "*min*..*max*". For example, "1..∞" indicates a minimum of one occurrence of the element and an unbounded upper limit:



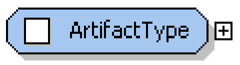
References to global elements are denoted by a small arrow in the lower right corner of the element's rectangle:



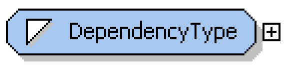
Attributes are denoted by a "@" symbol followed by the attribute name, inside a dashed rectangle.



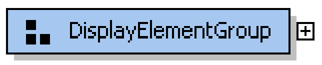
Complex types are denoted by a rectangle with all the corners truncated and a white square followed by the element name:



Simple types are denoted by a rectangle with all the corners truncated and a white triangle followed by the element name:

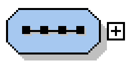
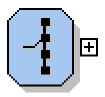


Groups are denoted by a rectangle with three small squares followed by the group name: black squares and a solid rectangle indicate element groups and white squares with a dashed rectangle indicate attribute groups:



A plus sign on the right border of a component indicates hidden child elements or attributes. When hidden, the child elements are usually described in a separate section.

There are two connectors (or compositors) used in the SDD schema diagrams to combine elements:

- A sequence of elements is indicated by the following symbol: 
- A choice among elements is indicated by the following symbol: 

A large yellow box indicates a data type that is referenced.

Blue shading appearing in a figure has no significance; it simply indicates that a component was currently selected in the XML editor.

The XSD schema figures were created with <oXygen/>.

1.11 Normative References

[CL2_Schema]	Solution Deployment Descriptor Schema See Appendix [A] for location.
[CONFORM]	OASIS, *OASIS Conformance Requirements for Specifications 1.0*, http://www.oasis-open.org/committees/download.php/305/conformance_requirements-v1.pdf.
[IANA-CHARSET]	Internet Assigned Numbers Authority, *Character Sets*, http://www.iana.org/assignments/character-sets, modified December 2006.
[IETF-UUID]	Internet Engineering Task Force Draft Specification, http://www.ietf.org/rfc/rfc4122.txt.
[ISO639.2]	Library of Congress, *Codes for the Representation of Names of Languages*, http://www.loc.gov/standards/iso639-2/englangn.html.
[ISO3166]	International Organization for Standardization, *English Country Names and Code Elements*, http://www.iso.ch/iso/en/prods-services/iso3166ma/02iso-3166-code-lists/list-en1.html.
[RFC2119]	S. Bradner, *Key words for use in RFCs to Indicate Requirement Levels*, http://www.ietf.org/rfc/rfc2119.txt, IETF RFC 2119, March 1997.
[RFC3066]	H. Alvestrand, ed. *RFC 3066: Tags for the Identification of Languages* 1995, http://www.ietf.org/rfc/rfc3066.txt.
[UNIT]	Bureau International des Poids et Mesures, http://www.bipm.fr.
[XMLDSIG-CORE]	Bartel et al., *XML-Signature Syntax and Processing*, http://www.w3.org/TR/xmldsig-core/, W3C Recommendation, February 2002.
[XSD]	W3C Schema Working Group, *XML Schema*, http://www.w3.org/TR/xmlschema-1/, W3C Recommendation, October 2004.

1.12 Non-Normative References

[CL1_Schema]	Solution Deployment Descriptor Conformance Level 1 Schema See Appendix [A] for location.
[CIM]	Distributed Management Task Force, Inc., Common Information Model (CIM) http://www.dmtf.org/standards/cim/.
[OGF-ACS]	Open Grid Forum, Application Contents Service WG (ACS-WG), http://www.ogf.org/gf/group_info/view.php?group=acs-wg.
[SDDP]	Solution Deployment Descriptor Primer http://docs.oasis-open.org/sdd/v1.0/sdd-primer-v1.0.doc http://docs.oasis-open.org/sdd/v1.0/sdd-primer-v1.0.pdf http://docs.oasis-open.org/sdd/v1.0/sdd-primer-v1.0.html
[SDDSP]	Solution Deployment Descriptor Starter Profile http://docs.oasis-open.org/sdd/v1.0/sdd-starter-profile-v1.0.doc http://docs.oasis-open.org/sdd/v1.0/sdd-starter-profile-v1.0.pdf http://docs.oasis-open.org/sdd/v1.0/sdd-starter-profile-v1.0.html

2 Solution Deployment Descriptor Overview

2.1 Package and Deployment Descriptors

The package descriptor defines package content which includes artifacts whose processing results in deployment of the software package. The deployment descriptor defines metadata associated with those artifacts. The SDD package descriptor defines the package identity, the package content and various other attributes of the package. Each SDD consists of exactly one deployment descriptor and one package descriptor. The deployment descriptor is where the topology, selectability, inputs, requirements and conditions of the deployment are described.

2.2 Topology

The SDD's topology describes all the resources that may be required, created or modified when any of the deployment operations supported by the SDD are performed.

Primary identifying characteristics of the resources can be defined in topology. The topology includes identification of hosts–hosted by relationships between resources. It is usual that only a subset of the resources described in topology will play a role in any particular deployment. This is determined by the selection of content elements for the particular deployment. The resources that are required, created or modified by the content elements in scope for the deployment are the ones that will participate in the deployment and so will be associated with resources in the deployment environment.

At deployment time, definitions of the resources that participate in that particular deployment are associated with actual resource instances in the deployment environment. The mechanism for associating resource definitions with resource instances is not defined by the SDD.

The only resource definitions in the SDD are in topology. All other mention of resources in the SDD are references to the resource definitions in the topology.

2.3 Content and Artifacts

Metadata throughout the deployment descriptor is associated with package content in the definition of atomic content elements. The atomic content elements are *InstallableUnit*, *ConfigurationUnit* and *LocalizationUnit*. These are the only content elements that define *Artifacts* elements.

Artifact elements identify an artifact file or set of files defined in package content whose processing will perform all or a portion of the deployment for a particular deployment lifecycle operation. Artifact elements define the inputs and outputs, substitution values and types associated with the artifact files. The content element's target resource, identified by *targetResourceRef*, processes the artifact files with the defined inputs to perform deployment operations. Examples of artifact types include zip files, rpm files and executable install files. Artifact types are not defined by this specification. The artifact types defined in the SDD need to be understood by software that processes the SDD. *Profiles* are used to communicate the artifact types that an implementation is capable of processing [5.3].

Composite content elements organize the content of an SDD but do not define artifacts used to deploy SDD content. There are three types of composite content elements: *CompositeInstallable*, *CompositeUnit* and *CompositeLocalizationUnit*.

CompositeInstallable is used any time that more than one content element is defined in support of one operation on the package; any time aggregation of SDDs is needed; or any time the package includes selectable content. *CompositeInstallable* is the root of a content hierarchy that supports a single deployment lifecycle operation. It can define a base content hierarchy, a localization content hierarchy and a selectable content hierarchy that includes selection criteria. One SDD can have more than one *CompositeInstallable*–each supporting a different operation.

CompositeUnit is used to organize content elements within the base or selectable content hierarchies. *CompositeUnits* can define *InstallableUnits*, *ConfigurationUnits*, *ContainedPackages* and other

CompositeUnits. Requirements, conditions and variables that are common to all content elements defined by the *CompositeUnit* can be defined in the *CompositeUnit* to avoid repetition. Within the selectable content hierarchy, a *CompositeUnit* can provide an efficient means for selection of a set of related content elements by a *feature.*

CompositeLocalizationUnit serves the same purposes as *CompositeUnit* within the *LocalizatonContent* hierarchy.

SDD packages can aggregate other SDD packages. Metadata about the aggregation is defined in *ContainedPackage*, *ContainedLocalizationPackage* and *Requisite* elements. *ContainedPackage* elements are a content element that can be defined anywhere in the base and selectable content hierarchies. *ContainedLocalizationPackages* are content elements that can be defined in the localization content hierarchy. *Requisites* are packages that can be deployed, if necessary, to satisfy requirements in the aggregating SDD. They are not content of the SDD package. The type of all three of these elements is *ReferencedPackageType*. The term “referenced package” is used in this specification when referring to these elements as a group. The term “referenced SDD” is used when referring to any aggregated SDD.

Each referenced package element can further constrain the deployment of the referenced SDD by defining additional requirements; by mapping resources defined in the aggregating SDD to those defined in the referenced SDD; and by determining feature selections for deployment of the referenced SDD.

2.4 Resulting and Changed Resources

Deployment of an SDD package creates or modifies software resources. These resources are included in the topology definition and described in more detail in *ResultingResource* and *ResultingChange* elements.

The SDD author can choose to model resulting and modified resources at a very granular level, at a very coarse level; at any level in between, or not at all. An example of modeling resulting resources at a granular level would be modeling every file created by the deployment as a resulting resource. An example of modeling resulting resources at a very coarse level would be modeling the software product created by deployment as a single resulting resource. The choice depends on the needs of the solution deployment. If a resource is not modeled in the SDD, no requirements can be expressed on it, no conditions can be based on it and no variables can be set from values of its properties. It cannot play any of the roles described for resources in the *ResourceType* section of this document [4.2.2].

2.5 Base, Selectable and Localization Content Hierarchies

Each *CompositeInstallable* element can define three types of content hierarchies. Base content is the default content for the deployment lifecycle operation associated with the *CompositeInstallable*. This is content that will be deployed whenever the associated operation is performed on the SDD package. Base content may be conditioned on characteristics of the deployment environment but it is not selectable by the deployer.

The SDD author can define selectable subsets of optional content in the selectable content hierarchy. The selection criteria include features and groups of features that select content from the selectable content hierarchy. Selectability, as used in the SDD, is a characteristic of the deployment lifecycle operation and the package. For example, the decision to provide selectability for one operation in one package has no semantic relationship to the selectability provided in another package related to the same software. It also has no semantic relationship to the selectability provided for a different operation within the same package.

Localization content is the third type of content hierarchy. Localization refers to enabling a particular piece of software for support for one or more languages. Anything that needs to be deployed to provide support for a particular language in that software is considered localization content. Translated materials are a primary, but not the only, example of localization content.

Localization content is similar in many ways to other content, but there are important differences in how localization content is selected for deployment that lead to the need for a separate content hierarchy and separate types. There are two criteria for determining that localization content is in scope for a particular deployment.

- The first criterion has to do with the language or languages supported by the localization content. At least one of the languages must be in scope for the content to be selected.
- The second criterion has to do with the availability of the resources to be localized–the localization base. The localization base may be a resource deployed by base or selectable content, or it may be a resource previously deployed and found in the deployment environment.

2.6 Constraints

The SDD author needs to communicate constraints on resources for a variety of purposes.

- Some constraints must be met for the requirements of a content element to be met.
- Other constraints must be met for a resource to serve as the required base for an update.
- Still others must be met to satisfy a condition that determines the applicability of a content element or completion action.

The Constraint types are:

- *CapacityConstraint*
- *ConsumptionConstraint*
- *PropertyConstraint*
- *VersionConstraint*
- *UniquenessConstraint*
- *RelationshipConstraint*

2.7 Requirements

Requirements are defined by content elements. A requirement consists of resource constraints that the SDD author states MUST be met prior to successful deployment or use of the software described by the SDD package. Each requirement definition lists one or more deployment lifecycle operations to which the requirement applies. When the requirement is specified in an atomic content element, the operation associates the requirement with artifacts within the atomic content element

When a requirement can be satisfied in more than one way, alternatives can be defined within a requirement. A requirement is considered met when any one of the alternatives is satisfied.

2.8 Conditions

Conditions are expressed on characteristics of resources in the deployment environment. Conditions are used to indicate when particular elements of the SDD are applicable, or when they should be ignored. Conditions are not requirements. Failure to satisfy a condition does not indicate a failure; it simply means the conditioned element should be ignored. Conditions are used to:

- determine if a content element is applicable
- choose from among values for a variable
- determine when a feature is applicable
- determine when a particular result is applicable
- determine if a particular completion action is necessary.

Because conditions are always based on the characteristics of resources, they are expressed using resource constraints.

2.9 Variables

Variables provide a way to associate user inputs, resource property values, fixed strings and values derived from these with input arguments for artifacts and with constraints on resources.

3 Package Descriptor

A package descriptor is an XML document that provides information about the identity and the contents of a software package. A software package is a bundle of one or several content elements that deploy or remove computer software; add features to existing software; or apply maintenance to existing software. Each package descriptor is associated with a deployment descriptor.

3.1 PackageDescriptor

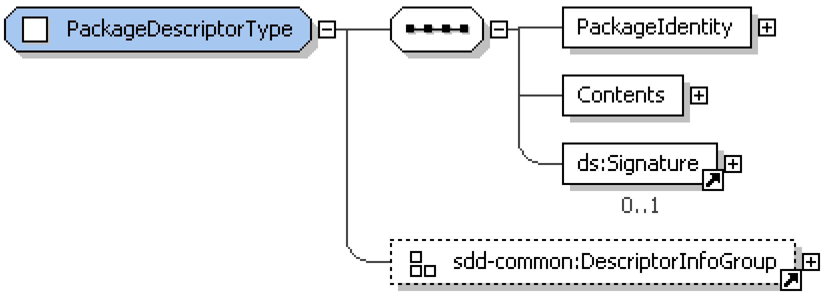


Figure 2: PackageDescriptor structure.

The root element of a package descriptor XML document is *PackageDescriptor*. *PackageDescriptor* includes elements that describe the package identity and the contents that make up the package. The *PackageDescriptor* includes the associated deployment descriptor XML document by defining a *Content* element with a *purpose* attribute set to *deploymentDescriptor*.

3.1.1 PackageDescriptor Property Summary

Name	Data Type	*	Description
PackageIdentity	PackageIdentityType	1	Human-understandable identity information for the software package.
Contents	ContentsType	1	A list of package contents.
ds:Signature	ds:SignatureType	0..1	A signature for the package descriptor.
schemaVersion	xsd:string	1	The descriptor complies with this version of the Solution Deployment Descriptor Specification. **fixed value="1.0"
descriptorID	UUIDType	1	Identifier of a particular package's descriptor.
lastModified	xsd:dateTime	1	The time the descriptor was last modified.
descriptorLanguageBundle	xsd:token	0..1	The root name of language bundle files containing translations for display text elements in the PackageDescriptor.
	xsd:anyAttribute	0..*	

3.1.2 PackageDescriptor Property Usage Notes

- **PackageIdentity**: The *PackageIdentity* element provides identity information about the software package that can be used by the consumer of the package for deployment planning or aggregation of the package into a larger solution.

  See the *PackageIdentityType* section for structure and additional usage details [3.3].

- **Contents**: The *Contents* element defines a list of one or more *Content* elements describing all the files that are part of the package. All files in the package MUST be defined in *Contents*.

  See the *ContentsType* section for structure and additional usage details [3.11].
- **ds:Signature**: The package descriptor and each file in the package MAY be digitally signed. It is RECOMMENDED that they be digitally signed by using an XML-Signature **[XMLDSIG-CORE]**.

  The signature element is an enveloped signature over the SDD package. Note that each *Content* element included in the package is digitally signed indirectly via this digest. Files can also be individually signed in the *Content* element.
- **schemaVersion**, **descriptorID**, **lastModified**, **descriptorLanguageBundle**: See the *DescriptorInfoGroup* section for structure and additional usage details [3.2].

3.2 DescriptorInfoGroup

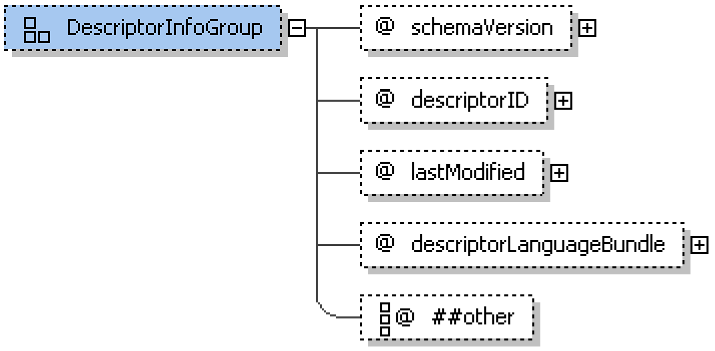


Figure 3: DescriptorInfoGroup structure.

The attributes defined by *DescriptorInfoGroup* are included in both *PackageDescriptor* and *DeploymentDescriptor*.

3.2.1 DescriptorInfoGroup Property Usage Notes

- **schemaVersion**: The *schemaVersion* attribute identifies the Solution Deployment Descriptor specification version to which the descriptor conforms. It MUST have a fixed value of “1.0”.
- **descriptorID**: The *descriptorID* attribute, combined with the *lastModified* attribute value, provides a unique identifier for the descriptor. The *descriptorID* value MUST be unique within the scope of use of the deployment descriptor or package descriptor. The *descriptorID* attribute is an instance of *UUIDType*, which is based on `xsd:hexBinary` with length 16. This enables use of a 128-bit UUID **[IETF-UUID]**. The *descriptorID* value supports descriptor updates by allowing updated descriptors to be correctly associated with an earlier version of the same descriptor.

  For example, if a descriptor contains errors, it may be replaced by an error-free version using the same *descriptorID* value but a different *lastModified* value.
- **lastModified**: The *lastModified* value can be used to differentiate between different versions of the same descriptor, for example, the descriptor for one particular package. Comparison of *lastModified* values can be used to determine which descriptor is newer.

  The *lastModified* attribute MUST be defined as a value that conforms to the `xsd:dateTime` type as defined in **[XSD]** and MUST match the following lexical representation: `[-]CCYY-MM-DDThh:mm:ss[Z|(+|-)hh:mm]`. This is a combination of a complete date and time of day, where the time zone can be specified as Z (UTC) or (+|-)hh:mm.

  For example, the following are valid values for the *lastModified* attribute:

  - 2001-10-26T21:32:52
  - 2001-10-26T21:32:52+02:00
  - 2001-10-26T19:32:52Z

    - 2001-10-26T19:32:52+00:00
    - -2001-10-26T21:32:52
    - 2001-10-26T21:32:52.12679

  However, the following values would be invalid:

    - 2001-10-26
    - 2001-10-26T21:32
    - 01-10-26T21:32
    - 2001-10-26T25:32:52+02:00

  The first three invalid examples do not specify all the required parts, and the fourth includes an out of range hours part, “25”.

- **descriptorLanguageBundle**: Language translations for elements of *DisplayTextType* in the descriptor MAY be included in the solution package. Note that these are not translations for the software deployed by the package, but rather translations only for the text in the descriptors themselves. The root name of the files containing these translations can be specified in the *descriptorLanguageBundle* attribute, which is an instance of `xsd:token`. Language bundles are associated with specific locales at run time using Java-style resource bundle resolution; that is, the bundle file names SHOULD take the form *languageBundle_locale*, where *locale* consists of optional language, location (country) and variant codes, separated by an underscore character. Language codes consist of two lowercase letters **[ISO639.2]** and location codes consist of two uppercase letters **[ISO3166]**.

  For example, “SampleStrings_en_US” refers to the United States English version of the SampleStrings bundle and “SampleStrings_ja” identifies the Japanese version of the same bundle.

  See the *DisplayTextType* section for structure and additional usage details [4.14.3].

3.3 PackageIdentityType

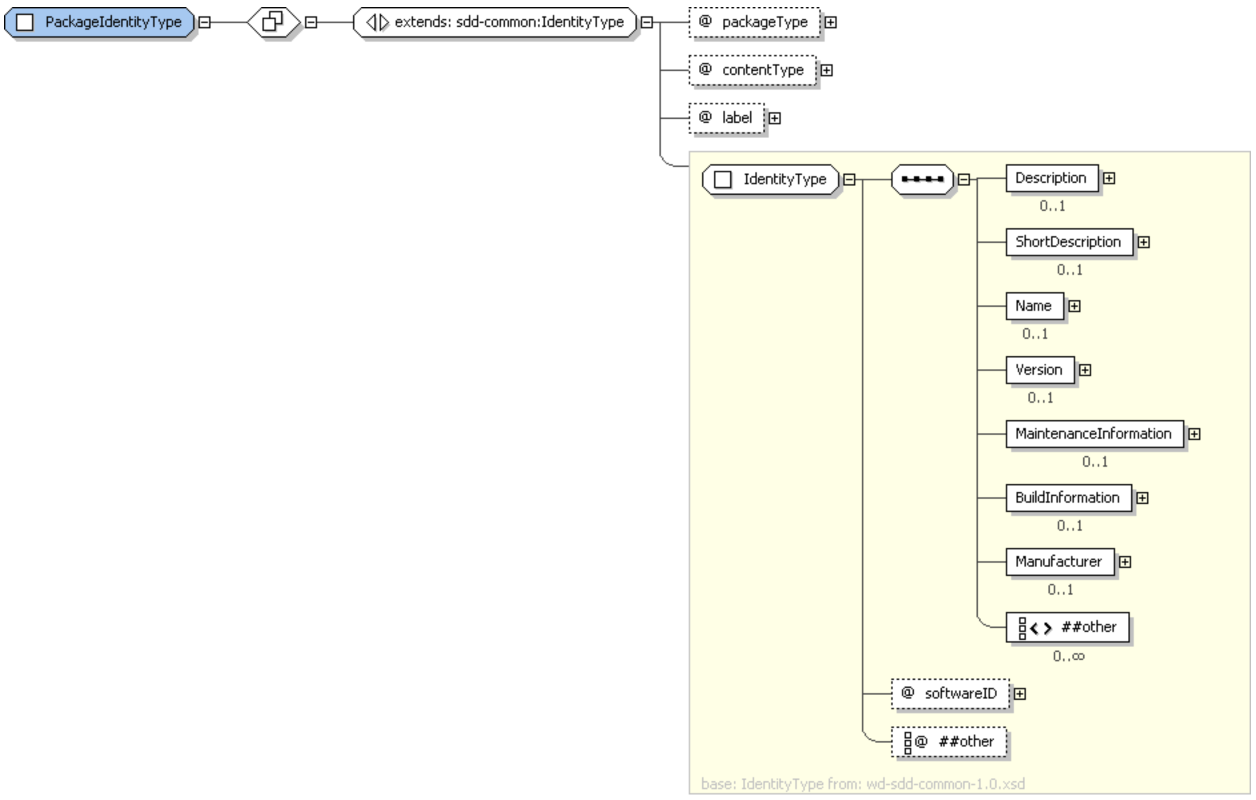


Figure 4: PackageIdentityType structure.

The software package described by the SDD can be identified for humans and package management software using the properties in *PackageIdentity*. The *PackageIdentity* is not to be confused with the identity of the deployed software, which is described in the resulting resource elements of the deployment descriptor; see the *ResultingResourceType* section [4.8.1].

3.3.1 PackageIdentityType Property Summary

Name	Data Type	*	Description
	[extends] IdentityType		See the IdentityType section for additional properties [3.4].
packageType	PackageTypeType	0..1	The type of the package, for example, “baseInstall” or “maintenance”. **default value=“baseInstall”.
contentType	xsd:QName	0..1	The type of content provided by this package, for example, BIOS.
label	xsd:NCName	0..1	A programmatic label for this package.
	xsd:anyAttribute	0..*	

3.3.2 PackageIdentityType Property Usage Notes

See the *IdentityType* section for details of the inherited attributes and elements [3.4].

- **packageType**: The package type is provided to aid consumer understanding of the type of content contained in the package. A package can contain more than one type of content. In this case, a single *packageType* value should be selected that represents the primary content type as determined by the SDD author. The SDD defines a set of enumeration values in *PackageTypeType* which are extendable by the SDD author.

The enumerated types defined by the SDD are as follows:

- **baseInstall**: The value *baseInstall* indicates that the package provides a complete installation of the solution. This package type is associated with deployment descriptors that contain installable units with installation artifacts that install the primary solution resources.

  When *packageType* is not specified, this is the default value.

- **baseUninstall**: The value *baseUninstall* indicates that the package provides a complete uninstallation of the solution. This package type is associated with deployment descriptors that contain installable units with uninstall artifacts that remove the primary solution resources.
- **configuration**: The value *configuration* indicates that the package configures the solution. This package type is associated with deployment descriptors that contain configuration units with configuration artifacts that configure the solution.
- **maintenance**: The value *maintenance* indicates that the package fixes one or more problems in the solution. This package type is associated with deployment descriptors that contain installable units with update artifacts.
- **modification**: The value *modification* indicates that the package modifies the function of the solution in some way such as by adding new function. This package type is associated with deployment descriptors that contain installable units with update artifacts.
- **replacement**: The value *replacement* indicates that the package installs a solution that replaces a previous version of the solution. Replacement MAY be associated with migration of data into the new solution and/or with deletion of the replaced solution. When associated with migration of data, installation or configuration artifacts within the solution package would perform the migration. When associated with deletion of the replaced solution, uninstall artifacts within the solution package would perform the deletion. This package type is associated with deployment descriptors that contain installable units with installation artifacts that deploy a set of resources that replace the set of resources associated with a previous version of the solution.
- **localization**: The value *localization* indicates that the package contains materials that localize deployed software for one or more languages.

▪ **contentType**: The value of *contentType* is determined by the SDD manufacturer to communicate a characteristic of the package that MAY be used in the manufacturer’s package management system or other manufacturer-specific tools that use the SDD. The SDD author chooses the values; they are not defined in this specification.

▪ **label**: The label MAY be used as an index in a package management system. The SDD author chooses the values; they are not defined in this specification.

3.4 IdentityType

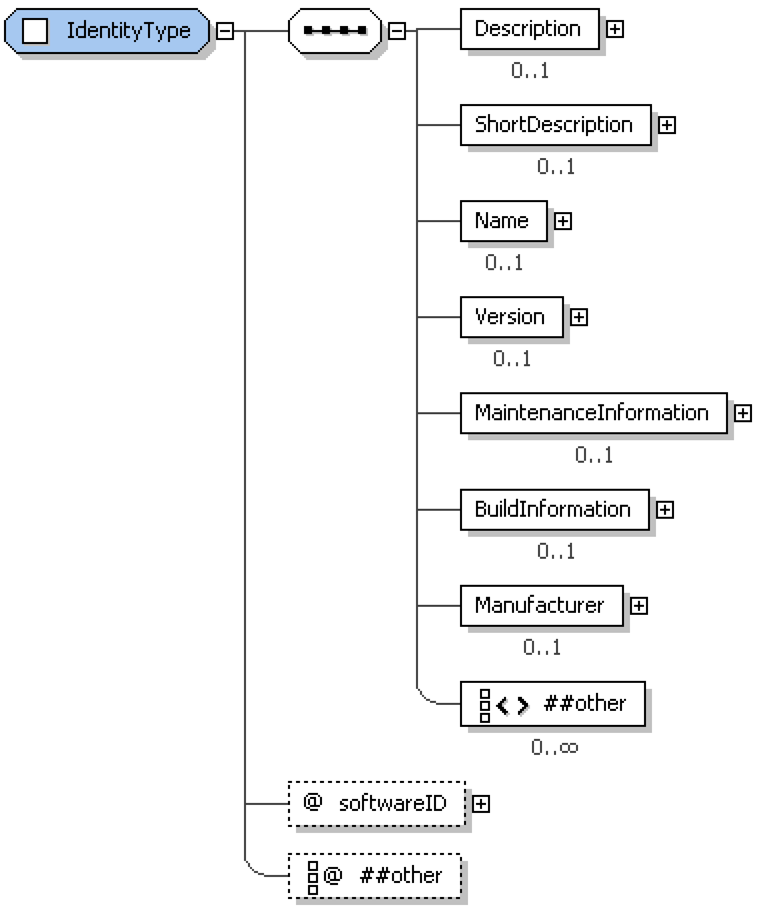


Figure 5: IdentityType structure.

This complex type provides identity information for the package as a whole, as well as for content elements, which are portions of the package. Content elements are the *InstallableUnit, LocalizationUnit, ConfigurationUnit, CompositeUnit* and *CompositeInstallable* elements defined in the deployment descriptor.

3.4.1 IdentityType Property Summary

Name	Data Type	*	Description
Description	DisplayTextType	0..1	A verbose description of the package or content element.
ShortDescription	DisplayTextType	0..1	A limited description of the package or content element.
Name	DisplayTextType	0..1	A human-readable, translatable, name for the package or content element.
Version	VersionType	0..1	The package or content element version.
MaintenanceInformation	MaintenanceInformationType	0..1	Information about package or content element content used when the package contains maintenance.
BuildInformation	BuildInformationType	0..1	A manufacturer identifier for the build of this package or content element. This property can be extended with additional manufacturer-specific information about the build.

Manufacturer	ManufacturerType	0..1	Information about the manufacturer of the package or content element.
	xsd:any	0..*	
softwareID	xsd:string	0..1	A manufacturer's identification number for the software created or updated by the package or content element.
	xsd:anyAttribute	0..*	

3.4.2 IdentityType Property Usage Notes

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the package.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayTextType* section for structure and additional usage details [4.14.3].

- **Name**: When the manufacturer of the SDD has a package management system, *Name* in *PackageIdentity* should correspond to the name of the package as known in the package management system. *Name* in a content element's *Identity* should correspond to the name of the unit of packaging, if it is known in the package management system.

  When the *PackageIdentity* element is defined, *Name* MUST be defined.

  Software packages that create software often have the same name as the deployed software. Software packages that update software often have a name that reflects the fact that the package is a maintenance package, differentiating it from the base deployed software. The author of the software package that is described by *PackageIdentity* determines whether the *Name* is the same as or different from the *Name* of the deployed software.

  See the *DisplayTextType* section for structure and additional usage details [4.14.3].

- **Version**: This is a packaging version. In *PackageIdentity*, it is the version of the package as a whole. In content element identities, this is the version of the unit of packaging represented by the content element. In either case, the SDD author MAY choose to make this version correspond to the version of a resulting or changed resource, but it should not be confused with resource versions.

  In the case of a base install, version MAY be the same as the top level resulting resource. In the case of a configuration package, version SHOULD NOT be the same as the top level resulting resource.

  See the *VersionType* section for structure and additional usage details [3.10].

- **MaintenanceInformation**: This is used when the package or content element describes the deployment of maintenance.

  See the *MaintenanceInformationType* section for structure and additional usage details [3.5].

- **BuildInformation**: In *PackageIdentity*, this describes the build of the package as a whole. In content element *Identity*, this describes the build of the artifact(s) and the content element describing the artifact.

  See the *BuildInformationType* section for structure and additional usage details [3.7].

- **Manufacturer**: See the *ManufacturerType* section for structure and additional usage details [3.8].

- **softwareID**: The software identified by *softwareID* is the software whose deployment is described by the SDD. When the manufacturer maintains software identifiers within a sales and distribution system, the *softwareID* SHOULD correspond to an identifier for the software within that system. If a format for software identifiers is not pre-existing within the manufacturer's systems, a UUID SHOULD be used for *softwareID*. When a UUID is used, it MUST be unique within the domain in which the described software is used.

3.5 MaintenanceInformationType

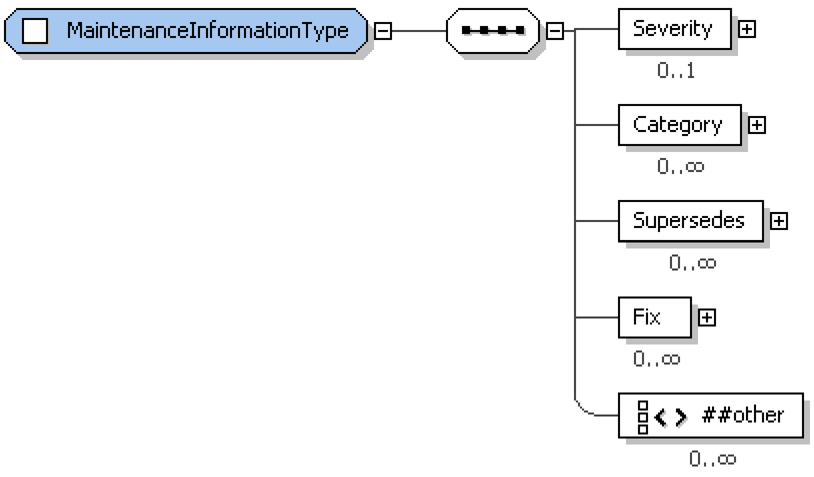


Figure 6: MaintenanceInformationType structure.

If the package provides maintenance for deployed software, *MaintenanceInformation* declares information about the fix or fixes provided. If the package content is a single fix, *MaintenanceInformation* describes the information about that one fix. If the content is a collection of fixes—for example, a fix pack—*MaintenanceInformation* describes each of the fixes provided by the fix pack.

3.5.1 MaintenanceInformationType Property Summary

Name	Data Type	*	Description
Severity	DisplayTextType	0..1	Severity of the maintenance content.
Category	DisplayTextType	0..*	Category of the maintenance content.
Supersedes	MaintenanceInformationType	0..*	A previously released fix that is superseded by application of this maintenance.
Fix	FixIdentityType	0..*	An included fix.
	xsd:any	0..*	

3.5.2 MaintenanceInformationType Property Usage Notes

- **Severity**: This value SHOULD correspond to a severity value used within the SDD provider's support system. It serves as a hint to the deployer about the urgency of applying the described maintenance.

  See the *DisplayTextType* section for structure and additional usage details [4.14.3].
- **Category**: These values SHOULD correspond to maintenance categories within the SDD provider's support system.

  See the *DisplayTextType* section for structure and additional usage details [4.14.3].
- **Supersedes**: Superseded fixes are ones that fix a problem also fixed by the superseding maintenance package or content element and therefore need not be applied.

  This element does not indicate whether or not the superseded fix needs to be removed. To indicate that the previous fix must be removed before the superseding maintenance can be applied successfully; the SDD author can create a requirement stating that the fix must not be present.

  Superseded fixes MAY include all the information defined in *MaintenanceInformationType*. At a minimum, a superseded fix MUST include at least one *Fix* element with the name of the superseded fix defined.
- **Fix**: *Fix* elements provide information about individual fixes provided by the maintenance content.

See the *FixIdentityType* section for structure and additional usage details [3.6].

3.6 FixIdentityType

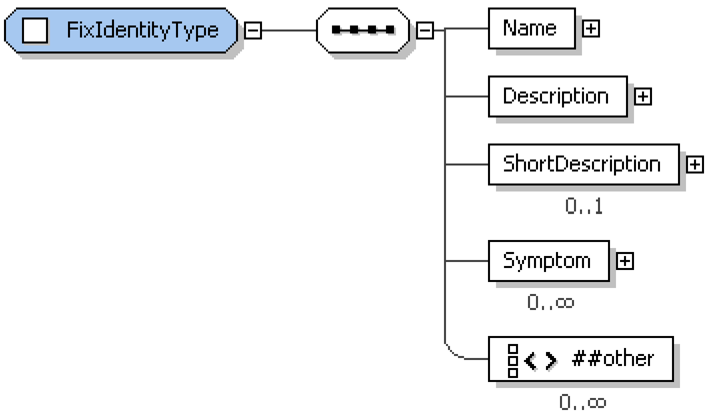


Figure 7: FixIdentityType structure.

Elements of *FixIdentityType* describe fixes that will be applied when the package is deployed or the content element is applied.

3.6.1 FixIdentityType Property Summary

Name	Type	*	Description
Name	xsd:NMTOKEN	1	A name for the fix which is, at a minimum, unique within the scope of the resource fixed.
Description	DisplayTextType	1	A complete description of the fix.
ShortDescription	DisplayTextType	0..1	An abbreviated description of the fix.
Symptom	DisplayTextType	0..*	A symptom of the problem fixed.
	xsd:any	0..*	

3.6.2 FixIdentityType Property Usage Notes

- **Name**: The *Name* element MUST provide a value that uniquely identifies a fix within a scope defined by the manufacturer. This is a name provided by the manufacturer that corresponds to the fix name as understood in the deployment environment.
- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the fix.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayTextType* section for structure and additional usage details [4.14.3].
- **Symptom**: Symptom strings can be used to correlate a fix with one or more experienced problems.

  See the *DisplayTextType* section for structure and additional usage details [4.14.3].

3.7 BuildInformationType

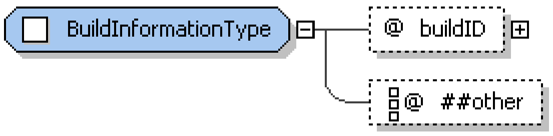


Figure 8: BuildInformationType structure.

BuildInformationType provides the type definition for the *BuildInformation* element in package and content element identity. *BuildInformation* provides information about the creation of the package and its parts.

3.7.1 BuildInformationType Property Summary

Name	Type	*	Description
buildID	xsd:token	1	Identifies the build of the package or package element.
	xsd:anyAttribute	0..*	

3.7.2 BuildInformationType Property Usage Notes

- **buildID**: The *buildID* attribute is an identifier provided by the manufacturer and meaningful to developers that can be used to identify a build of the defining element. This information MUST correspond with information known in the manufacturer's build environment. It is traditionally used during problem determination to allow maintainers of the software to determine the specifics of package creation. Inclusion of *buildID* in the SDD allows the end user to provide this information to package maintainers, enabling them to correlate the deployed software with a particular known build of the software.

3.8 ManufacturerType

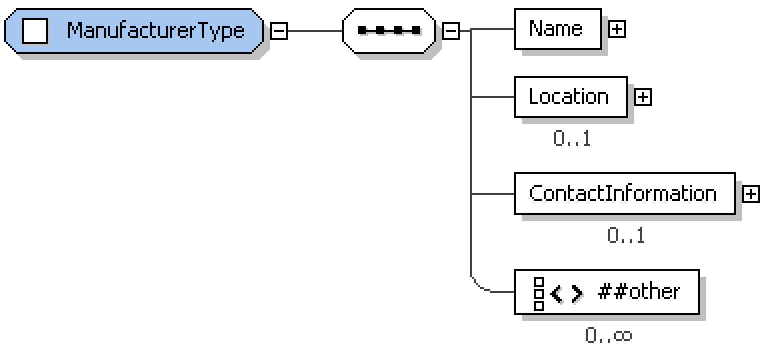


Figure 9: ManufacturerType structure.

The SDD author can include information about the package manufacturer that includes name, location and contact information such as the address of the manufacturer's Web site or telephone number.

3.8.1 ManufacturerType Property Summary

Name	Type	*	Description
Name	DisplayTextType	1	A translatable name for the manufacturer.
Location	LocationType	0..1	The address and country of the manufacturer.
ContactInformation	DisplayTextType	0..1	Contact information for the manufacturer.
	xsd:any	0..*	

3.8.2 ManufacturerType Property Usage Notes

- **Name**: The value provided in the *Name* element MUST be an identifiable name of the manufacturer of the SDD.

  See the *DisplayTextType* section for structure and additional usage details [4.14.3].
- **Location**: See the *LocationType* section for structure and additional usage details [3.9].

- **ContactInformation**: This element MAY provide additional contact information for the named manufacturer, such as a support Web site address or a technical support telephone number.

  See the *DisplayTextType* section for structure and additional usage details [4.14.3].

3.9 LocationType

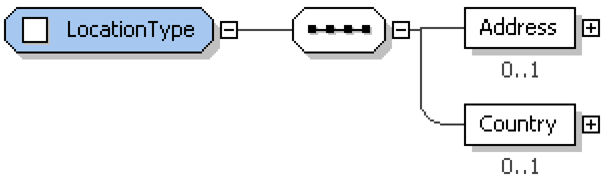


Figure 10: LocationType structure.

LocationType supports inclusion of the manufacturer's address and country in package and content element identity.

3.9.1 LocationType Property Summary

Name	Type	*	Description
Address	DisplayTextType	0..1	The manufacturer's address.
Country	DisplayTextType	0..1	The manufacturer's country.

3.9.2 LocationType Property Usage Notes

- **Address:** This is the mailing address or the physical address.

  See the *DisplayTextType* section for structure and additional usage details [4.14.3].

- **Country:** Recording the manufacturer's country in the SDD provides information that may be of interest in relation to import and export of software.

  See the *DisplayTextType* section for structure and additional usage details [4.14.3].

3.10 VersionType

VersionType provides the type definition for version elements in the package descriptor and deployment descriptor. It is a simple type that is based on `xsd:string` with no further restrictions. This means that versions in the SDD are represented simply as strings. Because resource versions exist in the deployment environment, their formats and semantics vary widely. For this reason, the format and semantics of versions are not defined by this specification.

3.11 ContentsType

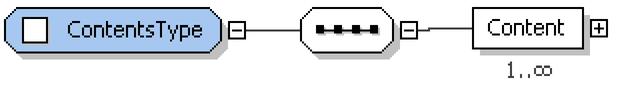


Figure 11: Contents structure.

ContentsType is used in *PackageDescriptor* to provide a list of one or more *Content* elements.

3.11.1 ContentsType Property Summary

Name	Type	*	Description
Content	ContentType	1..*	Describes the physical contents of the software package.

3.11.2 ContentsType Property Usage Notes

- **Content:** A *PackageDescriptor* MUST contain a *Contents* element that is a list of one or more *Content* elements.

  See the *ContentType* section for structure and additional usage details [3.12].

3.12 ContentType

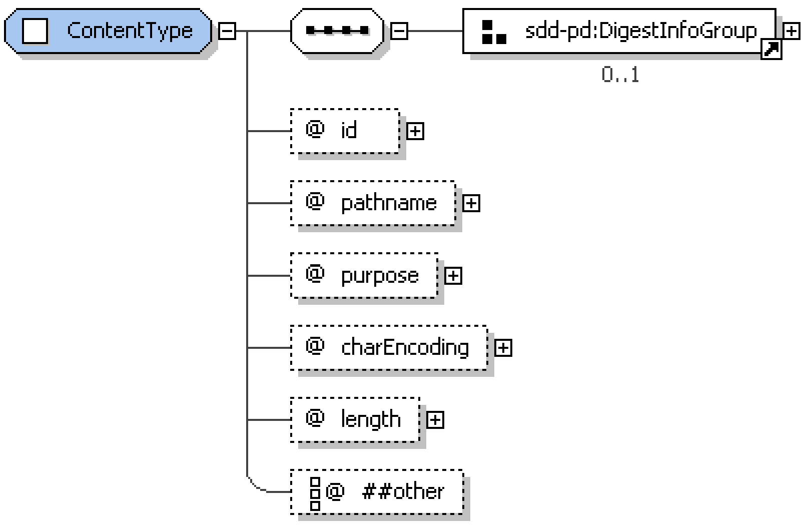


Figure 12: ContentType structure.

A software package includes one or more content files. *ContentType* defines the properties of a content file included in the package descriptor. Content defined in the package descriptor as part of the software package does not need to be physically co-located. Each element MUST be in a location that can be identified by a URI. The *pathname* attribute of each content file defines a URI for accessing the file. Characteristics of the content files—such as their length, purpose and character encoding—MAY be declared in the package descriptor.

3.12.1 ContentType Property Summary

Name	Data Type	*	Description
ds:DigestMethod	ds:DigestMethodType	0..1	Specifies the digest method applied to the file.
ds:DigestValue	ds:DigestValueType	0..1	Specifies the Base64-encoded value of the digest of the file.
id	xsd:ID	1	An identifier used in deployment descriptors to refer to the file definition in the associated package descriptor.
pathname	xsd:anyURI	1	The absolute or relative path of the content file including the file name.
purpose	ContentPurposeType	0..1	Associates a purpose classification with a file. **default value="content"
charEncoding	xsd:string	0..1	Specifies the character encoding of the contents of the file.
length	xsd:nonNegativeInteger	0..1	Specifies the size of the file in bytes.
	xsd:anyAttribute	0..*	

3.12.2 ContentType Property Usage Notes

- **ds:DigestMethod, ds:DigestValue**: These values MAY be used to assist with file verification.

See the *DigestInfoGroup* section for structure and additional usage details [3.13].

- **id**: This is the identifier for the content that is used as a reference in artifact elements in the deployment descriptor.

  The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.
- **pathname**: *pathname* is used to access content in the package. The path of the file MUST be a URI that specifies an absolute path or a path relative to the location of the package descriptor. It MUST include the file name.
- **purpose**: The *purpose* attribute enables the *PackageDescriptor* author to associate a classification with a file. The classification identifies the file as having a specific purpose. *ContentPurposeType* defines a union of *SDDContentPurposeType* with `xsd:NCName`. The *purpose* value MAY be chosen from one of the following values enumerated in *SDDContentPurposeType* or be a valid NCName value provided by the SDD author. If *purpose* is not specified, the default value is *content*.

  Enumerated values for *purpose* are:
  - **readMe:** A file with information about the package. An implementation may choose to display this to a user as part of the deployment process.
  - **endUserLicenseAgreement:** A file containing an end user license agreement. An implementation may choose to display this to a user as part of the deployment process.
  - **responseFile:** A file that contains input values for an operation.
  - **deploymentDescriptor**: An XML file containing the *DeploymentDescriptor* definition associated with the *PackageDescriptor*. A valid *PackageDescriptor* MUST have exactly one *Content* element with a *purpose* value of *deploymentDescriptor*.
  - **packageDescriptor**: Supports aggregation of packages. This is used to reference a *packageDescriptor* of an aggregated package.
  - **descriptorLanguageBundle:** A file containing translations of text defined directly in the package descriptor or its associated deployment descriptor.
  - **content**: A file used during deployment of solution content. This is the default value for purpose.
- **charEncoding**: This attribute need only be used for files that a run-time is required to render. Common *charEncoding* values include “ASCII”, “UTF-8”, “UTF-16” and “Shift_JIS”. For an extensive list of character encodings, see **[IANA-CHARSET]**.
- **length**: The file length MAY be used for simple file verification.

3.13 DigestInfoGroup

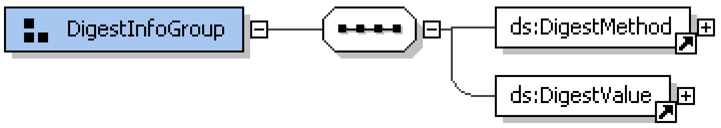


Figure 13: DigestInfoGroup structure.

When digest information is used to sign a content file, both the digest method and the digest value MUST be provided.

3.13.1 DigestInfoGroup Property Usage Notes

- **ds:DigestMethod, ds:DigestValue**: *ds:digestMethod* and *ds:digestValue* MAY be used to digitally sign individual files. If files are signed, the digest value MUST be calculated over the whole of each file.

  See **[XMLDSIG-CORE]** for details on the usage of *ds:DigestMethod* and *ds:DigestValue*.

4 Deployment Descriptor

A solution package contains a deployment descriptor in addition to a package descriptor. The deployment descriptor describes the topology, selectability, inputs, requirements and conditions of the deployment. The deployment descriptor is associated with a package descriptor and refers to content files in that package descriptor.

4.1 DeploymentDescriptor

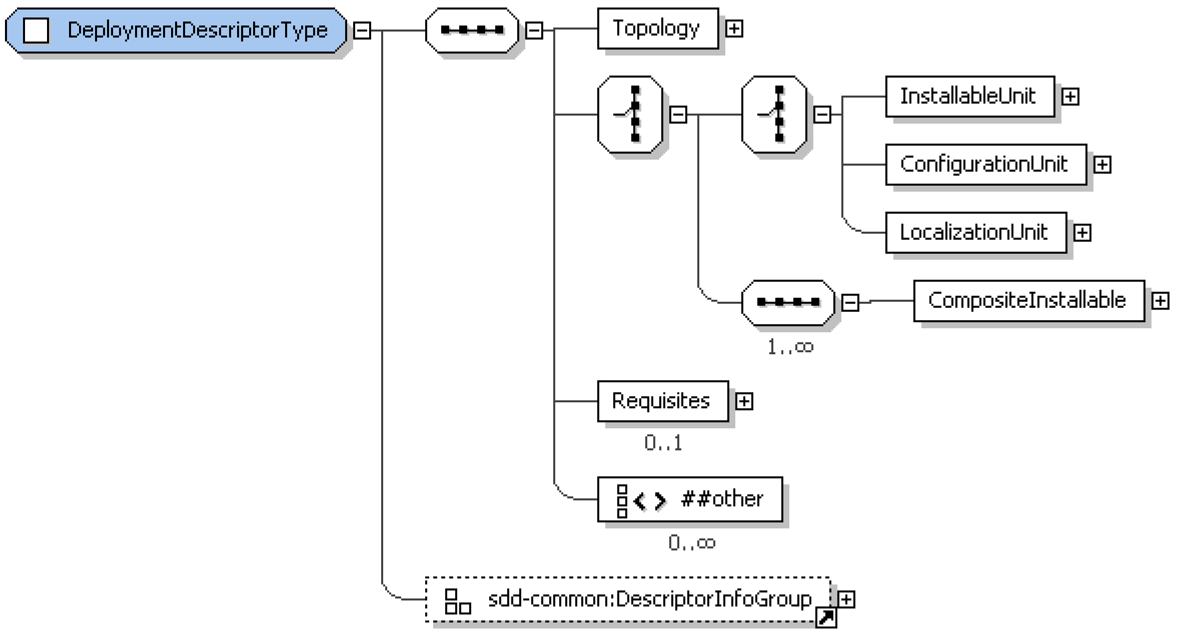


Figure 14: DeploymentDescriptor structure.

DeploymentDescriptor is the top level element of a deployment descriptor. The *DeploymentDescriptor* defines the information required to support deployment of the package contents. This includes the *Topology*, which declares all of the resources that may participate in deployment. It also includes one atomic content element or one or more *CompositeInstallable* content elements. Atomic content elements are *InstallableUnit*, *ConfigurationUnit*, or *LocalizationUnit*. Atomic content elements define artifacts that can be processed to deploy software resources. They are atomic because they cannot aggregate other content elements. A *CompositeInstallable* element is the root of a content element hierarchy that defines content that performs the one deployment operation supported by the *CompositeInstallable*. A *CompositeInstallable* can define base, selectable and localization content as well as the aggregation of other content elements.

4.1.1 DeploymentDescriptor Property Summary

Name	Data Type	*	Description
Topology	TopologyType	1	Defines resources that are required, created or modified by deployment.
InstallableUnit	InstallableUnitType	0..1	Defines content that installs, updates and/or uninstalls resources. When an InstallableUnit is defined, no ConfigurationUnit, LocalizationUnit or CompositeInstallable elements can be defined.
ConfigurationUnit	ConfigurationUnitType	0..1	Defines content that configures resources. When a ConfigurationUnit is defined, no InstallableUnit, LocalizationUnit or CompositeInstallable elements can be defined.
LocalizationUnit	LocalizationUnitType	0..1	Defines content that installs, updates and/or uninstalls translated materials. When a LocalizationUnit is defined, no InstallableUnit, ConfigurationUnit or CompositeInstallable elements can be defined.
CompositeInstallable	CompositeInstallableType	0..*	Defines a hierarchy of base, selectable and/or localization content used to perform one deployment lifecycle operation. When one or more CompositeInstallable elements are defined, no InstallableUnit, ConfigurationUnit or LocalizationUnit elements can be defined.
Requisites	RequisitesType	0..1	A list of references to SDD packages that can optionally be deployed to satisfy deployment requirements of the defining SDD.
	xsd:any	0..*	
schemaVersion	xsd:string	1	The descriptor complies with this version of the Solution Deployment Descriptor Specification. **fixed value="1.0"
descriptorID	UUIDType	1	Identifier of the deployment descriptor for a particular set of deployable content.
lastModified	xsd:dateTime	1	The time the descriptor was last modified.
descriptorLanguageBundle	xsd:token	0..1	The root name of language bundle files containing translations for display text elements in the deployment descriptor.
	xsd:anyAttribute	0..*	

4.1.2 DeploymentDescriptor Property Usage Notes

- **Topology**: *Topology* provides a logical view of all resources that may participate in any particular deployment. A resource can participate by being required, created or modified by the deployment. A required resource MAY also play the role of target resource, meaning that it can process artifacts to perform some portion of the deployment. The resources that actually participate in a particular deployment are determined by the user inputs, selections and resource bindings provided during that deployment.

  See the *TopologyType* section for structure and additional usage details [4.2.1].

- **InstallableUnit, ConfigurationUnit, LocalizationUnit, CompositeInstallable:** A simple software deployment that uses a single artifact for each supported deployment operation MAY be described using an SDD that defines a single atomic content element–*InstallableUnit*, *ConfigurationUnit* or *LocalizationUnit*.

  A software deployment that requires multiple artifacts, aggregates other deployment packages or has selectable content MAY be described using an SDD that defines one or more *CompositeInstallable* elements. Each *CompositeInstallable* MUST describe one deployment lifecycle operation for the package.

  See the respective sections (*InstallableUnitType* [4.3.1], *ConfigurationUnitType* [4.3.2], *LocalizationUnitType* [4.13.2] and *CompositeInstallableType* [4.9.1]) for structure and additional usage details.

- **Requisites**: When the package author chooses to provide deployment packages for required software, those packages are described by *Requisite* elements in *Requisites*.

  Including requisite packages in the SDD package MAY provide a convenient way for the deployer to satisfy one or more SDD requirements.

  See the *RequisitesType* section for structure and additional usage details [4.10.5].

- **schemaVersion, descriptorID, lastModified, descriptorLanguageBundle**: These attributes can be useful to tooling that manages, creates or modifies deployment descriptors and to tooling and deployment software that displays information from the deployment descriptor to humans.

  See the *DescriptorInfoGroup* section for structure and additional usage details [3.2].

4.2 Topology

The SDD's topology describes all the resources that may be required, created or modified when any of the deployment operations supported by the SDD are performed.

Primary identifying characteristics of the resources can be defined in topology. Constraints beyond these primary characteristics are not defined in topology; they are defined in content elements that reference the resource definitions in topology.

The topology includes identification of *hosts–hostedBy* relationships between resources. When both resources in that relationship participate in a particular deployment, the relationship is considered a requirement for that deployment.

It is possible that only a subset of the resources described in topology will play a role in a particular deployment. This is determined by the selection of content elements for the particular deployment. The resources that are required, created or modified by the content elements in scope for the deployment are the ones that will participate in the deployment and so are associated with resources in the deployment environment.

At deployment time, definitions of the resources that participate in that particular deployment are associated with actual resource instances in the deployment environment. The mechanisms for associating resource definitions with resource instances are not described by the SDD. The SDD metadata describes the characteristics of the participating resources. Whether associations of resource instances with matching characteristics are made by user choice or entirely by software does not affect the success of the deployment. Resource characteristics used when making this association include those defined in topology plus all those defined in constraints on the resource in the content elements that are in scope for the particular deployment.

Some topologies are variable. That is, a particular set of logical resources of the same type in the topology might be associated with different physical resource instances or the same physical resource during deployment. In this case, a separate logical resource definition is created in topology for each possible physical resource instance. Uniqueness constraints can then be used to describe the conditions under which the separate resources can be associated with a single resource.

All resource definitions in the SDD are in topology. All other descriptions of resources in the SDD are references to the resource definitions in the topology.

4.2.1 TopologyType

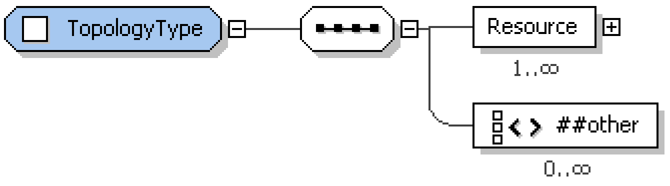


Figure 15: TopologyType structure.

The *Topology* element defines one or more hierarchies of resource specifications that describe the resources that MAY play a role in the deployment of the contents of the solution package. These resource specifications do not identify specific resource instances in a specific deployment environment. Instead, they are logical specifications of resources that can be associated with specific resource instances in the deployment environment for a particular deployment based on the described resource identity characteristics. These resources have a role in a particular solution deployment only when they are required, created or modified by a content element, or referred to by a variable, in that particular solution deployment.

4.2.1.1 TopologyType Property Summary

Name	Type	*	Description
Resource	ResourceType	1..*	The root of a tree of resources that play a role in the solution.
	xsd:any	0..*	

4.2.1.2 TopologyType Property Usage Notes

- **Resource**: The SDD author's decision to model a resource in the deployment environment as a resource in the SDD depends on the need to know about that resource when planning for deployment, aggregating, deploying and managing the resource lifecycle using the SDD. All resources required by the solution SHOULD be included. For all *Requirements* declared in the SDD, resources MUST be specified. Resources referred to by *ResultingResource* or *ResultingChange* elements MUST also be included. The more complete the SDD is, the more useful it will be in guiding successful deployment.

  See the *ResourceType* section for structure and additional usage details [4.2.2].

4.2.2 ResourceType

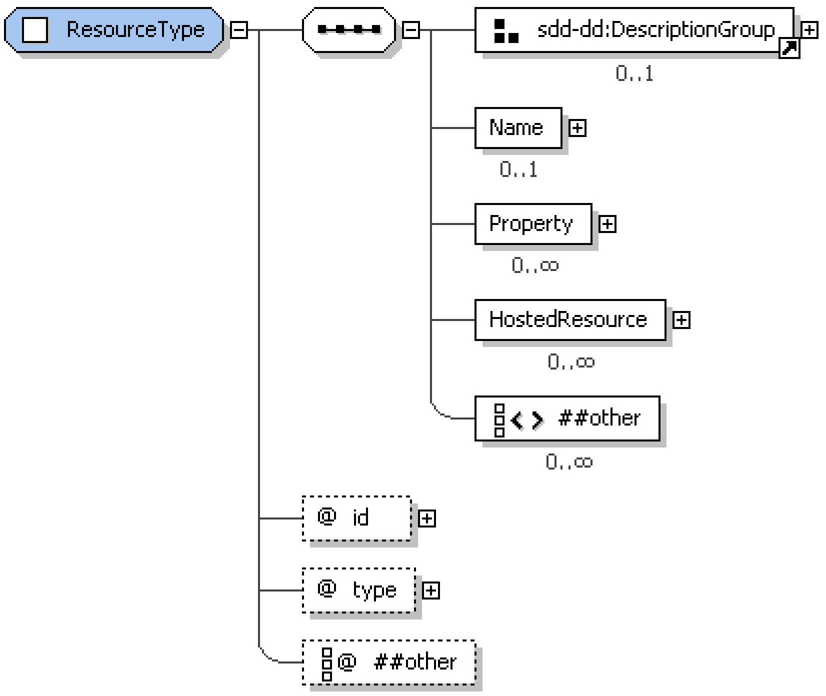


Figure 16: ResourceType structure.

Elements of *ResourceType*—both the top level *Resource* elements and the *HostedResource* elements within the resource hierarchy—make up the topology of an SDD. Each *Resource* element declares, at a minimum, the type of the resource. Values for resource type are not defined by this specification. A core assumption of this specification is that an understanding of specific resource types and resource characteristics are shared by the deployment descriptor author and the deployment software. Therefore, if the deployment descriptor author declares a new resource type, then deployment software operating on the SDD needs to understand how to handle that resource type.

In addition to defining type, the resource elements MAY specify a name and other identity properties that can be used to identify instances of the resource in the deployment environment. The resource identity elements, *Name* and *Property,* are optional and MAY be specified in content elements rather than in topology. Identity properties used in the resource specification in topology MUST be those that do not change during deployment, even when the resource is updated. Because resource versions can often change during an update, there is no version element in resource specifications in *Topology*. Values can be defined for resource name and resource properties that help to identify the resource. These represent the basic identity of the resource and are true for all uses of the resource in the solution.

ResourceType provides the type definition for the *Resource* and *HostedResource* elements defined in *Topology*. All resources MAY nest resource definitions for resources that they host. To host a resource means to provide the execution environment for that resource.

> For example, an operating system provides the execution environment for software, and a database engine provides the execution environment for a database table. The operating system hosts the software and the database engine hosts the database table.

Each resource in these hierarchies may play a role in solution deployment.

Content elements determine a resource's participation and role(s) in a particular solution deployment. Content elements can refer to resources in *Topology* in several ways. A resource can be identified via `xsd:IDREF`:

- as the target of the content element's artifacts. A target resource is a resource that is capable of processing a particular artifact. A target resource is often, but not always, the host of the resources created by the artifacts it processes.

For example, an operating system may be the target of an artifact that is a zip file. When the files are unzipped, the file system resource is the host of those files.

See the *targetResourceRef* attribute in the *InstallableUnitType* [4.3.1], *ConfigurationUnitType* [4.3.2] and *LocalizationUnitType* [4.13.2] sections.

- as the required base for an update applied by the artifact referenced by the content element.

  See the *RequiredBaseType* section [4.7.8].
- as the resource that will be created by deploying the artifact referenced by the content element.

  See the *ResultingResourceType* section [4.8.1].
- as the resource that will be changed by deploying the artifact referenced by the content element.

  See the *ResultingChangeType* section [4.8.2].
- as the localization base for translated materials. The localization base is the resource that is localized by deploying the translated materials.

  See the *LocalizationBase* element in the *LocalizationUnitType* section [4.13.2].
- as a required resource named in the content element's *Requirements*.

  See the *RequirementsType* section [4.7.1].
- to establish a variable value from a resource property.

  See the *ResourcePropertyType* section [4.6.12].

One resource MAY be referred to by any number of content elements and can be identified to play any or all of the roles just listed. When a content element participates in a particular solution deployment, the resources it references participate in that solution deployment and are associated with resource instances in the deployment environment.

4.2.2.1 ResourceType Property Summary

Name	Type	*	Description
Description	DisplayTextType	0..1	A description of the resource and its role in the solution described by the SDD.
ShortDescription	DisplayTextType	0..1	A short description of the resource and its role.
Name	VariableExpressionType	0..1	The name of the resource as known in the deployment environment.
Property	PropertyType	0..*	An identity property of the resource.
HostedResource	ResourceType	0..*	A resource that participates in the solution and that is hosted by the defining resource.
	xsd:any	0..*	
id	xsd:ID	1	An identifier of the resource scoped to the descriptor.
type	ResourceTypeNameType	1	A well-known resource type.
	xsd:anyAttribute	0..*	

4.2.2.2 ResourceType Property Usage Notes

- **Description, ShortDescription**: If used, these elements MUST provide a human-readable description of the resource.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DescriptionGroup* section for structure and additional usage details [4.14.1].

- **Name**: The resource name is an identifying characteristic of the resource that correlates with a name for the resource in the deployment environment.

  The type of the *Name* element, *VariableExpressionType*, allows the resource name to be expressed as a simple string or in terms of a user input parameter or other variable.

  > An example of a good use of a variable expression in *Resource*.*Name* is to make sure that the installation directory is hosted on a file system that has sufficient space available for deployment. In this example, the file system resource element would define a *HostedResource* element for the directory. The *Name* of the directory would be expressed as a variable expression that refers to a user input parameter for installation location. Content elements that use the installation directory would express a requirement on the directory and on the file system with the additional constraint that the file system have a certain amount of available space (to satisfy the consumption constraints). The fact that both resources are required and that they are defined with a *hosts–hostedBy* relationship in *Topology,* means that the directory that is used must be the installation directory and it must be hosted by a file system that meets the consumption constraint for available space.

  Only the *Variable* elements defined in a top level content element can be used to define a resource *Name,* because these are the only variables visible within *Topology*.

  If the name of a resource is changed during deployment, for example, during an update, then the resource name SHOULD NOT be included in the resource specification. Instead, the pre-update resource name SHOULD be specified in the *RequiredBase* element of the installable unit that provides the update, and the post-update name SHOULD be specified in the *ResultingResource* element of the same installable unit.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].

- **Property**: *Property* elements SHOULD be used when *Name* alone is not sufficient to identify the resource. The property used represents an identifying characteristic of a resource.

  See the *PropertyType* section for structure and additional usage details [4.2.3].

- **HostedResource**: A *Resource* MAY define *HostedResource* elements. Each *HostedResource* element is an instance of *ResourceType*. When both the host and the hosted resource participate in a particular solution deployment, the associated resource instances selected for use during that deployment must have a *hosts* relationship.

  > For example, a Web application declared to be hosted on a Web server must be hosted on the instance of the Web server that is selected for use during the deployment.

  If only the host resource is identified by the *DeploymentDescriptor's* content elements as participating in the solution, then there is no assumption that the hosted resource exists.

- **id**: The *id* attribute uniquely identifies the resource element within the *DeploymentDescriptor*. This *id* value is used by other elements in the *DeploymentDescriptor* to refer to this resource. This value is created by the descriptor author.

  The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.

- **type**: The *type* attribute defines the class of resource. The value of *type* correlates with the resource type known for the resource in the deployment environment. *ResourceTypeNameType* restricts *type* to valid `xsd:QNames`. The values for *type* are not defined by this specification. Creators of *DeploymentDescriptors* rely on knowledge of resource types that are understood by supporting infrastructure in the target environment. To honor the descriptor author's intent, the deploying infrastructure must be able to discover the existence of resources of the types defined in the SDD; the values of the resource's properties; and the existence and type of resource relationships. The deploying infrastructure also needs to understand how to use the artifact types associated with the resource type to create, modify and delete the resource.

4.2.3 PropertyType

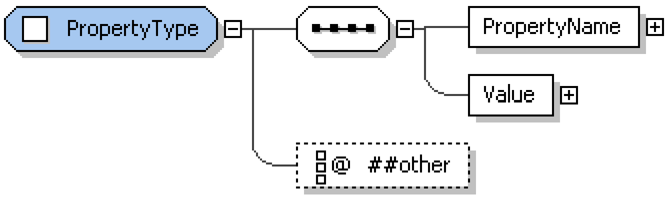


Figure 17: PropertyType structure.

PropertyType provides the type definition for elements used to declare an identity property of a resource, namely, the *Property* elements of *Resource* and *HostedResource* in *Topology.* It also provides the type definition for *Property* elements in *Relationship* and *RelationshipConstraint*.

4.2.3.1 PropertyType Property Summary

Name	Type	*	Description
PropertyName	xsd:QName	1	The property name.
Value	VariableExpressionType	1	The property value.
	xsd:anyAttribute	0..*	

4.2.3.2 PropertyType Property Usage Notes

- **PropertyName**: The *PropertyName* MAY be used to provide additional identification for the resource in the deployment environment.

  The *PropertyName* MAY be used to provide constraints on the configuration of a resource.
- **Value**: Evaluation of the *Value* expression provides the value of the property.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].

4.2.4 ResultingPropertyType

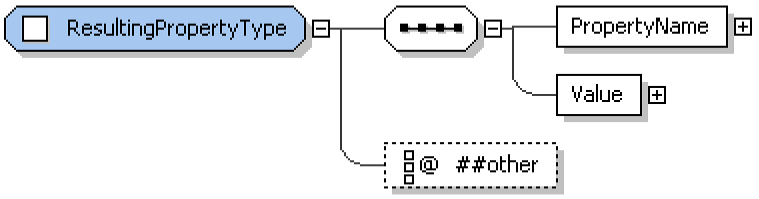


Figure 18: ResultingPropertyType structure.

ResultingPropertyType provides the type definition for elements used to declare an identity property of a resulting resource or to declare a configuration change to a resource property which results from deployment of an artifact.

4.2.4.1 ResultingPropertyType Property Summary

Name	Type	*	Description
PropertyName	xsd:string	1	The resulting property name.
Value	VariableExpressionType	1	The resulting property value.
	xsd:anyAttribute	0..*	Additional attributes of the resulting property.

4.2.4.2 ResultingPropertyType Property Usage Notes

- **PropertyName**: The *PropertyName* MAY be used to provide additional identification for the resource in the deployment environment.

  The *PropertyName* MAY be used to declare a configuration change to a resource.
- **Value**: Evaluation of the *Value* expression provides the value of the resulting property.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].

4.3 Atomic Content Elements

The package descriptor defines package content that includes artifacts whose processing results in deployment of the software package. The deployment descriptor defines metadata associated with those artifacts. The metadata includes conditions, requirements, results, inputs, outputs and completion actions. Metadata throughout the deployment descriptor is associated with package content in the definition of atomic content elements. The atomic content elements are *InstallableUnit*, *ConfigurationUnit* and *LocalizationUnit*. These are the only content elements that define *Artifacts* elements.

Artifact elements identify an artifact file or set of files defined in package content whose processing will perform all or a portion of the deployment for a particular deployment lifecycle operation. The name of the artifact element indicates the operation supported by the artifact. Names of the artifact elements are created by prefixing “Artifacts” with the operation name. The artifacts defined for use in the SDD are *InstallArtifact*, *UpdateArtifact*, *UndoArtifact*, *UninstallArtifact*, *RepairArtifact* and *ConfigArtifact*.

Artifact elements define the inputs and outputs, substitution values and types associated with the artifact files. The content element’s target resource, identified by *targetResourceRef*, processes the artifact files with the defined inputs to perform deployment operations. Examples of artifact types include zip files, rpm files and executable install files. Artifact types are not defined by this specification. The artifact types defined in the SDD need to be understood by software that processes the SDD.

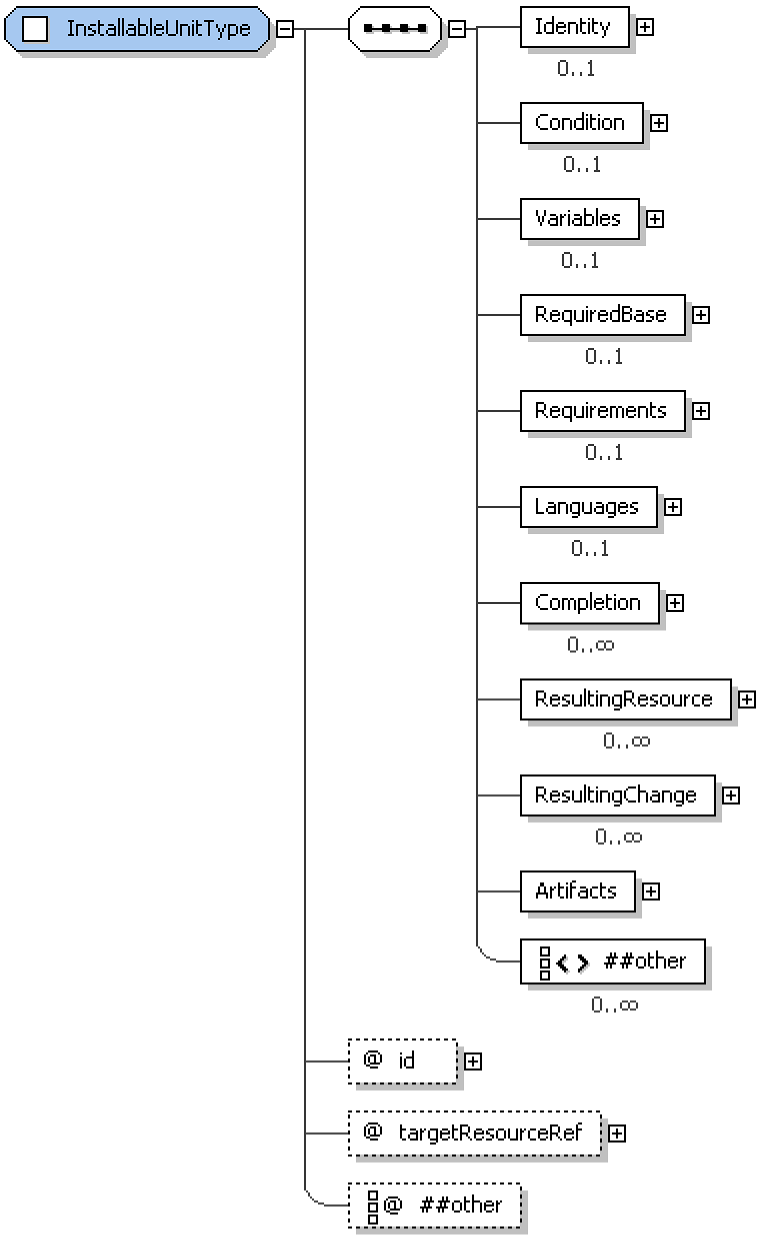
There MAY be multiple atomic content elements within a composite installable that describe the deployment of multiple resources as part of a single software deployment or there MAY be a single atomic content element (singleton) in the deployment descriptor that describes the entirety of a simple deployment. When an atomic content element is used in a *CompositeInstallable*, it MUST define exactly one artifact. When an atomic content element is a singleton, it MUST define at least one artifact element and MAY define one of each type of artifact element allowed for its type. The inclusion of an artifact element in a singleton atomic content element implies support for the associated operation.

> For example, a singleton *ConfigurationUnit* that defines a *ConfigArtifact* associates a configure operation with the *ConfigArtifact*. Similarly, an SDD with a singleton *InstallableUnit* that defines an *InstallArtifact* and an *UpdateArtifact* associates an *install* operation with the *InstallArtifact* and an *update* operation with the *UpdateArtifact*.

When an atomic content element is defined within a *CompositeInstallable* hierarchy, its one artifact MUST support the single top level operation associated with the *CompositeInstallable*. The single artifact defined need not be an artifact for the operation defined for the *CompositeInstallable*.

> For example, in a *CompositeInstallable* that defines metadata for an *update* operation, there may be one *InstallableUnit* that defines an *InstallArtifact* element and another *InstallableUnit* that defines an *UpdateArtifact* element. Both of these artifacts are used when performing the overall *update* operation defined for the *CompositeInstallable*.

1309 ### 4.3.1 InstallableUnitType



1310

1311 **Figure 19: InstallableUnitType structure.**

1312 The *InstallableUnit* element is an atomic content element that defines artifacts that install or update
1313 software and defines requirements for applying those artifacts. It may also define artifacts that undo an
1314 update or that uninstall or repair existing software.

1315 #### 4.3.1.1 InstallableUnitType Property Summary

Name	Type	*	Description
Identity	IdentityType	0..1	Human-understandable identity information about the InstallableUnit.
Condition	ConditionType	0..1	A condition that determines if the content element is relevant to a particular deployment.
Variables	VariablesType	0..1	Variables for use within the InstallableUnit's requirements and artifact

			definitions.
RequiredBase	RequiredBaseType	0..1	A resource that will be updated when the InstallableUnit's UpdateArtifact is processed.
Requirements	RequirementsType	0..1	Requirements that must be met prior to successful processing of the InstallableUnit's artifacts.
Languages	LanguagesType	0..1	Languages supported by the InstallableUnit.
Completion	CompletionType	0..*	Describes completion actions such as restart and the conditions under which the action is applied.
ResultingResource	ResultingResourceType	0..*	A resource that will be installed or updated by processing the InstallableUnit's artifacts.
ResultingChange	ResultingChangeType	0..*	A resource that will be configured by processing the InstallableUnit's artifacts.
Artifacts	InstallationArtifactsType	1	The set of artifacts associated with the InstallableUnit.
	xsd:any	0..*	
id	xsd:ID	1	An identifier for the InstallableUnit scoped to the deployment descriptor.
targetResourceRef	xsd:IDREF	1	Reference to the resource that can process the InstallableUnit's artifacts.
	xsd:anyAttribute	0..*	

4.3.1.2 InstallableUnitType Property Usage Notes

- **Identity**: The *InstallableUnit's Identity* element defines human-understandable information that reflects the identity of the solution as understood by the end user of the solution.

  If the *InstallableUnit* defines a resulting resource, the *Identity* of the *InstallableUnit* SHOULD reflect the identity of the resulting resource.

  When the *InstallableUnit* is the only content element in the deployment descriptor, its *Identity* MAY define values that are the same as the corresponding *PackageIdentity* element values.

  > This would be useful, for example, in a case where the package is known by the same name as the resource created by the *InstallableUnit*.

  See the *IdentityType* section for structure and additional usage details [3.4].

- **Condition**: A *Condition* is used when the *InstallableUnit's* content should be deployed only when certain conditions exist in the deployment environment.

  > For example, one *InstallableUnit* may be applicable only when the operating system resource is resolved to a Linux®[2] operating system during deployment. The *InstallableUnit* would define a

[2] Linux® is the registered trademark of Linus Torvalds in the U.S. and other countries.

> *Condition* stating that the type of the operating system must be Linux for the *InstallableUnit* to be considered in scope for a particular deployment.

See the *ConditionType* section for structure and additional usage details [4.5.1].

- **Variables**: An *InstallableUnit's Variables* element defines variables that are used in the definition of the *InstallableUnit's* requirements and in parameters and properties passed to the *InstallableUnit's* target resource.

  When the deployment descriptor defines a single *InstallableUnit* at the top level, that is, not inside a *CompositeInstallable*, the variables it defines MAY be referred to by any element under *Topology*.

  See the *VariablesType* section for structure and additional usage details [4.6.3].

- **Languages**: When translated materials are deployed by the *InstallableUnit's* artifacts, the languages of the translations are listed in *Languages*.

  See the *LanguagesType* section for structure and additional usage details [4.13.6].

- **RequiredBase**: When an *InstallableUnit* can be used to update resources, the *RequiredBase* element identifies the resources that can be updated.

  See the *RequiredBaseType* section for structure and additional usage details [4.7.8].

- **Requirements**: *Requirements* specified in an *InstallableUnit* identify requirements that must be met prior to successful processing of the *InstallableUnit's* artifacts.

  See the *RequirementsType* section for structure and additional usage details [4.7.1].

- **Completion**: A *Completion* element MUST be included if the artifact being processed requires a system operation such as a reboot or logoff to occur to function successfully after deployment or if the artifact executes a system operation to complete deployment of the contents of the artifact.

  There MUST be an artifact associated with the operation defined by a *Completion* element.

  > For example, if there is a *Completion* element for the *install* operation, the *InstallableUnit* must define an *InstallArtifact*.

  See the *CompletionType* section for structure and additional usage details [4.3.14].

- **ResultingResource**: An *InstallableUnit's ResultingResource* element identifies the resources in *Topology* that will be installed or updated when the *InstallableUnit's* artifacts are processed.

  See the *ResultingResourceType* section for structure and additional usage details [4.8.1].

- **ResultingChange**: Multiple content elements within the SDD MAY specify the same resource in their *ResultingChange* elements. In this case each content element is capable of modifying the configuration of that resource.

  An example use of the *ResultingChange* element is to understand whether or not one content element can satisfy the requirements specified in another content element.

  See the *ResultingChangeType* section for structure and additional usage details [4.8.2].

- **Artifacts**: When the *InstallableUnit* is a singleton defined outside of a *CompositeInstallable*, it MUST define at least one artifact element and MAY define one of each type of artifact element allowed for its type. The inclusion of an artifact element in a singleton *InstallableUnit* implies support for the associated operation.

  When the *InstallableUnit* is defined within a *CompositeInstallable*, it MUST define exactly one artifact. The artifact defined MAY be any artifact allowed in an *InstallableUnit* and it MUST support the single top level operation defined by the *CompositeInstallable*. This does not mean the operation associated with the artifact has to be the same as the one defined by the *CompositeInstallable*.

  > For example, an update of a resource may be required to support an install of the overall solution, in which case the *InstallableUnit* would define an *UpdateArtifact* to support the top level *install* operation.

  See the *InstallationArtifactsType* section for structure and additional usage details [4.3.4].

- **id**: The *id* attribute is referenced in features to identify an *InstallableUnit* selected by the feature and *Dependency* elements to indicate a dependency on processing of the content element.

The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.

- **targetResourceRef**: The *targetResourceRef* attribute identifies the resource that will process the *InstallableUnit's* artifacts.

  The resources created or modified by artifact processing are frequently, but not necessarily, hosted by the target resource.

  This value MUST match an *id* of a resource element in *Topology*.

  The target may be a resource that has not yet been created. In this case, there is a dependency on the complete installation of the target resource prior to applying the *InstallableUnit*. This dependency MUST be represented in a *Dependency* element within *Requirements* that apply to the *InstallableUnit*.

4.3.2 ConfigurationUnitType

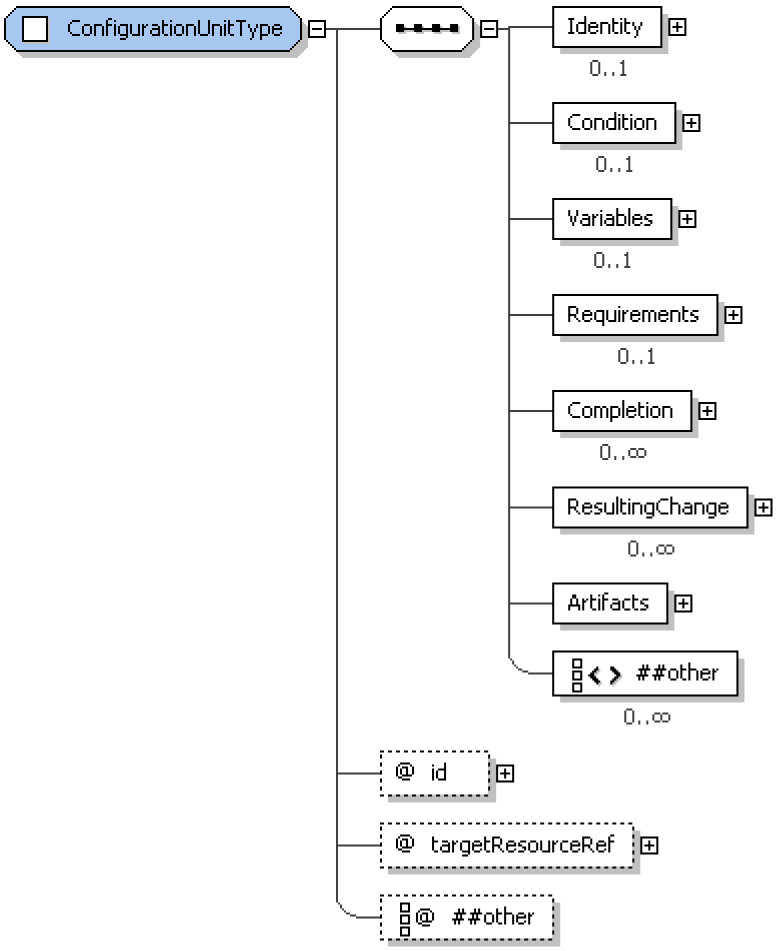


Figure 20: ConfigurationUnitType structure.

The *ConfigurationUnit* element defines artifacts that configure one or more existing resources. It also defines the requirements for applying those artifacts. It MUST NOT install, update, or uninstall resources.

4.3.2.1 ConfigurationUnitType Property Summary

Name	Type	*	Description
Identity	IdentityType	0..1	Human-understandable identity information about the ConfigurationUnit.

Condition	ConditionType	0..1	A condition that determines if the content element is relevant to a particular deployment.
Variables	VariablesType	0..1	Variables for use within the ConfigurationUnit's requirement and artifact definitions.
Requirements	RequirementsType	0..1	Requirements that must be met prior to successful processing of the ConfigurationUnit's artifacts.
Completion	CompletionType	0..*	Describes completion actions such as restart and the conditions under which the action is applied.
ResultingChange	ResultingChangeType	0..*	A definition of changes made to a resource that is configured by processing the ConfigurationUnit's ConfigArtifact.
Artifacts	ConfigurationArtifactsType	1	The artifact associated with the ConfigurationUnit.
	xsd:any	0..*	
id	xsd:ID	1	An identifier for the ConfigurationUnit scoped to the deployment descriptor.
targetResourceRef	xsd:IDREF	1	Reference to the resource that can process the ConfigurationUnit's artifacts.
	xsd:anyAttribute	0..*	

4.3.2.2 ConfigurationUnitType Property Usage Notes

- **Identity**: The *ConfigurationUnit's Identity* element defines human-understandable information that reflects the identity of the provided configuration as understood by the end user of the solution. *Identity* has elements that are common with elements in the corresponding *PackageDescriptor's PackageIdentity* element, for example, *Name* and *Version*. The values of these common elements SHOULD be the same as the corresponding *PackageIdentity* element values.

  See the *IdentityType* section for structure and additional usage details [3.4].
- **Condition**: A *Condition* is used when the deployment of configuration content is dependent on the existence of certain conditions in the deployment environment.

  For example, a package that has one configuration artifact that creates a database table for one database product and a different artifact that creates a table for a different database product would have two configuration units, each with a condition on the associated database product.

  See the *ConditionType* section for structure and additional usage details [4.5.1].
- **Variables**: A *ConfigurationUnit's Variables* element defines variables that are used in the definition of requirements and artifact parameters.

  When the deployment descriptor defines a single *ConfigurationUnit* at the top level, that is, not inside a *CompositeInstallable*, the variables it defines MAY be referred to by any element under *Topology*.

  See the *VariablesType* section for structure and additional usage details [4.6.3].
- **Requirements**: *Requirements* specified in a *ConfigurationUnit* identify requirements that MUST be met prior to successful processing of the *ConfigurationUnit's* artifacts.

  See the *RequirementsType* section for structure and additional usage details [4.7.1].
- **Completion**: A *Completion* element MUST be included if the artifact being processed requires a system operation such as a reboot or logoff to occur to function successfully after deployment or if the artifact executes a system operation to complete deployment of the contents of the artifact.

  There MUST be an artifact associated with the operation defined by a *Completion* element.

  For example, if there is a *Completion* element for the *configure* operation, the *ConfigurationUnit* must define a *ConfigArtifact*.

See the *CompletionType* section for the structure and additional usage details [4.3.14].

- **ResultingChange**: Configuration changes made when the configuration artifact is processed SHOULD be declared here. This information may be necessary when the SDD is aggregated into another SDD and the resulting change satisfies a constraint in the aggregation. The information declared here can be compared with resource constraints to determine if application of the *ConfigurationUnit* will satisfy the constraint.

  See the *ResultingChangeType* section for structure and additional usage details [4.8.2].

- **Artifacts**: When the *ConfigurationUnit* is a singleton defined outside of a *CompositeInstallable*, it MUST define at least one artifact element. The inclusion of an artifact element in a singleton *ConfigurationUnit* implies support for the associated operation.

  When the *ConfigurationUnit* is defined within a *CompositeInstallable*, it MUST define exactly one artifact. The artifact defined MUST be a *ConfigArtifact* and it MUST support the single top level operation defined by the *CompositeInstallable*.

  See the *ConfigurationArtifactsType* section for structure and additional usage details [4.3.5].

- **id**: The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.

- **targetResourceRef**: The *targetResourceRef* attribute identifies the resource in *Topology* that will process the *ConfigurationUnit's* artifacts to configure the resources identified by the *ConfigurationUnit's ResultingChange* definition.

  This value MUST match an *id* of a resource element in *Topology*.

4.3.3 ArtifactType

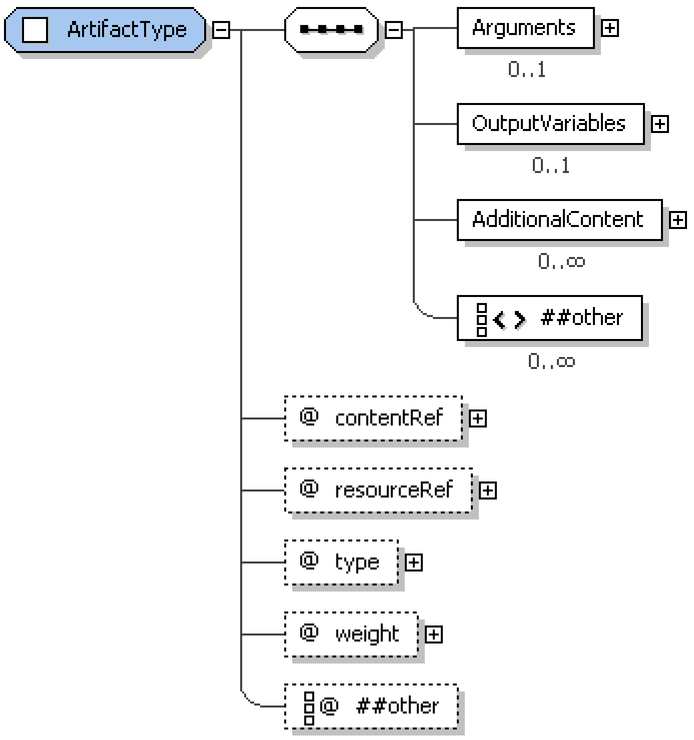


Figure 21: ArtifactType structure.

ArtifactType elements define the files, arguments and other information required to perform a particular deployment operation. Every artifact that can be defined in a content element is an instance of *ArtifactType*. These are *InstallArtifact, UpdateArtifact, UndoArtifact, UninstallArtifact, RepairArtifact and ConfigArtifact*.

4.3.3.1 ArtifactType Property Summary

Name	Type	*	Description
Arguments	ArgumentListType	0..1	Arguments used during processing of the artifact.
OutputVariables	OutputVariableListType	0..1	Variables whose values are set during processing of the artifact.
AdditionalContent	AdditionalContentType	0..*	Additional content files that are part of the artifact.
	xsd:any	0..*	
contentRef	xsd:token	0..1	The primary artifact file. Not used if resourceRef is used.
resourceRef	xsd:IDREF	0..1	The resulting resource representing the artifact file. Not used if contentRef is used.
type	ArtifactTypeNameType	0..1	Type of the primary artifact file.
weight	xsd:positiveInteger	0..1	The time required to process this artifact relative to all other artifacts in the SDD.
	xsd:anyAttribute	0..*	

4.3.3.2 ArtifactType Property Usage Notes

- **Arguments**: Inputs to the processing of the artifact MUST be specified by defining an *Arguments* element. All required inputs MUST be included in the arguments list. There are no implied arguments.

    For example, there is no implication that the selected required resource instances will be passed with an *InstallArtifact* on the install operation. If knowledge of those selections is required, instance identifiers should be passed as arguments.

  When one *Argument* refers to the *OutputVariable* of another artifact, the output value must be available at the time of processing the dependent artifact.

    For example, an artifact in a content element that is conditioned on the operating system being Linux should not refer to the output of an artifact in a content element conditioned on the operating system being Windows™[3].

  A *Dependency* requirement MUST be defined between the content elements to indicate that the artifact that defines the output variable is a pre-requisite of the content element with the dependent artifact.

  See the *ArgumentListType* section for structure and additional usage details [4.3.8].

- **OutputVariables**: *OutputVariables* are variables whose values are set by artifact processing.

  OutputVariables can also be useful in log and trace messages.

  See the *OutputVariableListType* section for structure and additional usage details [4.3.10].

[3] Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

- **AdditionalContent**: *AdditionalContent* elements MUST be defined when supporting files are needed by the artifact for this operation. The content file reference is specified via the *contentRef* attribute of *AdditionalContent*.

  See the *AdditionalContentType* section for structure and additional usage details [4.3.12].

- **contentRef**: The value MUST be a reference to the *id* of the primary artifact file defined in a *Content* element in the package descriptor.

  Note that it is valid to have no artifact file and drive the operation from arguments alone.

  When more than one artifact file is needed, *contentRef* points to the primary artifact file and *AdditionalContent*.*contentRef* points to any other files used during application of the content element.

  When *resourceRef* is defined, *contentRef* MUST NOT be defined.

- **resourceRef**: Sometimes, artifact files are created during a deployment rather than being contained in the package.

    For example, some install programs create an uninstall program when the software is deployed. The uninstall program is the artifact file that is needed by the *UninstallArtifact*, but is created by, but not contained in, the package. In this case, the created artifact file is represented as a *ResultingResource*.

  An *Artifact* element that defines *resourceRef* identifies the resulting resource as its artifact file.

  When *contentRef* is defined, *resourceRef* MUST NOT be defined.

  The value MUST reference the *id* of a resource element in *Topology*.

- **type**: The *type* attribute identifies the format of the artifact file or files. When there is no artifact file identified, *type* MAY be left undefined. If there is an artifact file or additional files defined, *type* MUST be defined.

  Values for this attribute are not defined by this specification. *ArtifactTypeNameType* restricts *type* to valid `xsd:QNames`.

- **weight**: Defining weights for all artifacts and referenced packages in an SDD provides useful information to software that manages deployment. The weight of the artifact refers to the relative time taken to deploy the artifact with respect to other artifacts and referenced packages in this SDD.

    For example, if the artifact takes three times as long to deploy as another artifact whose weight is “2”, then the weight would be “6”. The weight numbers have no meaning in isolation and do not describe actual time elapsed. They simply provide an estimate of relative time.

4.3.4 InstallationArtifactsType

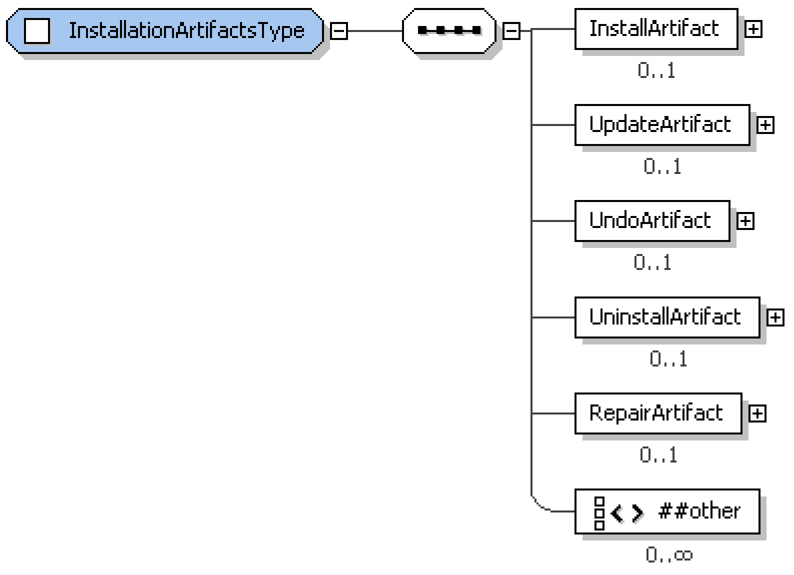


Figure 22: InstallationArtifactsType structure.

InstallationArtifactsType provides the type definition for the *Artifacts* element of *InstallableUnit* and *LocalizationUnit*. At least one *Artifact* element MUST be defined. Within a *CompositeInstallable* definition, exactly one *Artifact* element MUST be defined.

4.3.4.1 InstallationArtifactsType Property Summary

Name	Type	*	Description
InstallArtifact	ArtifactType	0..1	Artifact for install operation.
UpdateArtifact	ArtifactType	0..1	Artifact for update operation.
UndoArtifact	ArtifactType	0..1	Artifact for undo operation.
UninstallArtifact	ArtifactType	0..1	Artifact for uninstall operation.
RepairArtifact	ArtifactType	0..1	Artifact for repair operation.
	xsd:any	0..*	

4.3.4.2 InstallationArtifactsType Property Usage Notes

- **InstallArtifact**: The *InstallArtifact* element declares deployment information sufficient to enable the target resource to perform an install using the named artifact files. The *ResultingResource* and *ResultingChange* elements describe the characteristics of the new or modified resource(s).

  See the *ArtifactType* section for structure and additional usage details [4.3.3].

- **UpdateArtifact**: The *UpdateArtifact* element declares deployment information sufficient to enable the target resource to perform an update using the named artifact files. The *RequiredBase* element defines the resource(s) that can be updated. The *ResultingResource* and *ResultingChange* elements describe the updated characteristics of the resource(s).

  See the *ArtifactType* section for structure and additional usage details [4.3.3].

- **UndoArtifact**: The *UndoArtifact* element declares deployment information sufficient to enable the target resource to undo an update. This undo will put the resource back to a previous level.

  The update that can be undone is described in the *RequiredBase* element. The *ResultingResource* definition can be used to describe the state of the resource(s) after the undo completes.

See the *ArtifactType* section for structure and additional usage details [4.3.3].

- **UninstallArtifact**: The *UninstallArtifact* element declares deployment information sufficient to enable the target resource to perform an uninstall.

  If an *InstallArtifact* is defined in the same *InstallableUnit*, the *ResultingResource* element defines the resource(s) that will be uninstalled.

  When an *UninstallArtifact* is the only artifact defined for an *InstallableUnit*, the *RequiredBase* MUST be defined to declare the resource(s) that will be uninstalled. The *ResultingResource* element MUST be left blank because the result of the uninstall is that the resource(s) are removed.

  See the *ArtifactType* section for structure and additional usage details [4.3.3].

- **RepairArtifact**: The *RepairArtifact* element declares deployment information sufficient to enable the target resource to repair an installation.

  If an *InstallArtifact* is defined in the same *InstallableUnit*, the *ResultingResource* element defines the resource(s) that will be repaired.

  When a *RepairArtifact* is the only artifact defined for an *InstallableUnit*, the *RequiredBase* MUST be defined to declare the resource(s) that will be repaired.

  See the *ArtifactType* section for structure and additional usage details [4.3.3].

4.3.5 ConfigurationArtifactsType

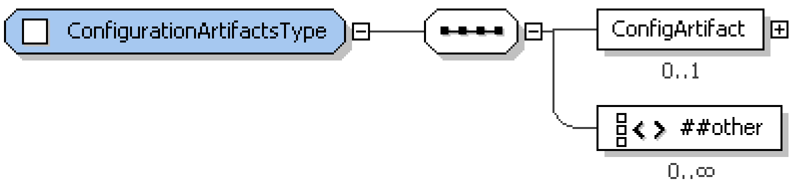


Figure 23: ConfigurationArtifactsType structure.

ConfigurationArtifactsType provides the type definition for the *Artifacts* element of *ConfigurationUnit.*

4.3.5.1 ConfigurationArtifactsType Property Summary

Name	Type	*	Description
ConfigArtifact	ArtifactType	0..1	Artifact for configure operation.
	xsd:any	0..*	

4.3.5.2 ConfigurationArtifactsType Property Usage Notes

- **ConfigArtifact**: The *ConfigArtifact* element declares deployment information sufficient to allow the target resource to configure the resources identified in the content element’s *ResultingChange* elements.

  See the *ArtifactType* section for structure and additional usage details [4.3.3].

4.3.6 OperationListType

This simple type extends the `xsd:list` type as defined in **[XSD]**, and adds the restriction that each value in the list must be one of the operations from the enumeration defined by *OperationType* [4.3.7].

4.3.7 OperationType

Operations are used in the SDD to associate requirements and completion actions with particular artifacts.

For example, when a requirement defines an *operation* attribute with value *undo*, it is a statement that the requirement must be met prior to processing of the undo artifact.

OperationType enumerates the basic resource lifecycle operations that use the content and information defined in the SDD to change the state of the resources being installed, updated, or configured.

4.3.7.1 OperationType Property Usage Notes

Elements and attributes of *OperationType* MUST be set to one of the following values:

- **configure**: Uses the *ConfigArtifact* to perform configuration actions on a resource.
- **install**: Uses the *InstallArtifact* to install resources.
- **repair**: Uses the *RepairArtifact* to repair an installation.
- **undo**: Uses the *UndoArtifact* to restore a resource to the state before the most recent update was applied.
- **update**: Uses the *UpdateArtifact* to update an existing instance of a resource, as specified by the required base.
- **use**: Associates a requirement or completion action with use of the deployed software resources. Setting the operation attribute to *use* indicates that the requirement or completion action is not associated with an artifact.
- **uninstall**: Uses the *UninstallArtifact* to uninstall a resource.

4.3.8 ArgumentListType

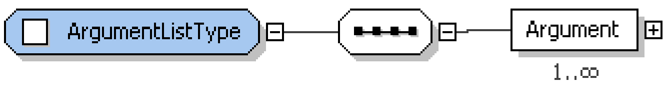


Figure 24: ArgumentListType structure.

Each artifact MAY optionally include an *Arguments* element whose type is provided by *ArgumentListType*. This simply defines a list of *Argument* elements.

4.3.8.1 ArgumentListType Property Summary

Name	Type	*	Description
Argument	ArgumentType	1..*	An input to artifact processing.

4.3.8.2 ArgumentListType Property Usage Notes

- **Argument**: An argument value is a variable expression used to define a fixed value for the argument or to define a value in terms of one of the variables visible to the artifact.

  See the *ArgumentType* section for structure and additional usage details [4.3.9].

4.3.9 ArgumentType

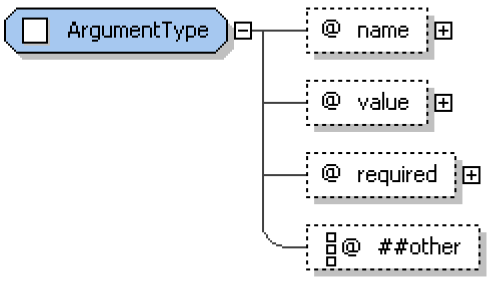


Figure 25: ArgumentType structure.

ArgumentType provides the type definition for *Argument* elements in artifacts [4.3.3]. This complex type is used to declare the argument name and optionally include a value for that argument.

4.3.9.1 ArgumentType Property Summary

Name	Type	*	Description
name	VariableExpressionType	1	The argument name.
value	VariableExpressionType	0..1	The argument value.
required	xsd:boolean	0..1	Indicates that the argument value must result in a valid expression for each particular deployment. **default value="true"
	xsd:anyAttribute	0..*	

4.3.9.2 ArgumentType Property Usage Notes

- **name**: Evaluation of the *name* expression produces the name of the argument. This can be useful for arguments with only a name, for example, those that are not name-value pairs.

  When the argument name alone is sufficient to communicate its meaning, the argument value SHOULD be omitted.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].
- **value**: Evaluation of the *value* expression provides the value of the argument.

  The variable expression MAY be used to define a fixed value for the argument or to define a value in terms of one of the variables visible to the artifact.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].
- **required**: In cases where the argument should be ignored when the value expression is not valid for a particular deployment, set required to "false".

4.3.10 OutputVariableListType

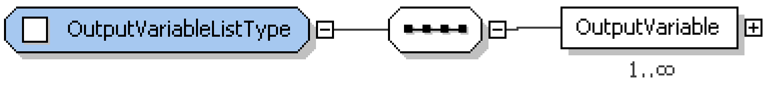


Figure 26: OutputVariableListType structure.

An artifact can set variables. The variables set by the artifact are defined in the artifact's *OutputVariables*.

4.3.10.1 OutputVariableListType Property Summary

Name	Type	*	Description
OutputVariable	OutputVariableType	1..*	An output from artifact processing.

4.3.10.2 OutputVariableListType Property Usage Notes

- **OutputVariable**: This is the definition of the variable, not a reference to a variable defined elsewhere.

  See the *OutputVariableType* section for structure and additional usage details [4.3.11].

4.3.11 OutputVariableType

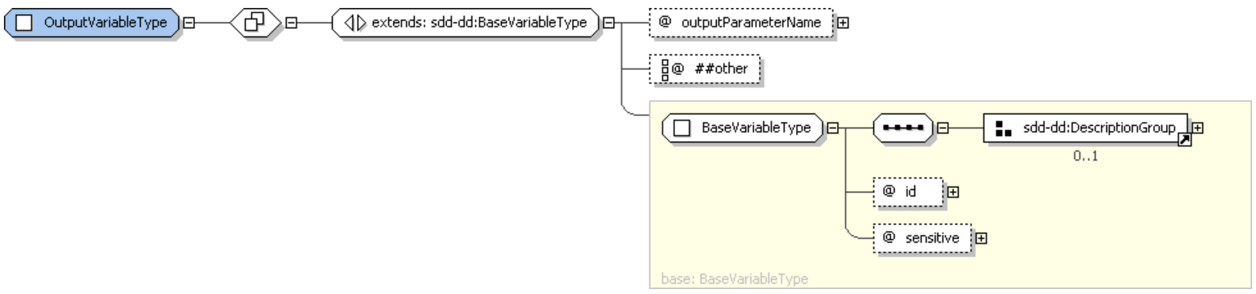


Figure 27: OutputVariableType structure.

Output variables are variables whose value is set by artifact processing. *OutputVariableType* extends *BaseVariableType* and so has all of the attributes defined there, including an *id* attribute that is used to refer to the output variable within the SDD. Output variables can be useful in log and trace messages.

4.3.11.1 OutputVariableType Property Summary

Name	Type	*	Description
	[extends] BaseVariableType		See the BaseVariableType section for additional properties [4.6.2].
outputParameterName	xsd:NCName	0..1	An output from artifact processing.
	xsd:anyAttribute	0..*	

4.3.11.2 OutputVariableType Property Usage Notes

See the *BaseVariableType* section for details of the inherited attributes and elements [4.6.2].

- **outputParameterName**: This is the name of the output variable as understood within the artifact processing environment. The output value is associated with the output variable's *id*. The SDD author uses this *id* within the SDD to refer to this output value.

4.3.12 AdditionalContentType

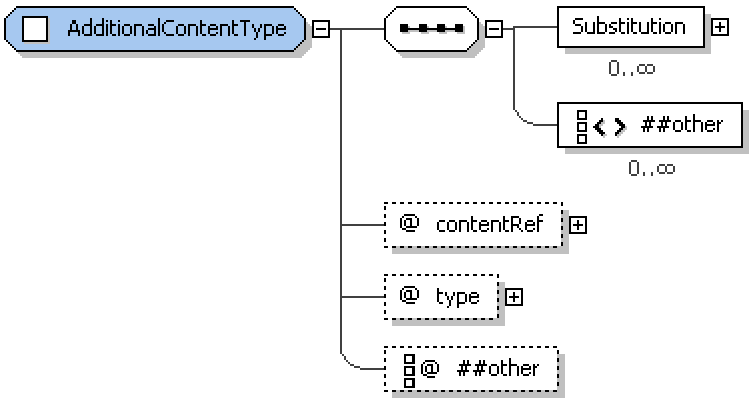


Figure 28: AdditionalContentType structure.

When artifact processing requires more than a single file, the artifact declaration includes information about the additional files needed. *AdditionalContentType* provides the type definition. Additional content MAY include input files that need to be edited to include values received as input to a particular solution deployment. In this case, the additional file can include a *Substitution* element.

4.3.12.1 AdditionalContentType Property Summary

Name	Type	*	Description
Substitution	SubstitutionType	0..*	A value to substitute into the file.
	xsd:any	0..*	
contentRef	xsd:token	1	A reference to the content element's id defined in the package descriptor.
type	ArtifactTypeNameType	0..1	Type of the additional artifact file.
	xsd:anyAttribute	0..*	

4.3.12.2 AdditionalContentType Property Usage Notes

- **Substitution**: The *Substitution* element supports the use of files that require some editing before they can be used in artifact processing. The definitions in this element support placement of values determined during a particular deployment into the file identified by the *contentRef* attribute.

  See the *SubstitutionType* section for structure and additional usage details [4.3.13].
- **contentRef**: The *contentRef* attribute points back to the package descriptor for information about the physical file. This value MUST match an *id* of a content element in the package descriptor.
- **type**: The *type* attribute identifies the format of the additional file. Values for this attribute are not defined by this specification. *ArtifactTypeNameType* restricts values of *type* to valid `xsd:QNames`.

4.3.13 SubstitutionType

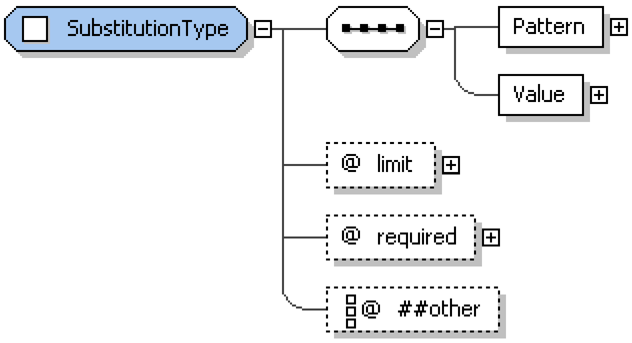


Figure 29: SubstitutionType structure.

SubstitutionType provides the type definition for the *Substitution* element in *AdditionalContent* declarations. It enables declaration of patterns in the file and the values that should replace the patterns before the file is used in artifact processing.

4.3.13.1 SubstitutionType Property Summary

Name	Type	*	Description
Pattern	xsd:string	1	The search pattern in the file that needs to be substituted.
Value	VariableExpressionType	1	The value to be substituted in the file.
limit	xsd:positiveInteger	0..1	The number of substitutions that should be made.
required	xsd:boolean	0..1	Indicates that substitution's value must result in a valid expression for each particular deployment. **default value="true"

	xsd:anyAttribute	0..*	

4.3.13.2 SubstitutionType Property Usage Notes

- **Pattern**: This is the string that will be replaced with the value when found in the file.
- **Value**: Evaluation of the variable expression results in the value that will be substituted for the pattern.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].
- **limit**: If *limit* is not defined, there is no limit and all instances of the pattern found in the file will be replaced.
- **required**: In cases where the substitution should be ignored when the value expression is not valid for a particular deployment, set required to “false”.

4.3.14 CompletionType

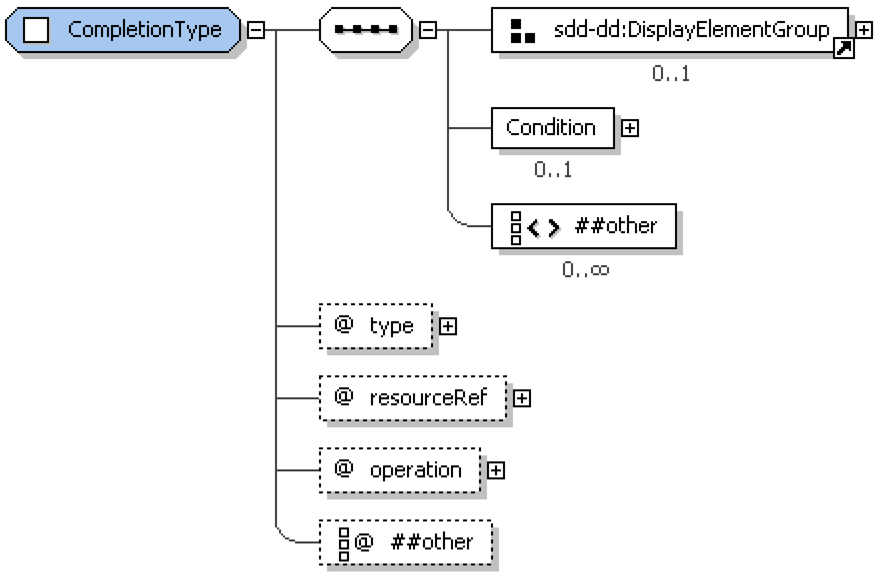


Figure 30: CompletionType structure.

For some deployments certain completion actions such as restart and logoff are required before a deployment operation using a particular content element can be considered complete. The *CompletionType* elements enable the SDD author to indicate either that one of these actions is required or that one of these actions will be performed by the associated artifact.

4.3.14.1 CompletionType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	Name of the completion action.
Description	DisplayTextType	0..1	Description of the completion action.
ShortDescription	DisplayTextType	0..1	Short description of the completion action.
Condition	ConditionType	0..1	Conditions that determine when the completion action will be used.
	xsd:any	0..*	
type	CompletionTypeNamesType	1	The type of the completion action.

resourceRef	xsd:IDREF	1	The resource where the completion action will be executed.
operation	OperationListType	1	Associates a completion action with the processing of a particular artifact.
	xsd:anyAttribute	0..*	

4.3.14.2 CompletionType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the *Completion* element.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the *Completion* element.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Condition**: *Conditions* specified on resource characteristics determine if the completion action applies. If the conditions are met, the action applies. If not met, then the action is not needed. Unmet conditions are not considered a failure. When no conditions are defined, the action always applies.

  See the *ConditionType* section for structure and additional usage details [4.5.1].
- **type**: This is the completion action that applies when conditions defined in *ResourceConstraint* are met. Allowed values defined in *CompletionTypeNameType* are:
  - **restartRequiredImmediately**: A system restart is required before the deployment operation is considered complete and the artifact associated with the operation does not perform the restart. The restart MUST happen before further deployment actions are taken.
  - **restartRequiredBeforeUse**: A system restart is required before the deployment operation is considered complete and the artifact associated with the operation does not perform this action. The restart MUST happen before the associated resources are used.
  - **restartOccurs**: The artifact associated with the lifecycle operation will initiate a system restart.
  - **logoffRequired**: A logoff and logon to the user account is required before the deployment operation is considered complete and the artifact associated with the operation does not perform this action. The logoff and logon MUST happen before the operation can be considered complete.
- **resourceRef**: This will often be the resource named as the target resource for the defining content element.

  The value MUST reference the *id* of a resource element in *Topology*.
- **operation**: A completion action is associated with the processing of one artifact by setting *operation* to the operation associated with that artifact. The element that defines the *Completion* MUST also define an artifact associated with the operation defined for the *Completion* element.

  See the *OperationListType* section for *operation* enumerations and their meaning [4.3.6].

4.4 Constraints

The SDD author needs to communicate constraints on resources for a variety of purposes.

- Some constraints must be met for the requirements of a content element to be met. See the *RequirementsType* section [4.7.1].
- Other constraints must be met for a resource to serve as the required base for an update. See the *RequiredBaseType* section [4.7.8].
- Still others must be met for to satisfy a condition that determines the applicability of a content element or completion action. See the *ConditionType* section [4.5.1] and the *CompletionType* section [4.3.14].

The *Constraint* types described in this section support identification of resource constraints in these various contexts. These types are:

- *CapacityConstraint*
- *ConsumptionConstraint*
- *PropertyConstraint*
- *VersionConstraint*
- *UniquenessConstraint*
- *RelationshipConstraint*

All of these constraint types are constraints on a property of a resource. There are different constraint types because there are distinct semantics for different types of resource properties. Examples of these varying semantics include constraints that the property value be:

- within a certain range;
- one of a set of values;
- all of a set of values;
- equal to a certain value;
- no more than or no less than a certain value;
- no more than or no less than a certain value when all constraints of that type are added together.

In all cases, deployment software must be able to discover the property's value to honor the SDD author's intent.

4.4.1 CapacityConstraintType

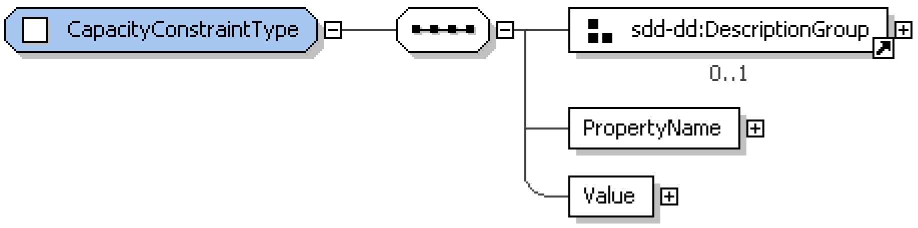


Figure 31: CapacityConstraintType structure.

CapacityConstraintType provides the type definition of the *Capacity* elements of *RequirementResourceConstraintType* [4.7.5]. These elements are used to express a requirement on the capacity of a particular resource property such as memory available from an operating system. Capacity is shared: multiple capacity constraints expressed on the same property are evaluated individually without assuming any change to the available quantity of the property.

4.4.1.1 CapacityConstraintType Property Summary

Name	Type	*	Description
Description	DisplayTextType	0..1	A description of the capacity constraint. Required if ShortDescription is defined.
ShortDescription	DisplayTextType	0..1	A short description of the capacity constraint.
PropertyName	xsd:QName	1	Name of the constrained property.
Value	CapacityValueType	1	Bounds on the value of the constrained property.

4.4.1.2 CapacityConstraintType Property Usage Notes

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the capacity constraint on the resource.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DescriptionGroup* section for structure and additional usage details [4.14.1].
- **PropertyName**: This name corresponds to the name of the constrained resource property in the environment. This name may be specified in profiles [5.3].
- **Value**: *Value* specifies the bound and optional recommended bound on the resource property identified in the *PropertyName* element.

  See the *CapacityValueType* section for structure and additional usage details [4.4.2].

4.4.2 CapacityValueType

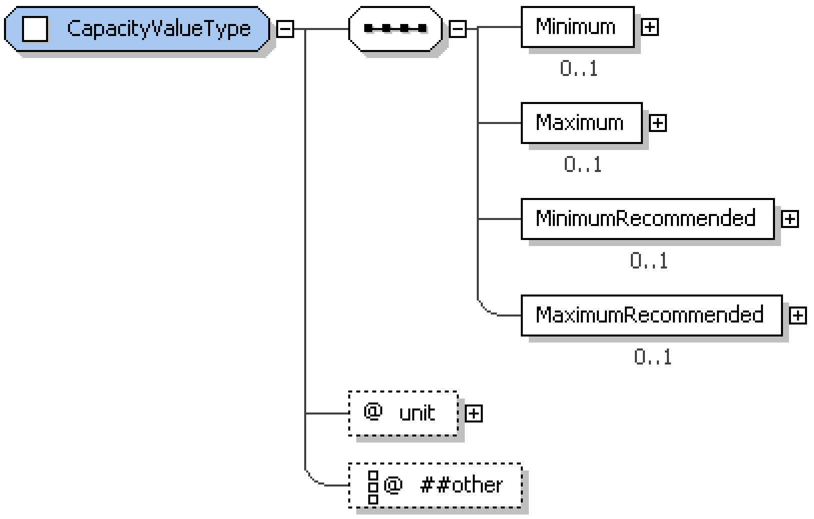


Figure 32: CapacityValueType structure.

Capacity value is expressed in terms of a minimum or maximum capacity. *CapacityValueType* provides the elements that support this expression. It also supports expression of a recommended minimum or maximum capacity.

4.4.2.1 CapacityValueType Property Summary

Name	Type	*	Description
Minimum	VariableExpressionType	0..1	Minimum capacity.
Maximum	VariableExpressionType	0..1	Maximum capacity.
MinimumRecommended	VariableExpressionType	0..1	Minimum recommended capacity.
MaximumRecommended	VariableExpressionType	0..1	Maximum recommended capacity.
unit	xsd:string	0..1	Unit of measure used to interpret the capacity value.
	xsd:anyAttribute	0..*	

4.4.2.2 CapacityValueType Property Usage Notes

- **Minimum**: There will usually be either a minimum value or a maximum value defined, but not both. When minimum is specified, the actual value of the capacity property MUST be equal to or greater than the minimum value.

See the *VariableExpressionType* section for structure and additional usage details [4.6.1].

- **Maximum**: When specified, the actual value of the capacity property MUST be less than or equal to the defined maximum.

  If *Minimum* and *Maximum* are both defined, *Minimum* MUST be less than or equal to *Maximum*.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].

- **MinimumRecommended**: The SDD author can indicate a preferred, but not required, minimum by defining a value for this element.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].

- **MaximumRecommended**: The SDD author can indicate a preferred, but not required, maximum by defining a value for this element.

  If *MinimumRecommended* and *MaximumRecommended* are both defined, *MinimumRecommended* MUST be less than or equal to *MaximumRecommended*.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].

- **unit**: Values for *unit* SHOULD be well-known units of measure from the International System of Units **[UNIT]**. A unit of measure SHOULD be specified for all properties that are measured in any kind of unit.

4.4.3 ConsumptionConstraintType

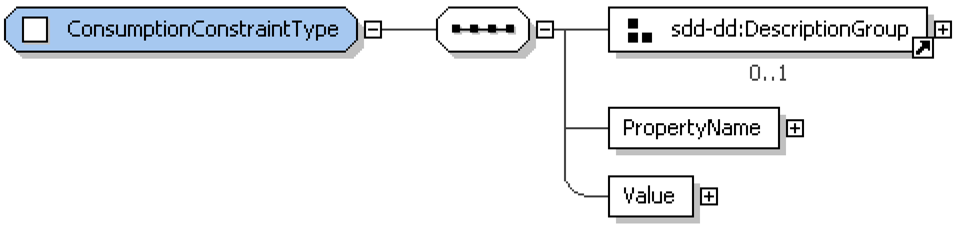


Figure 33: ConsumptionConstraintType structure.

ConsumptionConstraintType provides the type definition of the *Consumption* elements of *RequirementResourceConstraintType* [4.7.5]. These elements are used to express a requirement on the available quantity of a particular resource property such as disk space on a file system. *ConsumptionConstraints* represent exclusive use of the defined quantity of the resource property. In other words, consumption constraints are additive, with each consumption constraint specified in the SDD adding to the total requirement for the specified resource(s). A consumption constraint is assumed to alter the available quantity such that the portion of the property used to satisfy one constraint is not available to satisfy another consumption constraint on the same property.

For example, suppose that the target file system has 80 megabytes available. The application of a content element's *InstallArtifact* results in installation of files that use 5 megabytes of file space. The application of a second *InstallArtifact* results in installation of files that use 2 megabytes of file space. Consumption constraints are additive, so the total space used for this content element is 7 megabytes, leaving 73 (80–7) megabytes available on the target file system.

4.4.3.1 ConsumptionConstraintType Property Summary

Name	Type	*	Description
Description	DisplayTextType	0..1	A description of the consumption constraint. Required if ShortDescription is defined.
ShortDescription	DisplayTextType	0..1	A short description of the consumption constraint.
PropertyName	xsd:QName	1	Names the resource property to test.
Value	ConsumptionConstraintValueType	1	A variable expression defining the minimum available

			quantity.

4.4.3.2 ConsumptionConstraintType Property Usage Notes

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the consumption constraint on the resource.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DescriptionGroup* section for structure and additional usage details [4.14.1].
- **PropertyName**: The property name can be used to find the property value in the deployment environment. This name may be specified in profiles [5.3].
- **Value**: The result of evaluating this variable expression represents the minimum quantity of the named resource property that MUST be available for successful deployment of the defining content element's artifacts. This quantity will be consumed by application of the associated artifact.

  See the *ConsumptionConstraintValueType* section for structure and additional usage details [4.4.4].

4.4.4 ConsumptionConstraintValueType

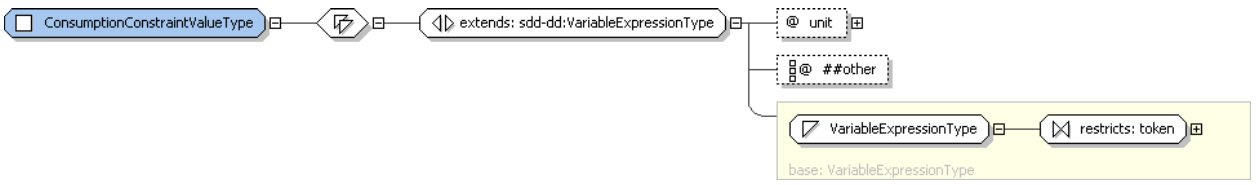

ConsumptionConstraintValueType
extends: sdd-dd:VariableExpressionType
@ unit
@ ##other
VariableExpressionType
restricts: token
base: VariableExpressionType

Figure 34: ConsumptionConstraintValueType structure.

A consumption value is defined using a variable expression. *ConsumptionConstraintValueType* provides the variable expression by extending *VariableExpressionType*.

4.4.4.1 ConsumptionConstraintValueType Property Summary

Name	Type	*	Description
	[extends] VariableExpressionType		See the VariableExpressionType section for additional properties [4.6.1].
unit	xsd:string	0..1	Unit of measure used to interpret the consumption value.
	xsd:anyAttribute	0..*	

4.4.4.2 ConsumptionConstraintValueType Property Usage Notes

See the *VariableExpressionType* section for details of the inherited attributes and elements [4.6.1].

- **unit**: Values for *unit* SHOULD be well-known units of measure from International System of Units **[UNIT]**. A unit of measure SHOULD be specified for all properties which are measured in any kind of unit.

4.4.5 PropertyConstraintType

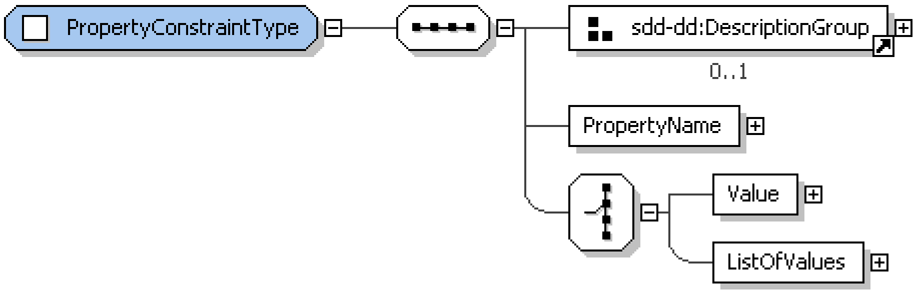


Figure 35: PropertyConstraintType structure.

PropertyConstraintType provides the type definition of the *Property* elements of *RequirementResourceConstraintType* [4.7.5]. It supports definition of a required value or set of acceptable values for a particular resource property.

4.4.5.1 PropertyConstraintType Property Summary

Name	Type	*	Description
Description	DisplayTextType	0..1	A description of the property constraint. Required if ShortDescription is defined.
ShortDescription	DisplayTextType	0..1	A short description of the property constraint.
PropertyName	xsd:QName	1	Name of the constrained property.
Value	VariableExpressionType	0..1	Required property value.
ListOfValues	PropertyValueListType	0..1	List of required property values.

4.4.5.2 PropertyConstraintType Property Usage Notes

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the property constraint on the resource.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DescriptionGroup* section for structure and additional usage details [4.14.1].
- **PropertyName**: The property name can be used to find the property value in the deployment environment. This name may be specified in profiles [5.3].
- **Value**: The result of evaluating this variable expression represents the required value of the named resource property.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].
- **ListOfValues**: A list of required values can be defined in place of a single required value.

  See the *PropertyValueListType* section for structure and additional usage details [4.4.6].

4.4.6 PropertyValueListType

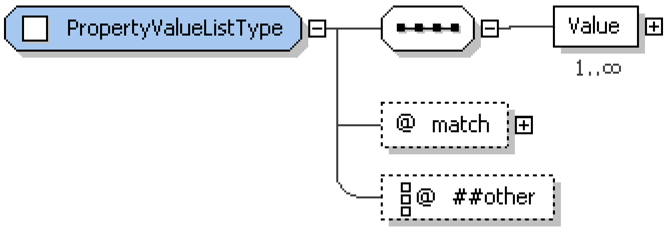


Figure 36: PropertyValueListType structure.

A property value list is expressed as one or more strings representing valid values for the property.

4.4.6.1 PropertyValueListType Property Summary

Name	Type	*	Description
Value	VariableExpressionType	1..*	A property value.
match	PropertyMatchType	0..1	Determines whether the actual property value must match any or all of the listed values. **default value="any"
	xsd:anyAttribute	0..*	

4.4.6.2 PropertyValueListType Property Usage Notes

- **Value**: The result of this variable expression represents one possible required value of the named resource property.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].
- **match**: The value or values of the property found in the deployment environment are compared to the value or values listed in the property constraint. *PropertyMatchType* defines two enumerated values: *any* and *all*. When *match* is set to *any*, the property constraint is considered met when any one of the found property values matches any one of the declared property values. When *match* is set to *all*, the constraint is considered met when all of the declared property values match values found for the property.

4.4.7 VersionConstraintType

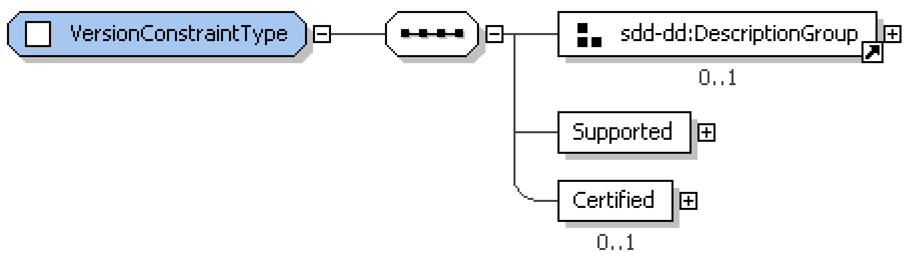


Figure 37: VersionConstraintType structure.

VersionConstraintType provides the type definition of the *VersionConstraint* elements of *RequirementResourceConstraintType* [4.7.5]. A *VersionConstraint* can define a set of individual versions or ranges of versions that are supported and a similar set that are certified.

4.4.7.1 VersionConstraintType Property Summary

Name	Type	*	Description
Description	DisplayTextType	0..1	A description of the version constraint. Required if ShortDescription is defined.
ShortDescription	DisplayTextType	0..1	A short description of the version constraint.
Supported	VersionConstraintValueType	1	A supported version or set of versions.
Certified	VersionConstraintValueType	0..1	A subset of the supported versions that are certified as tested.

4.4.7.2 VersionConstraintType Property Usage Notes

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the version constraint on the resource.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DescriptionGroup* section for structure and additional usage details [4.14.1].
- **Supported**: If the resource version is in the *Supported* set, it meets the requirements.

  See the *VersionConstraintValueType* section for structure and additional usage details [4.4.8].
- **Certified**: In some cases the set of required versions may be different from the set of versions that are certified by the manufacturer as thoroughly tested.

  See the *VersionConstraintValueType* section for structure and additional usage details [4.4.8].

4.4.8 VersionConstraintValueType

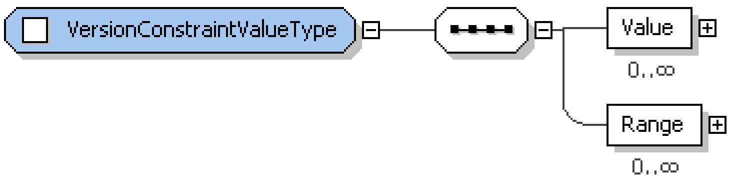


Figure 38: VersionConstraintValueType structure.

A version constraint can be specified using any number of individual version values in combination with any number of version ranges.

4.4.8.1 VersionConstraintValueType Property Summary

Name	Type	*	Description
Value	VersionValueType	0..*	A version value with associated fixes specified.
Range	VersionRangeType	0..*	A range of version values with associated fixes specified for each range.

4.4.8.2 VersionConstraintValueType Property Usage Notes

- **Value:** Discrete version values can be defined when the set of required versions includes versions that do not fall within a range. There is no assumption by this specification that version values are numerically comparable. The method of comparing version values may be resource-specific.

  See the *VersionValueType* section for structure and additional usage details [4.4.9].
- **Range**: See the *VersionRangeType* section for structure and additional usage details [4.4.10].

4.4.9 VersionValueType

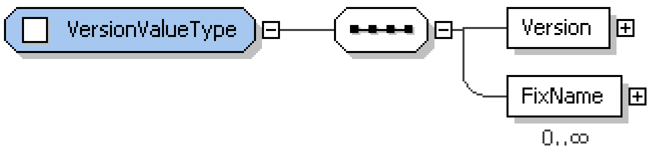


Figure 39: VersionValueType structure.

A version value includes a version and a list of required fixes associated with that version.

4.4.9.1 VersionValueType Property Summary

Name	Type	*	Description

Version	VersionType	1	An allowable version value.
FixName	xsd:string	0..*	The name of a fix.

4.4.9.2 VersionValueType Property Usage Notes

- **Version**: A string containing a single, exact version value. This is compared with the version value of specific resource instances. Only equal values satisfy this part of the constraint.

  See the *VersionType* section for structure and additional usage details [3.10].
- **FixName**: Any number of *FixName* elements can be defined, identifying fixes that must be discovered to be applied for the version constraint to be considered met.

4.4.10 VersionRangeType

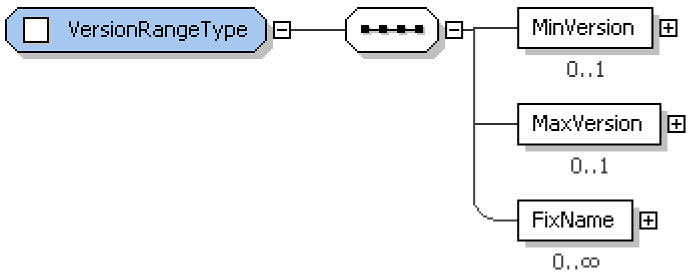


Figure 40: VersionRangeType structure.

A *VersionRange* is specified with a minimum and maximum version value and a list of required fixes associated with that range. The method of comparing version strings in a version range is resource-specific.

4.4.10.1 VersionRangeType Property Summary

Name	Type	*	Description
MinVersion	VersionType	0..1	The least allowable version value.
MaxVersion	MaxVersionType	0..1	The greatest allowable version value.
FixName	xsd:string	0..*	The name of a fix.

4.4.10.2 VersionRangeType Property Usage Notes

- **MinVersion**: This is the lower bound of a version range. If *MinVersion* is defined but *MaxVersion* is not, there is no upper bound. A version that is equal to *MinVersion* is within the defined range.

  See the *VersionType* section for structure and additional usage details [3.10].
- **MaxVersion**: This is the upper bound of a version range. If *MaxVersion* is defined but *MinVersion* is not, there is no lower bound. A version that is equal to *MaxVersion* may be within the defined range depending on the value specified for the *inclusive* attribute.

  See the *MaxVersionType* section for structure and additional usage details [4.4.11].
- **FixName**: Any number of *FixNames* can be defined identifying fixes that must be found to be applied for the version constraint is to be considered satisfied. This is true for all versions within the defined range.

  When *FixName* is defined, either a *MinVersion* or a *MaxVersion* element MUST also be defined.

4.4.11 MaxVersionType

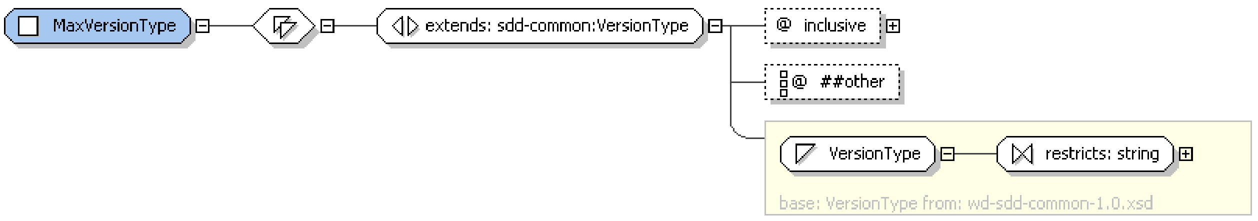

MaxVersionType
extends: sdd-common:VersionType
inclusive
##other
VersionType
restricts: string
base: VersionType from: wd-sdd-common-1.0.xsd

Figure 41: MaxVersionType structure.

A maximum version can be inclusive or exclusive.

4.4.11.1 MaxVersionType Property Summary

Name	Type	*	Description
	[extends] VersionType		See the VersionType section for additional properties [3.10].
inclusive	xsd:boolean	0..1	Indicates whether the max version value is included in the supported range of versions. **default value="false"
	xsd:any	0..*	

4.4.11.2 MaxVersionType Property Usage Notes

See the *VersionType* section for details of the inherited attributes and elements [3.10].

- **inclusive**: The *inclusive* attribute allows the SDD author to choose the semantics of maximum version. Supported ranges are often everything equal to or greater than the minimum version and up to, but not including, the maximum version. Sometimes it is more convenient for the range to include the maximum version.

4.4.12 UniquenessConstraintType

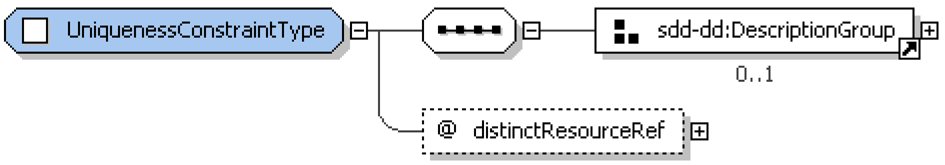


Figure 42: UniquenessConstraintType structure.

A *UniquenessConstraint* is used to indicate when two resources defined in topology MUST or MUST NOT resolve to the same resource instance during a particular deployment. A *UniquenessConstraint* indicates that the two resources MUST NOT be the same when it is defined in a *ResourceConstraint* element with testValue="true". A *UniquenessConstraint* indicates that the two resources MUST be the same when defined in a *ResourceConstraint* with testValue="false".

When no *UniquenessConstraint* is in scope for a particular pair of resources, the two resources MAY resolve to the same resource when their identifying characteristics are the same and when all in-scope constraints on both resources are satisfied.

The first of the pair of resources is identified in the *resourceRef* attribute of the *ResourceConstraint* element that defines the *UniquenessConstraint*. The second of the pair is identified in the *distinctResourceRef* attribute of the *UniquenessConstraint*.

4.4.12.1 UniquenessConstraintType Property Summary

Name	Type	*	Description

Description	DisplayTextType	0..1	A description of the uniqueness constraint, for example what must or must not be unique and why.
ShortDescription	DisplayTextType	0..1	A short description of the uniqueness constraint.
distinctResourceRef	xsd:IDREF	1	One of the pair of resources referred to by the constraint.

4.4.12.2 UniquenessConstraintType Property Usage Notes

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the uniqueness constraint on the resource.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DescriptionGroup* section for structure and additional usage details [4.14.1].
- **distinctResourceRef**: The second resource in the pair of resources.

  The value MUST reference the *id* of a resource element in *Topology*.

4.4.13 RelationshipConstraintType

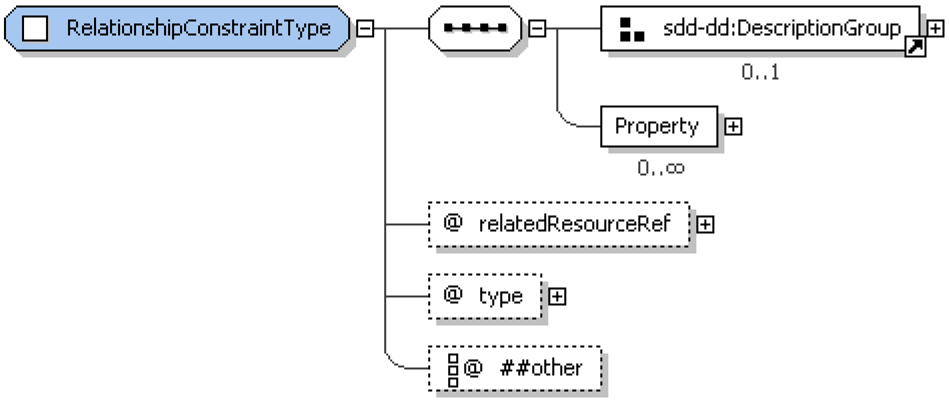


Figure 43: RelationshipConstraintType structure.

A *RelationshipConstraint* identifies a particular relationship between two resources that is constrained in some way by the SDD. The value of the *testValue* attribute of the *ResourceConstraint* that contains the *RelationshipConstraint* determines whether the constraint MUST be satisfied or MUST NOT be satisfied.

The first resource of the pair is defined by the *resourceRef* attribute of the *ResourceConstraint* containing the *RelationshipConstraint*.

4.4.13.1 RelationshipConstraintType Property Summary

Name	Type	*	Description
Description	DisplayTextType	0..1	A description of the relationship and its purpose in the overall solution.
ShortDescription	DisplayTextType	0..1	A short description of the relationship.
Property	PropertyType	0..*	A property constraint that further constrains the relationship.
relatedResourceRef	xsd:IDREF	0..1	The second resource in the relationship.
type	xsd:QName	1	The type of the relationship.
	xsd:anyAttribute	0..*	

4.4.13.2 RelationshipConstraintType Property Usage Notes

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the relationship constraint on the resource.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DescriptionGroup* section for structure and additional usage details [4.14.1].
- **Property**: This element MAY be used to provide additional constraints on the relationship.

  For example, a connectivity relationship might specify additional information such as the specific protocol used (for instance, TCP/IP) and/or particular characteristics of a protocol (for instance, port number).

  See the *PropertyType* section for structure and additional usage details [4.2.3].
- **relatedResourceRef**: Naming the second resource is optional. When it is not named, the relationship constraint is satisfied if the first resource has the defined relationship with any other resource.

  When it is named, the value MUST reference the *id* of a resource element in *Topology*.
- **type**: Values for relationship type are not defined by the SDD specification.

4.5 Conditions

Conditions are expressed on characteristics of resources in the deployment environment. Conditions are used to indicate when particular elements of the SDD are applicable, or when they should be ignored. Conditions are not requirements. Failure to satisfy a condition does not indicate a failure; it simply means the conditioned element should be ignored. Conditions are used to:

- determine if a content element is applicable
- choose from among values for a variable
- determine when a feature is applicable
- determine when a particular result is applicable
- determine if a particular completion action is necessary.

Because conditions are always based on the characteristics of resources, they are expressed using resource constraints.

4.5.1 ConditionType

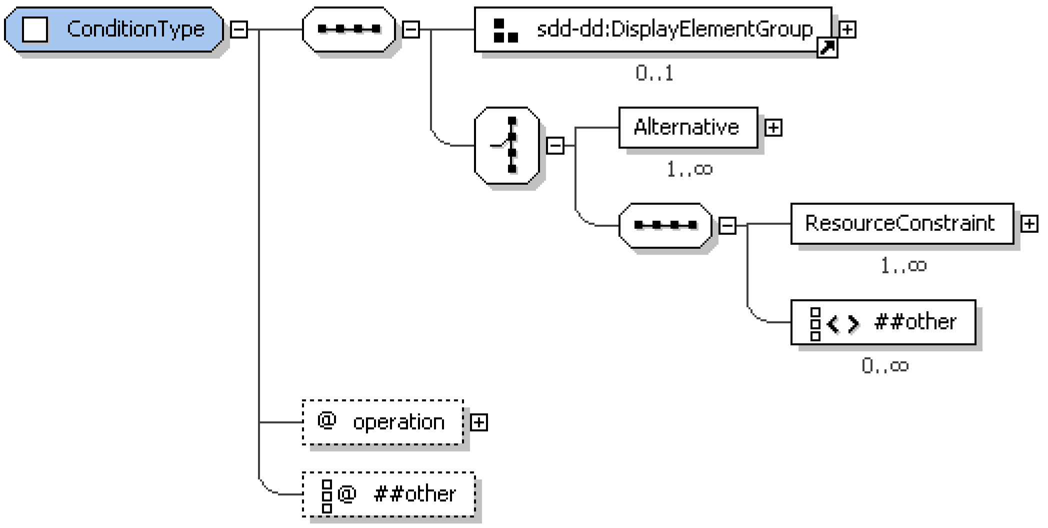


Figure 44: ConditionType structure.

ConditionType allows expression of the particular resource characteristics that must be true for the condition to be considered met. These are resource characteristics that may vary from one particular deployment to another.

For example, one deployment using the SDD might use one version of an application server and a different deployment might use a different version. The differences in the version might be great enough to:

- select among content elements.

  For example, one content element has an artifact for a Web application that works in a particular version and a different content element has an artifact for a later version of the same Web application.
- select among variable values.

  For example, the default installation path on one operating system may be different from the default install path on another operating system.
- select among completion actions.

  For example, a reboot may be required when deploying on one operating system but not another.

4.5.1.1 ConditionType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	Name of the condition.
Description	DisplayTextType	0..1	Description of the condition.
ShortDescription	DisplayTextType	0..1	Short description of the condition.
Alternative	AlternativeConditionalType	0..*	An alternative set of resource constraints.
ResourceConstraint	ConditionalResourceConstraintType	0..*	A set of constraints on one resource.
	xsd:any	0..*	
operation	OperationListType	0..1	The condition applies only when processing the artifact associated with this operation.
	xsd:anyAttribute	0..*	

4.5.1.2 ConditionType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the condition.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the condition.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Alternative**: When a condition can be satisfied in multiple ways, two or more *Alternative* elements are defined.

  As a convenience for tooling that produces SDDs, it is also possible to define a single *Alternative*. This is semantically identical to directly defining *ResourceConstraints*.

  To meet a condition, at least one of the specified *Alternatives* must be satisfied.

  See the *AlternativeConditionalType* section for structure and additional usage details [4.5.2].

- **ResourceConstraint**: When a condition can be satisfied in only one way, constraints MAY be defined directly under *Condition* or in a single *Alternative* element.

  Constraints are defined using a sequence of *ResourceConstraints*. Every constraint in the sequence must be met for the condition to be met.

  See the *ConditionalResourceConstraintType* section for structure and additional usage details [4.5.3].

- **operation**: In a singleton atomic content element, a condition MAY be associated with application of one or more artifacts. The association is made by setting the *operation* attribute to the operations associated with those artifacts.

  Conditions defined for *CompositeInstallable* and for atomic content elements defined within a *CompositeInstallable* SHOULD NOT define *operation*. If the *operation* is defined for a *CompositeInstallable Condition*, it MUST be set to the operation defined in the *CompositeInstallable's operation* attribute. If *operation* is defined for an atomic content element's *Condition*, it MUST be set to the operation associated with the single artifact defined by the atomic content element.

  When *operation* is not specified, the condition applies to the processing of all artifacts.

  See the *OperationListType* section for *operation* enumerations and their meaning [4.3.6].

4.5.2 AlternativeConditionalType

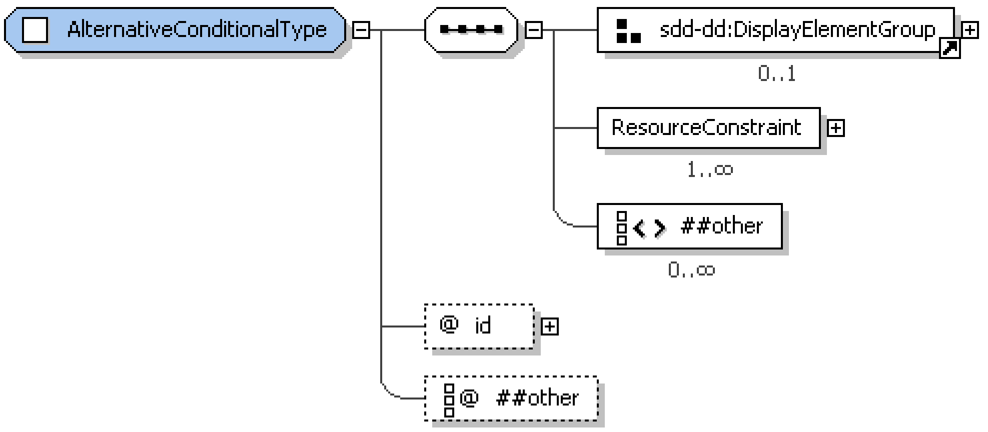


Figure 45: AlternativeConditionalType structure.

When a condition can be met in more than one way, alternative sets of conditional resource constraints can be defined. *AlternativeConditionalType* provides the type definition for these elements.

4.5.2.1 AlternativeConditionalType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	Name of the alternative.
Description	DisplayTextType	0..1	Description for the alternative.
ShortDescription	DisplayTextType	0..1	Short description of the alternative.
ResourceConstraint	ConditionalResourceConstraintType	1..*	A set of constraints on one resource.
	xsd:any	0..*	
id	xsd:IDREF	1	Identifier for the alternative that is unique within the deployment descriptor.
	xsd:anyAttribute	0..*	

4.5.2.2 AlternativeConditionalType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the alternative condition.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the alternative condition.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **ResourceConstraint**: All constraints defined in the individual *Alternative* MUST be met for the *Alternative* condition to evaluate to true.

  See the *ConditionalResourceConstraintType* section for structure and additional usage details [4.5.3].
- **id**: The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.

4.5.3 ConditionalResourceConstraintType

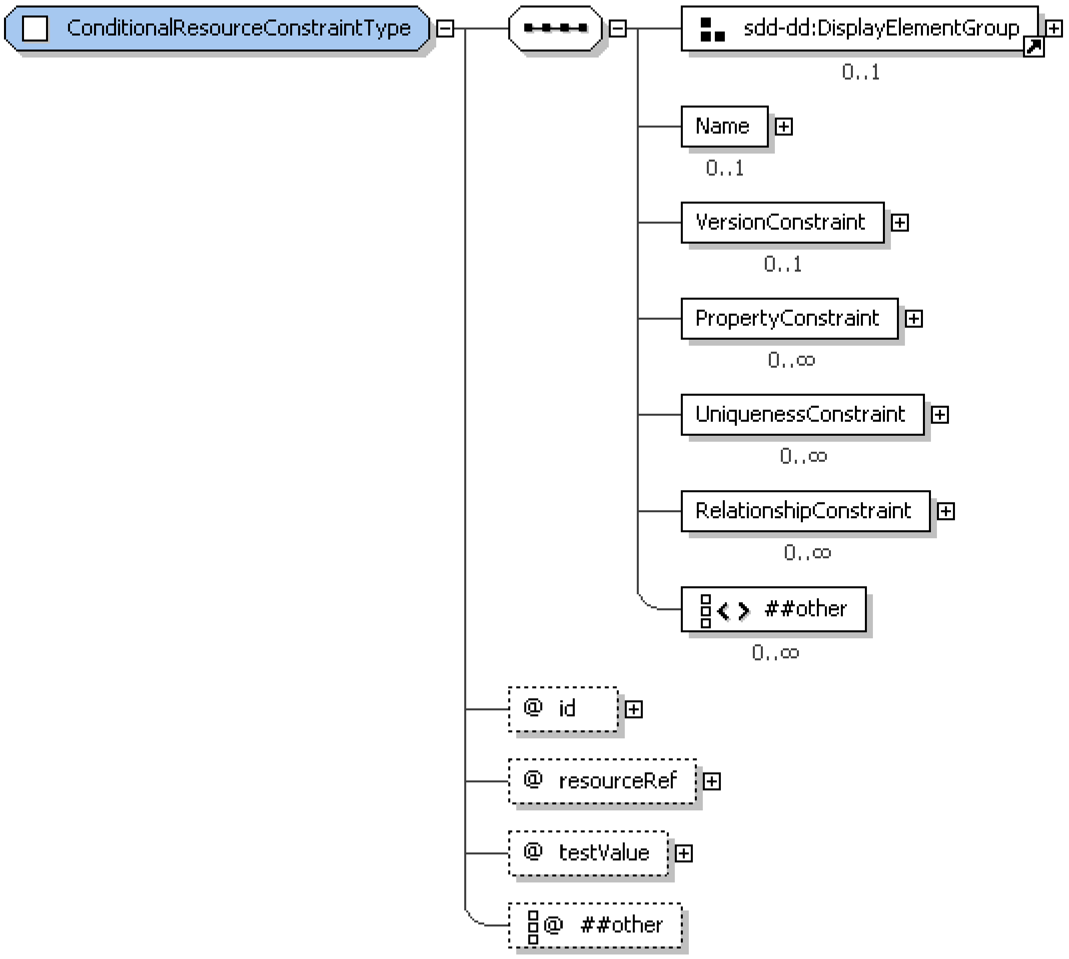


Figure 46: ConditionalResourceConstraintType structure.

ConditionalResourceConstraintType provides the type definitions for the *ResourceConstraint* elements used in conditions. These constraints do not represent requirements for deployment. They identify the resource characteristics associated with a condition. Name, version, property and the existence or absence of the resource can be specified with a resource constraint used in a condition.

4.5.3.1 ConditionalResourceConstraintType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	Name of the resource constraint.
Description	DisplayTextType	0..1	Description for the resource constraint.
ShortDescription	DisplayTextType	0..1	Short description of the resource constraint.
Name	VariableExpressionType	0..1	Name of the resource constraint.
VersionConstraint	VersionConstraintValueType	0..1	A resource version set.
PropertyConstraint	ConditionalPropertyConstraintType	0..*	A resource property name and required value.
UniquenessConstraint	UniquenessConstraintType	0..*	A required mapping of two resources in the topology to unique instances in the deployment environment.
RelationshipConstraint	RelationshipConstraintType	0..*	A required relationship between the resource identified in the resourceRef and another resource in the topology.
	xsd:any	0..*	
id	xsd:ID	1	Identifier for the resource constraint that is unique within the deployment descriptor.
resourceRef	xsd:IDREF	1	The resource to which the conditions apply.
testValue	xsd:boolean	0..1	The result of evaluating the contained constraints, which will result in the ResourceConstraint being met. **default value="true"
	xsd:anyAttribute	0..*	

4.5.3.2 ConditionalResourceConstraintType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the resource constraint.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the resource constraint.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Name**: The name of the resource identified by *resourceRef*. If the resource name is defined in topology it SHOULD NOT be defined here. If it is defined in both places, the one defined in the condition is used when evaluating the condition.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].
- **VersionConstraint**: The actual version of the resource MUST be one of the set of versions defined here for the version condition to be considered met.

  See the *VersionConstraintValueType* section for structure and additional usage details [4.4.8].
- **PropertyConstraint**: The actual value of the property MUST match the value defined here for the condition to be considered met.

  See the *ConditionalPropertyConstraintType* section for structure and additional usage details [4.5.4].

- **UniquenessConstraint**: *UniquenessConstraint* elements are used in *ResourceConstraints* to indicate when two resources defined in topology MUST or MUST NOT resolve to the same resource instance during a particular deployment.

  See the *UniquenessConstraintType* section for structure and additional usage details [4.4.12].
- **RelationshipConstraint**: *RelationshipConstraint* elements are used in *ResourceConstraints* to indicate a constraint on a particular relationship between resources.

  See the *RelationshipConstraintType* section for structure and additional usage details [4.4.13].
- **id**: The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.
- **resourceRef**: The version and property constraints defined here all apply to the one resource specification in topology identified by this attribute.

  The value MUST reference the *id* of that resource element in *Topology*.
- **testValue**: When the result of evaluating *Name* and all of the constraints defined in the *ResourceConstraint* matches the value of *testValue*, the *ResourceConstraint* is considered met.

  When no name, version or property constraints are defined, and *testValue* is “true”, the constraint is met if the resource exists as defined in topology.

  When no name, version or property constraints are defined, and *testValue* is “false”, the constraint is met if the resource, as defined in topology, does not exist.

4.5.4 ConditionalPropertyConstraintType

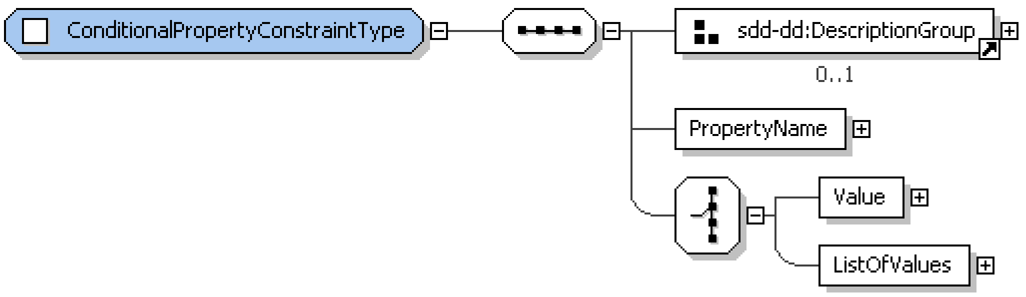


Figure 47: ConditionalPropertyConstraintType structure.

ConditionalPropertyConstraintType provides the type definition for a *PropertyConstraint* included within *Alternatives* specified in *Condition* elements. The *ConditionalPropertyConstraintType* is very similar to the *PropertyConstraintType*; the only difference is that the *Value* element defined in the *ConditionalPropertyConstraintType* is of type `xsd:string` which is less restrictive than the *Value* element defined in the *PropertyConstraintType* which is of *VariableExpressionType*.

4.5.4.1 ConditionalPropertyConstraintType Property Summary

Name	Type	*	Description
Description	DisplayTextType	0..1	A description of the property constraint. Required if ShortDescription is defined.
ShortDescription	DisplayTextType	0..1	A short description of the property constraint.
PropertyName	xsd:QName	1	Name of the constrained property.
Value	xsd:string	0..1	Required property value.
ListOfValues	PropertyValueListType	0..1	List of required property values.

4.5.4.2 ConditionalPropertyConstraintType Property Usage Notes

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the *PropertyConstraint* element.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DescriptionGroup* section for structure and additional usage details [4.14.1].
- **PropertyName**: The property name can be used to find the property value in the deployment environment. The name may be defined in a profile [5.3].
- **Value**: In a condition, the value used in a property constraint is a string rather than a variable expression.
- **ListOfValues**: A list of required values can be defined in place of a single required value.

  See the *PropertyValueListType* section for structure and additional usage details [4.4.6].

4.6 Variables

Variables provide a means to associate user inputs, resource property values, fixed strings and values derived from these with input arguments for artifacts and with constraints on resources.

4.6.1 VariableExpressionType

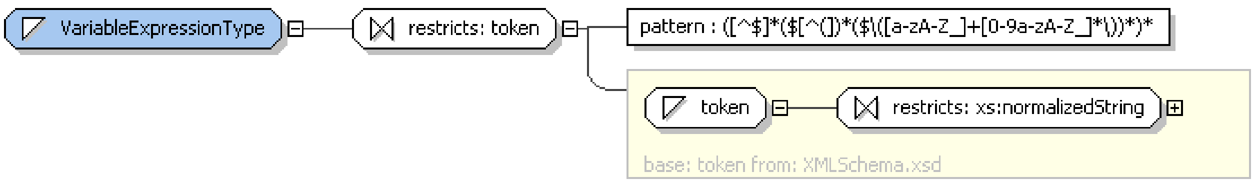

VariableExpressionType
restricts: token
pattern : ([^$]*($[^(])*($\([a-zA-Z_]+[0-9a-zA-Z_]*\))*)*
token
restricts: xs:normalizedString
base: token from: XMLSchema.xsd

Figure 48: VariableExpressionType structure.

Variable expressions are used in many places in the SDD. They allow the value of a variable to be used as all, or part of, the value of some other SDD element. A variable expression is a string that can include a reference to a variable. The string is evaluated by replacing all references to variables with the value of the variable. A variable reference is a variable id placed inside parentheses preceded by a dollar sign.

> For example, the variable expression “C:\Program Files\$(InstallDirectory)” resolves to “C:\Program Files\Acme Software Product” if the value of the variable with the id “InstallDirectory” has the value “Acme Software Product”.

The value of a variable that is replaced into a variable expression can itself have a variable reference. This reference is resolved before using the value. This nesting of variable expressions is unlimited. Any number of variable references can be used in a variable expression. If a variable expression string does not contain a variable reference, it is used as is.

A variable is considered defined if it has a value provided, even if that value is the empty string. A variable expression is considered valid if it contains no variable references, or if all contained variable references are defined.

Specifically, a *ResourceProperty* variable is undefined when the resource does not participate in the particular deployment or when the specified property has no value. A *Parameter* variable is undefined when it has no default value and has no value provided by the deployer. A *DerivedVariable* that uses *ConditionalExpression* elements is undefined when none of its conditions evaluates to true, or the selected condition's value expression is not valid. A *DerivedVariable* that uses an unconditioned *Expression* is undefined when its value expression is undefined.

To avoid an undefined *Parameter* variable, default parameter values may be used. To avoid an undefined *ResourceProperty* variable, replace references to the *ResourceProperty* variable with references to a *DerivedVariable* defined to provide a default value in cases where the *ResourceProperty* is undefined. This *DerivedVariable* would define one expression, conditioned on the resource, that refers to the *ResourceProperty* variable and another, low priority, catch-all expression that defines the desired “default” value. Note that the default value in either of these cases MAY be an empty string, for example,

"". An empty string acts just like any other defined variable value. When the provided value of a variable is an empty string, the variable reference in a variable expression is replaced by an empty string.

4.6.2 BaseVariableType

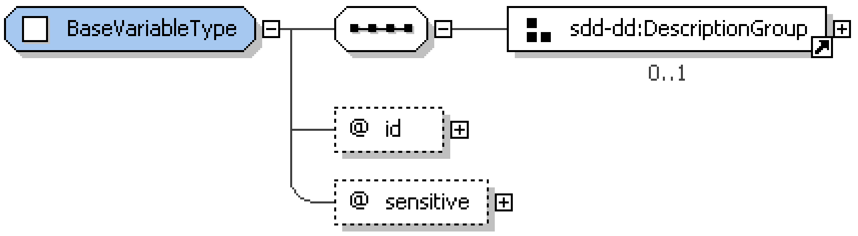


Figure 49: BaseVariableType structure.

BaseVariableType is the base type of the *DerivedVariable* and *ResourceProperty* elements defined by *VariablesType* [4.6.3]. It provides the *id* attribute, which is used to reference the variable in a variable expression.

4.6.2.1 BaseVariableType Property Summary

Name	Type	*	Description
Description	DisplayTextType	0..1	Description of the variable.
ShortDescription	DisplayTextType	0..1	Short description of the variable.
id	xsd:ID	1	Identifier used for referencing the variable within the descriptor.
sensitive	xsd:boolean	0..1	A "true" value indicates the variable contains sensitive data. **default value="false"

4.6.2.2 BaseVariableType Property Usage Notes

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the variable.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DescriptionGroup* section for structure and additional usage details [4.14.1].

- **id**: Variables may be referenced in deployment descriptor elements of type *VariableExpression* within the scope of the variable. The scope of the variable includes the content element where defined and all nested content elements. *Variables* defined in the top level content element are also visible in *Topology*. The *Variable* is referenced by placing the variable *id* within parentheses preceded by a dollar sign.

  For example, a variable with *id* value "InstallLocation" is referenced with the string "$(InstallLocation)".

  The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.

- **sensitive**: The *sensitive* attribute provides an indication of whether the data within a variable is likely to be considered sensitive. User name and password are examples of data that may be considered sensitive.

  For example, *sensitive* data typically would not be displayed in a user interface, written to a log file, stored without protection, or in any way made visible except to authorized users.

  The default value is "false".

4.6.3 VariablesType

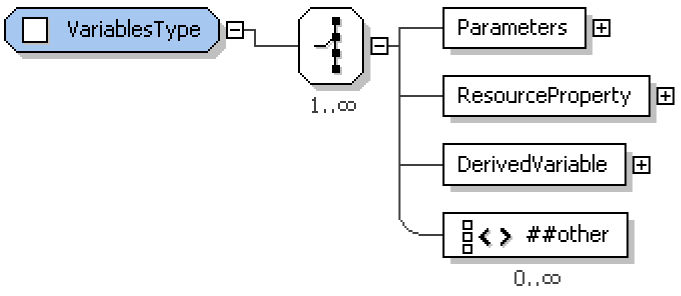


Figure 50: VariablesType structure.

There are three types of variables that can be defined in a content element: input parameter variables, variables that take the value of a resource property, and variables whose value is derived from a variable expression.

A variable is in scope for a particular deployment when the content element that defines the variable is in scope for that deployment.

4.6.3.1 VariablesType Property Summary

Name	Type	*	Description
Parameters	ParametersType	0..*	A list of variables whose values can be supplied as input to the deployment process.
ResourceProperty	ResourcePropertyType	0..*	A variable whose value is set from the value of a resource property.
DerivedVariable	DerivedVariableType	0..*	A set of expressions with optional associated conditions. The DerivedVariable's value is determined by evaluating the conditions and then setting the variable value to the result of the top priority expression from the set of expressions whose conditions evaluate to true.
	xsd:any	0..*	

4.6.3.2 VariablesType Property Usage Notes

- **Parameters**: See the *ParametersType* section for structure and additional usage details [4.6.4].
- **ResourceProperty**: See the *ResourcePropertyType* section for structure and additional usage details [4.6.12].
- **DerivedVariable**: See the *DerivedVariableType* section for structure and additional usage details [4.6.13].

4.6.4 ParametersType

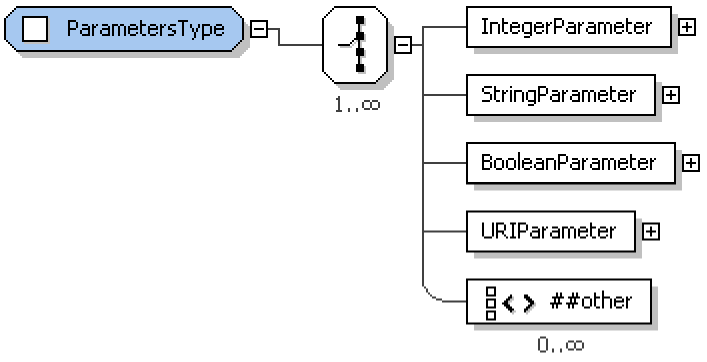


Figure 51: ParametersType structure.

Parameters are variables whose value is expected to be received as input to the deployment process. The SDD author can specify multiple specific types of parameters, including validation rules for the values of the parameters.

4.6.4.1 ParametersType Property Summary

Name	Type	*	Description
IntegerParameter	IntegerParameterType	0..*	An integer input parameter.
StringParameter	StringParameterType	0..*	A string input parameter.
BooleanParameter	BooleanParameterType	0..*	A boolean input parameter.
URIParameter	URIParameterType	0..*	A Universal Resource Identifier input parameter.
	xsd:any	0..*	

4.6.4.2 ParametersType Property Usage Notes

- **IntegerParameter**: See the *IntegerParameterType* section for structure and additional usage details [4.6.6].
- **StringParameter**: See the *StringParameterType* section for structure and additional usage details [4.6.8].
- **BooleanParameter**: See the *BooleanParameterType* section for structure and additional usage details [4.6.10].
- **URIParameter**: See the *URIParameterType* section for structure and additional usage details [4.6.11].

4.6.5 BaseParameterType

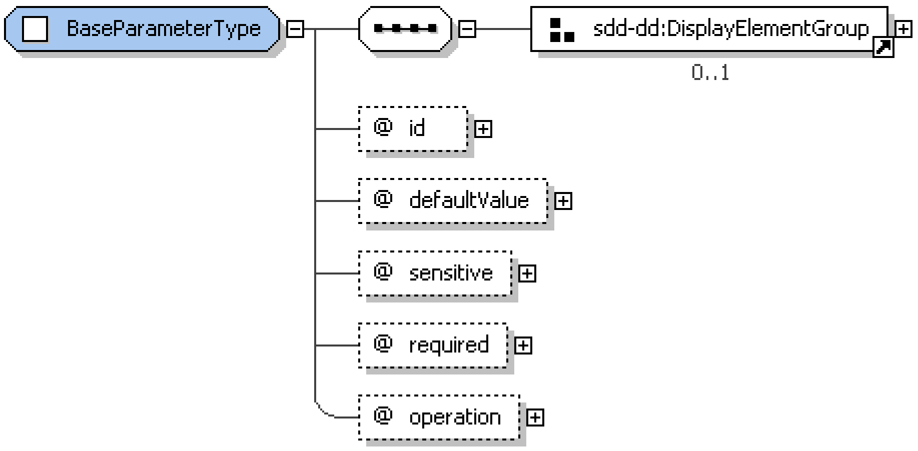


Figure 52: BaseParameterType structure.

BaseParameterType provides a default value, along with other attributes used by all parameter types. It also provides the *id* attribute, which is used to reference the parameter in variable expressions.

4.6.5.1 BaseParameterType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	Name of the parameter.
Description	DisplayTextType	0..1	Description of the parameter.
ShortDescription	DisplayTextType	0..1	Short description of the parameter.
id	xsd:ID	1	Identifier used for referencing the variable within the descriptor.
defaultValue	VariableExpressionType	0..1	Default value for the parameter.
sensitive	xsd:boolean	0..1	A “true” value indicates the variable contains sensitive data. **default value=“false”
required	xsd:boolean	0..1	A “true” value indicates that a value for the parameter must be provided. **default value=“true”
operation	OperationListType	0..1	The parameter is used when the specified operation(s) is (are) performed.

4.6.5.2 BaseParameterType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the parameter.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the parameter.

  These elements may be used to assist the deployer in understanding the purpose and expected values for the parameters.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].

- **id**: Parameters may be referenced in *DeploymentDescriptor* elements of type *VariableExpression* within the scope of the parameter variable. The scope of the variable includes the content element where the variable is defined and all nested content elements. Variables defined in the top level content element are also visible in *Topology*. The *Variable* is referenced by placing the variable *id* within parentheses preceded by a dollar sign.

  For example, a variable with *id* value “InstallLocation” is referenced with the string “$(InstallLocation)”.

  The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.
- **defaultValue**: The *defaultValue* is used if no other value is provided as input to the deployment process.

  The value is interpreted based on the type of the defining parameter.

  For example, the *defaultValue* for a *BooleanParameter* must be either “true” or “false”; the *defaultValue* for a *StringParameter* must be a string; etc.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].
- **sensitive**: The *sensitive* attribute provides an indication of whether the data within a variable is likely to be considered sensitive. User name and password are examples of data that may be considered sensitive.

  For example, *sensitive* data typically would not be displayed in a user interface, written to a log file, stored without protection, or in any way made visible except to authorized users.
- **required**: A “true” value for *required* indicates that a value for the parameter must be provided when the parameter is in scope for a particular deployment.

  In cases where the parameter should be ignored when the value expression is not valid for a particular deployment, set required to "false".

  A “false” value for the *required* attribute has no effect when *defaultValue* is set.
- **operation**: This attribute enables unique parameters to be defined per operation. Note that the use of a parameter for a particular operation is determined by a reference to the parameter in a variable expression or artifact argument used when performing that operation. The operation(s) associated with a parameter’s use can be determined by examining its use in the SDD. The *operation* attribute provides a quick way to know which operation(s) will use the parameter without having to examine the use of the parameter.

  All parameters defined within a *CompositeInstallable* are associated with the single operation supported by the *CompositeInstallalbe*. The *operation* attribute SHOULD NOT be set in this situation.

  See the *OperationListType* section for *operation* enumerations and their meaning [4.3.6].

4.6.6 IntegerParameterType

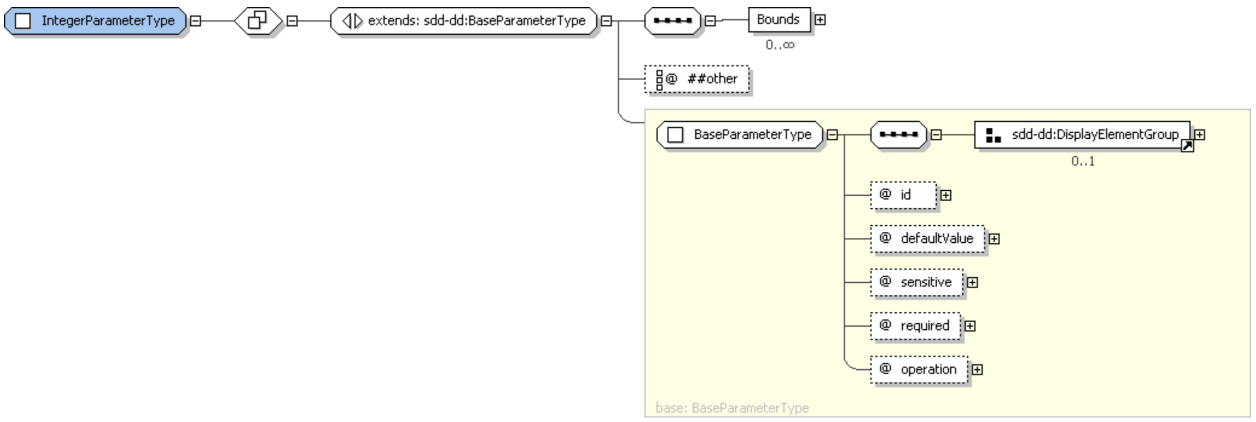


Figure 53: IntegerParameterType structure.

IntegerParameterType defines upper and lower bounds that can be used to validate the input received for that parameter.

4.6.6.1 IntegerParameterType Property Summary

Name	Type	*	Description
	[extends] BaseParameterType		See the BaseParameterType section for additional properties [4.6.5].
Bounds	BoundaryType	0..*	Specifies the boundaries for the value of the parameter.
	xsd:anyAttribute	0..*	

4.6.6.2 IntegerParameterType Property Usage Notes

See the *BaseParameterType* section for details of the inherited attributes and elements [4.6.5].

- **Bounds**: If there are restrictions on the range of values that are valid for a parameter, those restrictions MUST be specified in *Bounds*.

  See the *BoundaryType* section for structure and additional usage details [4.6.7].

4.6.7 BoundaryType

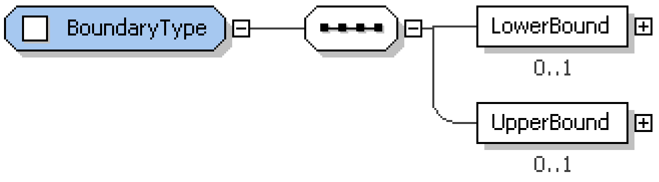


Figure 54: BoundaryType structure.

BoundaryType defines upper and lower bounds that can be used to validate the input received for that parameter.

4.6.7.1 BoundaryType Property Summary

Name	Type	*	Description
LowerBound	VariableExpressionType	0..1	Lowest valid value for the parameter.
UpperBound	VariableExpressionType	0..1	Highest valid value for the parameter.

4.6.7.2 BoundaryType Property Usage Notes

- **LowerBound**: This variable expression MUST resolve to an integer.

  If no *LowerBound* is specified, no integer value is too low.

  A *LowerBound* of “0” restricts the integer parameter to positive integer values.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].
- **UpperBound**: This variable expression MUST resolve to an integer.

  If no *UpperBound* is specified, no integer value is too high.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].

4.6.8 StringParameterType

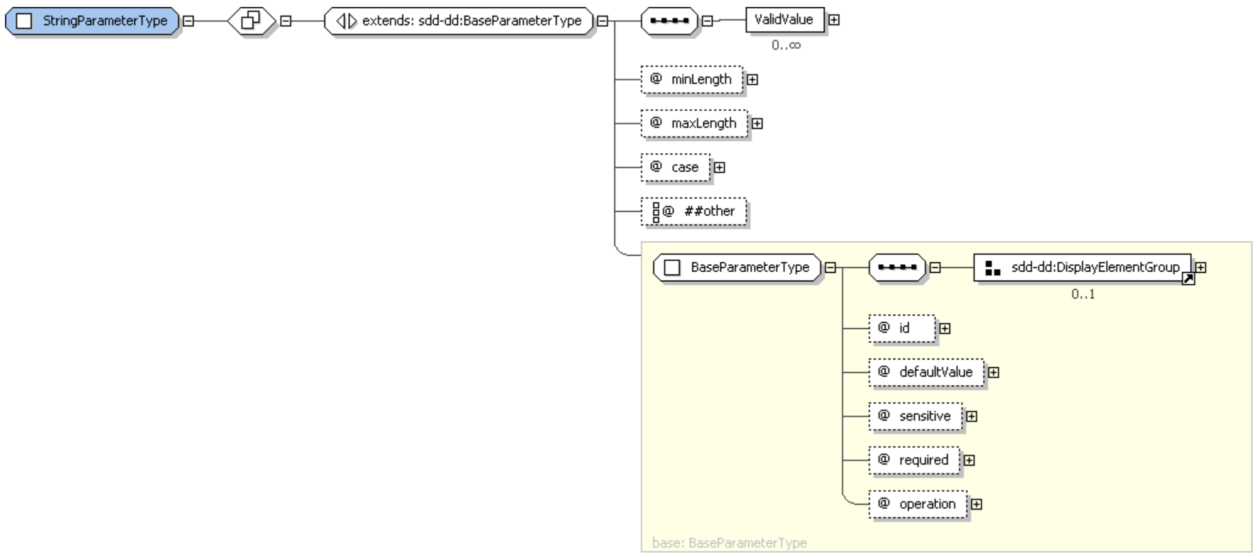


Figure 55: StringParameterType structure.

StringParameterType supports definition of minimum and maximum lengths that can be used to validate the input received for the string parameter. It also supports definition of a list of valid input values.

4.6.8.1 StringParameterType Property Summary

Name	Type	*	Description
	[extends] BaseParameterType		See the BaseParameterType section for additional properties [4.6.5].
ValidValue	xsd:string	0..*	A string representing one valid value for the parameter.
minLength	xsd:positiveInteger	0..1	Minimum length of the parameter value.
maxLength	xsd:positiveInteger	0..1	Maximum length of the parameter value.
case	StringCaseType	0..1	The case of the string–"upper", "lower" or "mixed". **default value="mixed"
	xsd:anyAttribute	0..*	

4.6.8.2 StringParameterType Property Usage Notes

See the *BaseParameterType* section for details of the inherited attributes and elements [4.6.5].

- **ValidValue**: Any number of valid values for the parameter can be listed using *ValidValue* elements.

  When both *defaultValue* and one or more *ValidValues* are specified, *defaultValue* MUST match one of the *ValidValues*.

  ValidValues should be in the correct case as identified in the *case* attribute.
- **minLength**: When no minimum length is specified, no string is too short, including an empty string.
- **maxLength**: When no maximum length is specified, no string is too long.
- **case**: Used when the case of the string is restricted. Defaults to *mixed* if not defined.

  See the *StringCaseType* section for enumeration values and their meaning [4.6.9].

4.6.9 StringCaseType

StringCaseType defines the enumeration values for specifying case restrictions on a string parameter.

4.6.9.1 StringCaseType Property Usage Notes

- **lower**: The string MUST be lower case.
- **upper**: The string MUST be upper case.
- **mixed**: The string SHOULD be mixed case.

4.6.10 BooleanParameterType

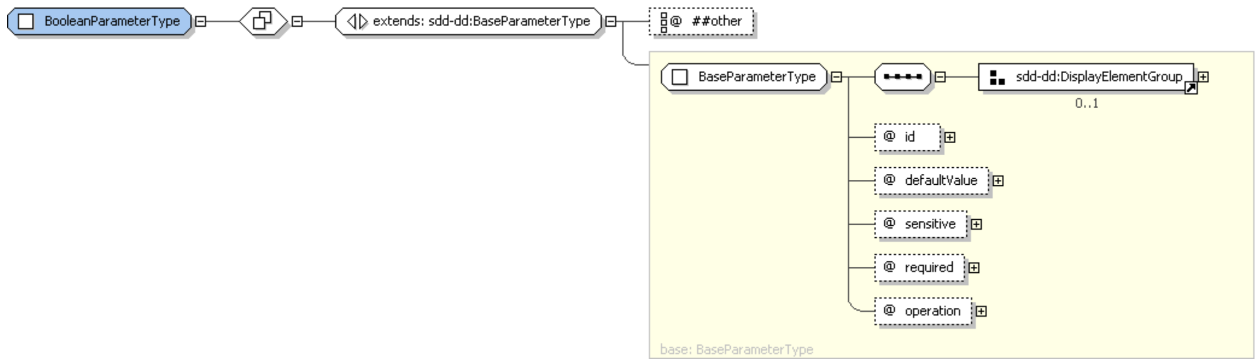


Figure 56: BooleanParameterType structure.

BooleanParameterType extends *BaseParameterType* without adding any additional attributes or elements. When the *defaultValue* attribute is defined for a boolean parameter, its value MUST be either “true” or “false”. See the *BaseParameterType* section for details of the inherited attributes and elements [4.6.5].

4.6.10.1 BooleanParameterType Property Summary

Name	Type	*	Description
	[extends] BaseParameterType		See the BaseParameterType section for additional properties [4.6.5].
	xsd:anyAttribute	0..*	

4.6.11 URIParameterType

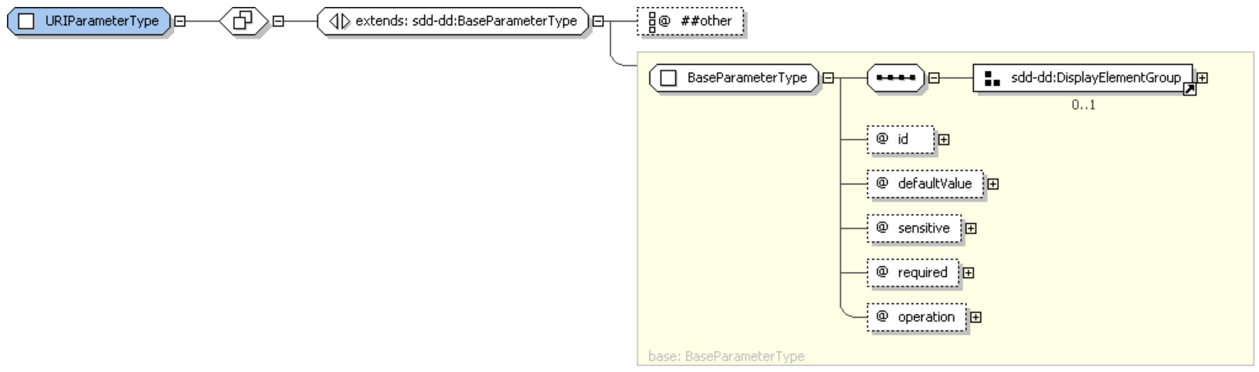


Figure 57: URIParameterType structure.

When the default value attribute is specified for a URI parameter, its value MUST be a valid Uniform Resource Identifier. See the *BaseParameterType* section for details of the inherited attributes and elements [4.6.5].

4.6.11.1 URIParameterType Property Summary

Name	Type	*	Description
	[extends] BaseParameterType		See the BaseParameterType section for additional properties [4.6.5].
	xsd:anyAttribute	0..*	

4.6.12 ResourcePropertyType

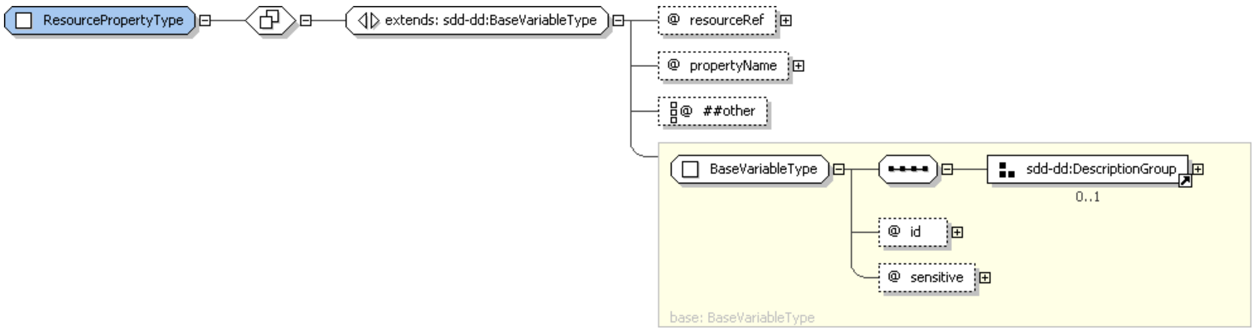


Figure 58: ResourcePropertyType structure.

ResourcePropertyType provides the type definition for the *ResourceProperty* element of *VariablesType* [4.6.3]. *ResourceProperty* is a variable whose value is set from the property of a specific instance of a resource during a particular solution deployment. All content elements can define *ResourceProperty* elements.

4.6.12.1 ResourcePropertyType Property Summary

Name	Type	*	Description
	[extends] BaseVariableType		See the BaseVariableType section for additional properties [4.6.2].
resourceRef	xsd:IDREF	1	The resource in Topology that owns the property.
propertyName	xsd:QName	1	Name of the property whose value provides the variable's values.
	xsd:anyAttribute	0..*	

4.6.12.2 ResourcePropertyType Property Usage Notes

See the *BaseVariableType* section for details of the inherited attributes and elements [4.6.2].

- **resourceRef**: The *resourceRef* attribute MUST identify the resource in *Topology* that owns the property and will provide the value for *ResourceProperty*.
- **propertyName**: The *propertyName* attribute identifies the name of the resource property whose value is to be used as the value of *ResourceProperty*.

4.6.13 DerivedVariableType

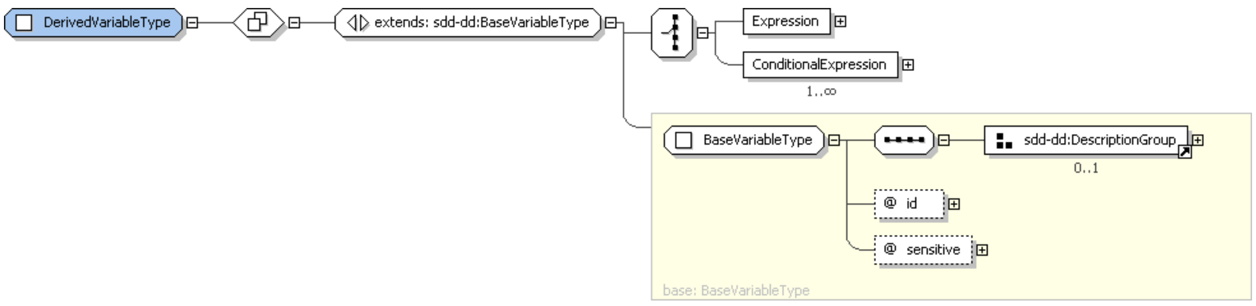


Figure 59: DerivedVariableType structure.

A *DerivedVariable* defines a series of expressions with optional conditions. The value of the variable is determined by evaluating the boolean conditions and then setting the variable to the result of the top priority expression from the set of expressions whose conditions evaluate to true. This restriction does not apply to variables of the same name in different descriptors. The SDD author MUST create *DerivedVariables* in a way that makes the selection of the expression unambiguous.

4.6.13.1 DerivedVariableType Property Summary

Name	Type	*	Description
	[extends] BaseVariableType		See the BaseVariableType section for additional properties [4.6.2].
Expression	VariableExpressionType	1	An expression whose results become the value of the variable.
ConditionalExpression	ConditionalDerivedVariableExpressionType	1..*	An expression and an associated condition.

4.6.13.2 DerivedVariableType Property Usage Notes

See the *BaseVariableType* section for details of the inherited attributes and elements [4.6.2].

- **Expression**: When the *DerivedVariable* is used to define one variable whose value is not conditional, the SDD author can include one variable expression defined in one *Expression* element.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].

- **ConditionalExpression**: When the variable will take one of a number of possible values depending on the characteristics of the resources that participate in the particular deployment, then one *ConditionalExpression* element is defined for each value-condition pair.

  See the *ConditionalDerivedVariableExpressionType* section for structure and additional usage details [4.6.14].

4.6.14 ConditionalDerivedVariableExpressionType

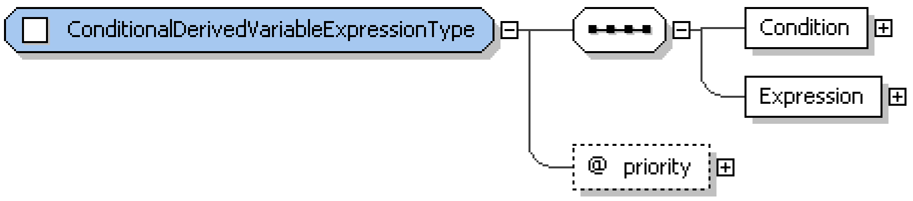


Figure 60: ConditionalDerivedVariableExpressionType structure.

ConditionalDerivedVariableExpressionType is the type of the *ConditionalExpression* elements in derived variables. These elements associate a condition with a variable expression.

4.6.14.1 ConditionalDerivedVariableExpressionType Property Summary

Name	Type	*	Description
Condition	ConditionType	1	A set of resource characteristics that are evaluated to determine if the associated expression is a candidate for determining the value of the derived variable.
Expression	VariableExpressionType	1	Evaluation of this expression produces a candidate value for the derived variable.
priority	xsd:positiveInteger	0..1	A priority used as a tie-breaker when multiple expressions are available to determine the value of the variable. **default value="1"

4.6.14.2 ConditionalDerivedVariableExpressionType Property Usage Notes

- **Condition**: Selection of conditioned expressions is based on the characteristics of one or more resources that participate in a particular solution deployment. These characteristics are defined in the *Condition* element.

  See the *ConditionType* section for structure and additional usage details [4.5.1].
- **Expression**: The *Expression* element contains the expressions that evaluate to a potential value of the *DerivedVariable*. Only one expression will be selected for use in a particular solution deployment.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].
- **priority**: When multiple conditions evaluate to true for a particular deployment, the expression chosen is determined by the *priority* value. A higher priority is indicated by a lower value. "1" is the highest priority.

4.7 Requirements

Requirements are defined by content elements. A *Requirement* consists of resource constraints that the SDD author states MUST be met prior to successful deployment or use of the software described by the SDD package. Each *Requirement* definition lists one or more deployment lifecycle operations to which the *Requirement* applies. When the *Requirement* is specified in an atomic content element, the operation associates the *Requirement* with artifacts within the atomic content element. (See the *OperationType* section for the mapping between operations and artifacts [4.3.7]. Note that the *use* operation indicates that the *Requirement* is associated with running of the software after deployment and not with content element artifacts.) When the *Requirement* is specified in a *CompositeUnit* or *CompositeInstallable*, the *operation* value MUST either be *use* or be the same top level *operation* as defined in the *CompositeInstallable* element. When the Requirement is specified for a *ReferencedPackage*, the *operation* associates the *Requirement* with a top level *operation* within the referenced SDD.

All *Requirements* specified for content elements that are in scope for a particular deployment MUST be met.

When a *Requirement* can be satisfied in more than one way, *Alternatives* can be defined within a *Requirement*. A *Requirement* is considered met when any one of the *Alternatives* is satisfied.

4.7.1 RequirementsType

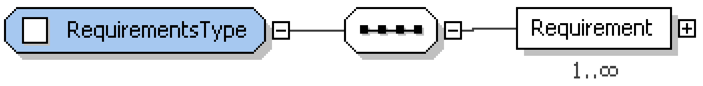


Figure 61: RequirementsType structure.

RequirementsType provides the type definition for *Requirements* in *InstallableUnit* and *LocalizationUnit* elements. It defines a list of *Requirement* elements.

4.7.1.1 RequirementsType Property Summary

Name	Type	*	Description
Requirement	RequirementType	1..*	A requirement that must be met prior to processing the defining content element's artifacts.

4.7.1.2 RequirementsType Property Usage Notes

- **Requirement**: The *Requirements* element contains a sequence of *Requirement* elements. The *Requirement* elements define requirements that MUST be met prior to successful processing of the content element's artifacts.

  See the *RequirementType* section for structure and additional usage details [4.7.2].

4.7.2 RequirementType

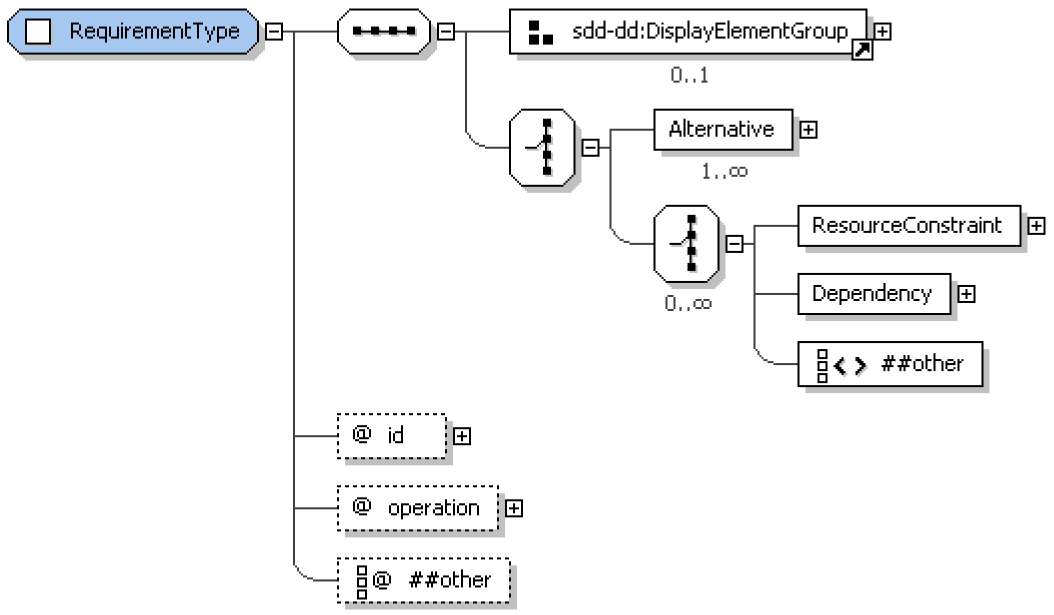


Figure 62: RequirementType structure.

A *Requirement* either directly defines a single set of resource constraints that MUST be met or defines one or more alternative sets of resource constraints, only one of which MUST be met.

When multiple *Requirement* elements are declared for the same operation, all MUST be met prior to processing the associated artifact.

The association is made between a requirement and an artifact via the *operation* attribute.

4.7.2.1 RequirementType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	Name of the requirement.
Description	DisplayTextType	0..1	Description of the requirement.
ShortDescription	DisplayTextType	0..1	Short description of the requirement.
Alternative	AlternativeRequirementType	0..*	An alternative that can satisfy the requirement.
ResourceConstraint	RequirementResourceConstraintType	0..*	A set of constraints on one resource.

Dependency	InternalDependencyType	0..*	A dependency on another content element.
	xsd:any	0..*	
id	xsd:ID	1	Identifier for requirement scoped to the deployment descriptor.
operation	OperationListType	1	Requirement must be met before this operation is performed.
	xsd:anyAttribute	0..*	

4.7.2.2 RequirementType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the requirement.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the requirement.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Alternative**: Alternative elements are used when a requirement can be satisfied in multiple ways.

  As a convenience for tooling that produces SDDs, it is also possible to define a single *Alternative*. This is semantically identical to directly defining *ResourceConstraints* under *Requirements*.

  To satisfy a requirement, at least one of the specified alternatives MUST be satisfied.

  See the *AlternativeRequirementType* section for structure and additional usage details [4.7.3].
- **ResourceConstraint**: When a requirement can be satisfied in only one way, constraints MAY be defined directly under *Requirement* or in a single *Alternative* element.

  Constraints are defined using a sequence of *ResourceConstraints*. Every constraint in the sequence MUST be met for the requirement to be met.

  See the *RequirementResourceConstraintType* section for structure and additional usage details [4.7.5].
- **Dependency**: When one content element must be processed before another for any reason, a *pre-req* type *Dependency* MUST be defined. Reasons for a pre-requisite dependency include the use of an output variable from one artifact as an argument to another; the deployment of a resource before it is configured; and the configuration of a resource before deployment of another resource that depends on it.

  See the *InternalDependencyType* section for structure and additional usage details [4.7.6].
- **id**: The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.
- **operation**: A *Requirement* is associated with application of one or more operations by setting its *operation* attribute value to one of the enumerated values defined in *OperationListType* [4.3.6].

  If the *Requirement* is not a pre-requisite for application of an operation, but rather is required before the resulting resources are considered usable, then the value SHOULD be set to *use*. (Note that a completion action may also be required before a resulting resource is considered usable. See the *CompletionType* section [4.3.14].)

  The value of *operation* for a *Requirement* defined in an atomic content element MUST be set either to *use* or to an *operation* that is associated with an artifact element defined in the content element's *Artifacts*. The *operation* value(s) associate the *Requirement* with one or more artifact(s).

When the *Requirement* is specified in a *CompositeUnit* or *CompositeInstallable*, the *operation* value MUST be set either to *use* or be the same top level *operation* as defined in the *CompositeInstallable* element.

There is no default value for *operation*. The SDD author must define it explicitly.

See the *OperationType* section for enumeration values and their meaning [4.3.7].

4.7.3 AlternativeRequirementType

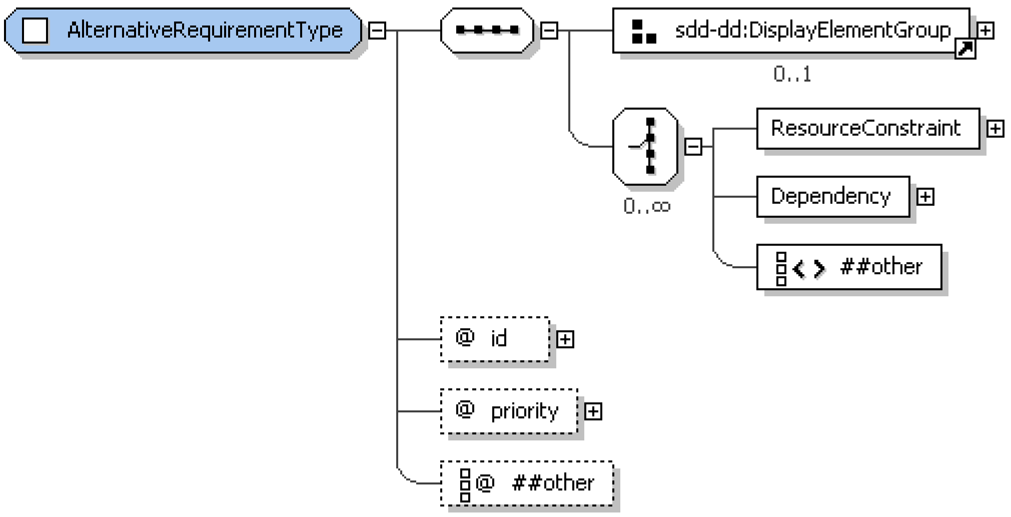


Figure 63: AlternativeRequirementType structure.

AlternativeRequirementType provides the type definition for *Alternative* elements used within requirements to define alternative sets of resource constraints that will satisfy the requirement.

4.7.3.1 AlternativeRequirementType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	Name of the alternative.
Description	DisplayTextType	0..1	Description of the alternative.
ShortDescription	DisplayTextType	0..1	Short description of the alternative.
ResourceConstraint	RequirementResourceConstraintType	1..*	A set of requirements on one resource.
Dependency	InternalDependencyType	0..*	A dependency on another content element.
	xsd:any	0..*	
id	xsd:ID	1	Identifier for the alternative scoped to the deployment descriptor.
priority	xsd:positiveInteger	0..1	Assists in determining alternative selected when multiple alternatives evaluate to true. **default value="1"
	xsd:anyAttribute	0..*	

4.7.3.2 AlternativeRequirementType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the alternative requirement.

See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the alternative requirement.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **ResourceConstraint**: Every *ResourceConstraint* defined in a single *Alternative* MUST be met for the alternative requirement to be considered satisfied.

  See the *RequirementResourceConstraintType* section for structure and additional usage details [4.7.5].
- **Dependency**: When one content element must be processed before another for any reason, a *pre-req* type *Dependency* MUST be defined. Reasons for a pre-requisite dependency include the use of an output variable from one artifact as an argument to another; the deployment of a resource before it is configured; and the configuration of a resource before deployment of another resource that depends on it.

  See the *InternalDependencyType* section for structure and additional usage details [4.7.6].
- **id**: The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.
- **priority**: If there are multiple satisfied alternatives during a particular solution deployment, one of the alternatives must be selected. The *priority* attribute communicates the SDD author's prioritization of the alternatives. A lower number represents a higher priority with "1" representing the highest priority. Other inputs may also be used to select an alternative. The criteria for making this selection are outside of the scope of the SDD.

4.7.4 ResourceConstraintGroup

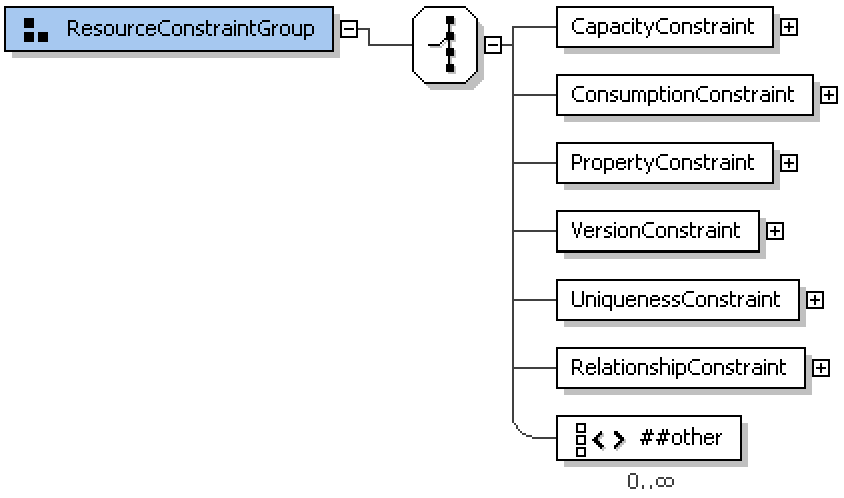


Figure 64: ResourceConstraintGroup structure.

The elements of *ResourceConstraintGroup* are used when defining content element requirements on resources. The *ResourceConstraint* element is used to group one or more constraints on a single resource.

4.7.4.1 ResourceConstraintGroup Property Summary

Name	Type	*	Description
CapacityConstraint	CapacityConstraintType	0..1	A bound on a quantifiable property of a resource.
ConsumptionConstraint	ConsumptionConstraintType	0..1	A required quantity of a property of a resource in any state.

PropertyConstraint	PropertyConstraintType	0..1	A required value or set of values of a property.
VersionConstraint	VersionConstraintType	0..1	A required value or set of values of a version property.
UniquenessConstraint	UniquenessConstraintType	0..1	A required mapping of two resources in the topology to unique instances in the deployment environment.
RelationshipConstraint	RelationshipConstraintType	0..1	A required relationship between the resource identified in the resourceRef and another resource in the topology.
	xsd:any	0..*	

4.7.4.2 ResourceConstraintGroup Property Usage Notes

- **CapacityConstraint**: *CapacityConstraint* elements are used in *ResourceConstraints* to express constraints on the available capacity of a particular property of a particular resource.

  A *CapacityConstraint* tests a numeric value representing a bound on a quantifiable property of a resource, such as processor speed. The test may be for a lower (minimum) or upper (maximum) bound. This constraint differs from a *ConsumptionConstraint* in that it is comparative, not cumulative.

  When multiple *CapacityConstraint* elements are defined by content elements participating in a particular solution deployment apply to the same property of the same resource, the most restrictive constraint applies.

  See the *CapacityConstraintType* section for structure and additional usage details [4.4.1].

- **ConsumptionConstraint**: *ConsumptionConstraint* elements are used in *ResourceConstraints* to express constraints on the quantity of a particular property of a specific resource that is available for consumption.

  A *ConsumptionConstraint* defines a required quantity of a consumable resource property. The *ConsumptionConstraint* is cumulative rather than comparative.

  > An example of a consumable resource property is the disk space property of a file system resource.

  When multiple *ConsumptionConstraint* elements are defined for the same resource by content elements participating in a particular solution deployment, the sum of all the expressed consumption constraints must be met by the resource.

  See the *ConsumptionConstraintType* section for structure and additional usage details [4.4.3].

- **PropertyConstraint**: *PropertyConstraint* elements are used in *ResourceConstraints* to indicate that specific resource properties must have a specific value or set of values.

  See the *PropertyConstraintType* section for structure and additional usage details [4.4.5].

- **VersionConstraint**: *VersionConstraint* elements are used in *ResourceConstraints* to express a constraint on the version of a specific resource.

  A *VersionConstraint* defines a required resource version or a range of versions. It MAY include a certified version or range of versions representing a more restrictive set of versions whose use carries a higher degree of confidence.

  Version formats and comparison rules vary greatly. The SDD does not provide information on how to interpret version strings.

  See the *VersionConstraintType* section for structure and additional usage details [4.4.7].

- **UniquenessConstraint**: *UniquenessConstraint* elements are used in *ResourceConstraints* to indicate when two resources defined in topology MUST or MUST NOT resolve to the same resource instance during a particular deployment.

  See the *UniquenessConstraintType* section for structure and additional usage details [4.4.12].

- **RelationshipConstraint**: *RelationshipConstraint* elements are used in *ResourceConstraints* to indicate a constraint on a particular relationship between resources.

See the *RelationshipConstraintType* section for structure and additional usage details [4.4.13].

4.7.5 RequirementResourceConstraintType

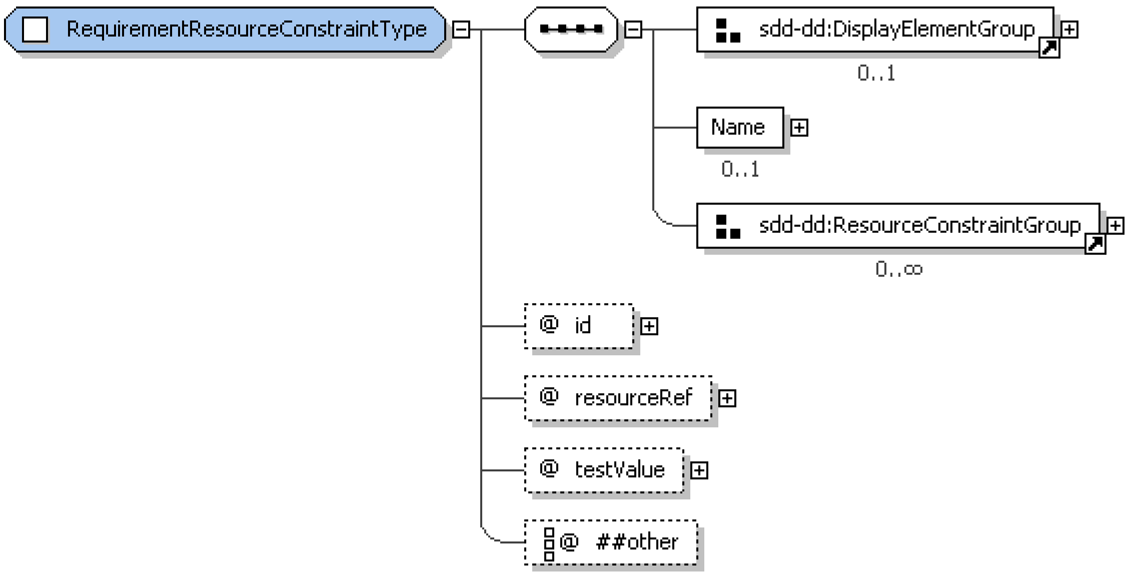

RequirementResourceConstraintType
sdd-dd:DisplayElementGroup
0..1
Name
0..1
sdd-dd:ResourceConstraintGroup
0..∞
id
resourceRef
testValue
##other

Figure 65: RequirementResourceConstraintType structure.

ResourceConstraintType provides the Type section for the *ResourceConstraint* element in content element *Requirements*. A *ResourceConstraint* is a set of zero or more constraints on one resource.

4.7.5.1 RequirementResourceConstraintType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	Name for the resource constraint.
Description	DisplayTextType	0..1	Description of the resource constraint.
ShortDescription	DisplayTextType	0..1	Short description of the resource constraint.
Name	VariableExpressionType	0..1	The name of the resource.
CapacityConstraint	CapacityConstraintType	0..1	A capacity constraint that applies to the resource identified in resourceRef.
ConsumptionConstraint	ConsumptionConstraintType	0..1	A consumption constraint that applies to the resource identified in resourceRef.
PropertyConstraint	PropertyConstraintType	0..1	A property constraint that applies to the resource identified in resourceRef.
VersionConstraint	VersionConstraintType	0..1	A version constraint that applies to the resource identified in resourceRef.
UniquenessConstraint	UniquenessConstraintType	0..1	A required mapping of two resources in the topology to unique instances in the deployment environment.
RelationshipConstraint	RelationshipConstraintType	0..1	A required relationship between the resource identified in the resourceRef and another resource in the topology.
	xsd:any	0..*	
id	xsd:ID	1	Identifier for the ResourceConstraint scoped to the

			deployment descriptor.
resourceRef	xsd:IDREF	1	Reference to a resource specification in topology.
testValue	xsd:boolean	0..1	Indicates whether the ResourceConstraint must evaluate to true or to false. **default value="true".
	xsd:anyAttribute	0..*	

4.7.5.2 RequirementResourceConstraintType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the resource constraint.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the resource constraint.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Name**: This name is used to identify the resource in the deployment environment. If the resource identified by *resourceRef* does not have the name defined here, then the constraint is not met.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].
- **CapacityConstraint, ConsumptionConstraint, PropertyConstraint, VersionConstraint, UniquenessConstraint, RelationshipConstraint:** See the *ResourceConstraintGroup* section for structure and additional usage of the individual constraints [4.7.4].
- **id**: The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.
- **resourceRef**: This is the resource to which the constraints apply.

  This reference MUST refer to the *id* of a resource in *Topology*.
- **testValue**: When the result of evaluating *Name* and all of the constraints defined in the *ResourceConstraint* matches the value of *testValue*, the *ResourceConstraint* is considered met.

  When no *Name* or constraints are defined, and *testValue* is "true", the constraint is met if the resource exists as defined in topology.

  When no *Name* or constraints are defined, and *testValue* is "false", the constraint is met if the resource, as defined in topology, does not exist.

4.7.6 InternalDependencyType

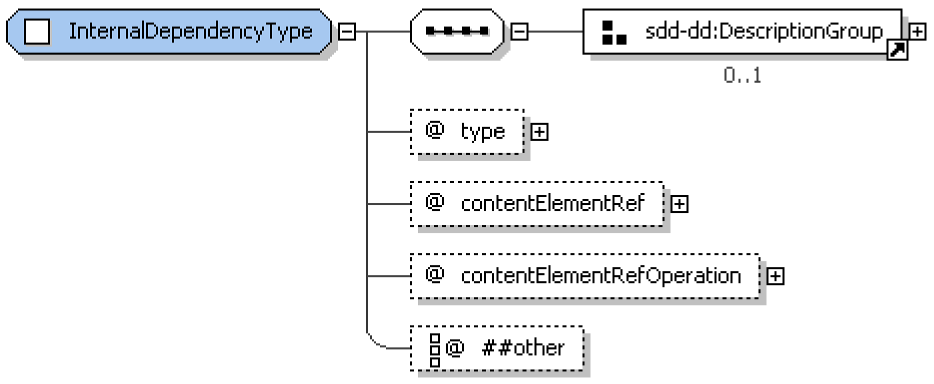


Figure 66: InternalDependencyType structure.

InternalDependencyType provides the type definition for *Dependency* elements defined in all types of content elements. *Dependency* elements allow the expression of dependence on the application of a particular operation to a content element defined in the deployment descriptor before application of a particular operation on the defining content element. The dependency is associated with an operation on the defining content element by the operation attribute in the *Requirement* defining the *Dependency* element. The dependency is associated with an operation on the depended on content element by the *contentRefOperation* attribute in the *Dependency*. There are three types of dependencies: pre-requisites, co-requisites and ex-requisites.

4.7.6.1 InternalDependencyType Property Summary

Name	Type	*	Description
Description	DisplayTextType	0..1	A human-understandable description of the dependency.
ShortDescription	DisplayTextType	0..1	A short human-understandable description of the dependency.
type	DependencyType	0..1	Type can be “pre-req”, “co-req”, or “ex-req”. **default value=“pre-req”
contentElementRef	xsd:IDREF	1	A reference to the content element which is depended on.
contentElementRefOperation	OperationListType	0..1	The dependency is on application of this operation to the content element identified in contentRef.
	xsd:anyAttribute	0..*	

4.7.6.2 InternalDependencyType Property Usage Notes

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the dependency.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DescriptionGroup* section for structure and additional usage details [4.14.1].
- **type**: See the *DependencyType* section for an explanation of the semantics of each of the possible dependency types [4.7.7].
- **contentElementRef**: The *contentElementRef* value is the *id* of the content element that is depended on.

  The value MUST reference the *id* of a content element.
- **contentElementRefOperation**: When the depended-on content element is an atomic content element, the operation defined here effectively identifies the artifact that must be processed for a pre-requisite or co-requisite or not processed for an ex-requisite.

  When the depended-on content element is a *CompositeUnit*, the operation defined in *contentElementRefOperation* MUST be the top level operation defined by the containing *CompositeInstallable*.

  See the *OperationListType* section for structure and additional usage details [4.3.6].

4.7.7 DependencyType

The *DependencyType* enumeration provides the value for the *type* attribute in *Dependency* elements.

4.7.7.1 DependencyType Property Usage Notes

- **pre-req**: A *pre-req* dependency is satisfied if the other content element is in scope for the deployment. The *pre-req* indicates that the other content element MUST be processed before the content element that defines the *pre-req*.

The dependency is not met if the other content element is not in scope.

- **co-req**: A *co-req* dependency is satisfied if the other content element is in scope for the deployment. There is no dependence on order of processing.

  The dependency is not met if the other content element is not in scope.
- **ex-req**: An *ex-req* dependency indicates that the other content element MUST NOT be in scope.

  The dependency is not met if the other content element is in scope.

4.7.8 RequiredBaseType

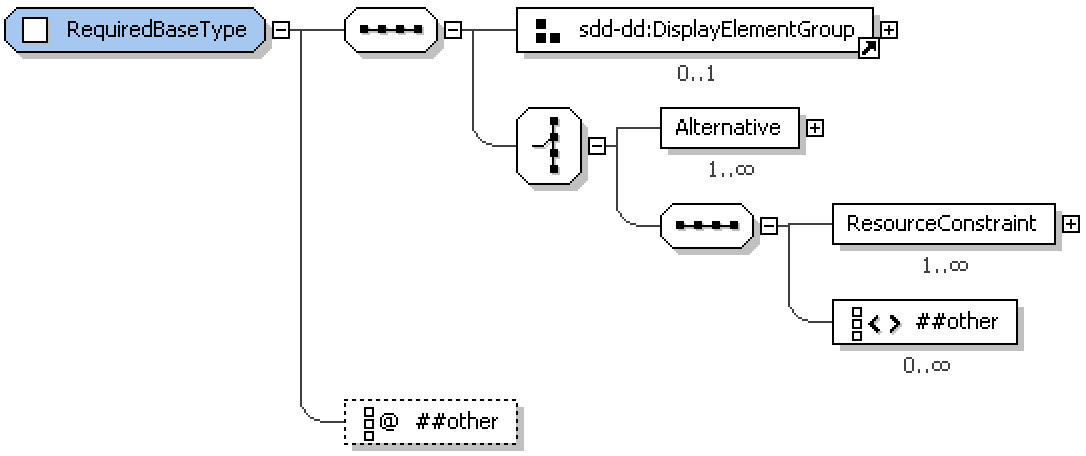


Figure 67: RequiredBaseType structure.

RequiredBaseType provides the type definition for the *RequiredBase* element of *InstallableUnit* and *LocalizationUnit* elements and the *LocalizationBase* element of *LocalizationUnits*. These elements declare the identity characteristics of one or more resources that will be modified or localized by applying of the content element's artifacts. Definition of a *RequiredBase* element represents a requirement that a resource matching the declared characteristic exists. Definition of a *LocalizationBase* element represents a condition on the existence of a resource that matches the declared characteristics.

4.7.8.1 RequiredBaseType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	Display name for the requirement on a resource to serve as the base of an update or localization.
Description	DisplayTextType	0..1	Description of the requirement. Required if ShortDescription is defined.
ShortDescription	DisplayTextType	0..1	Short description of the requirement.
Alternative	AlternativeRequiredBaseConstraintType	0..*	Alternative set of constraints on a required base resource.
ResourceConstraint	RequiredBaseConstraintType	1..*	Constraints on the required base resource.
	xsd:any	0..*	
	xsd:anyAttribute	0..*	

4.7.8.2 RequiredBaseType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the required base element.

See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the required base for this content element.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].

- **Alternative**: When more than one resource can be used as the update or localization base, two or more *Alternative* elements are defined to describe the choices. As a convenience for tooling that produces SDDs, a single *Alternative* can be defined in place of a *ResourceConstraint*.

  See the *AlternativeRequiredBaseConstraintType* section for structure and additional usage details [4.7.10].

- **ResourceConstraint**: *ResourceConstraints* defined here identify one or more particular resources that can serve as the update or localization base. If *ResourceConstraints* are defined for multiple resources, they are all updated or localized by application of the content element.

  See the *RequiredBaseConstraintType* section for structure and additional usage details [4.7.9].

4.7.9 RequiredBaseConstraintType

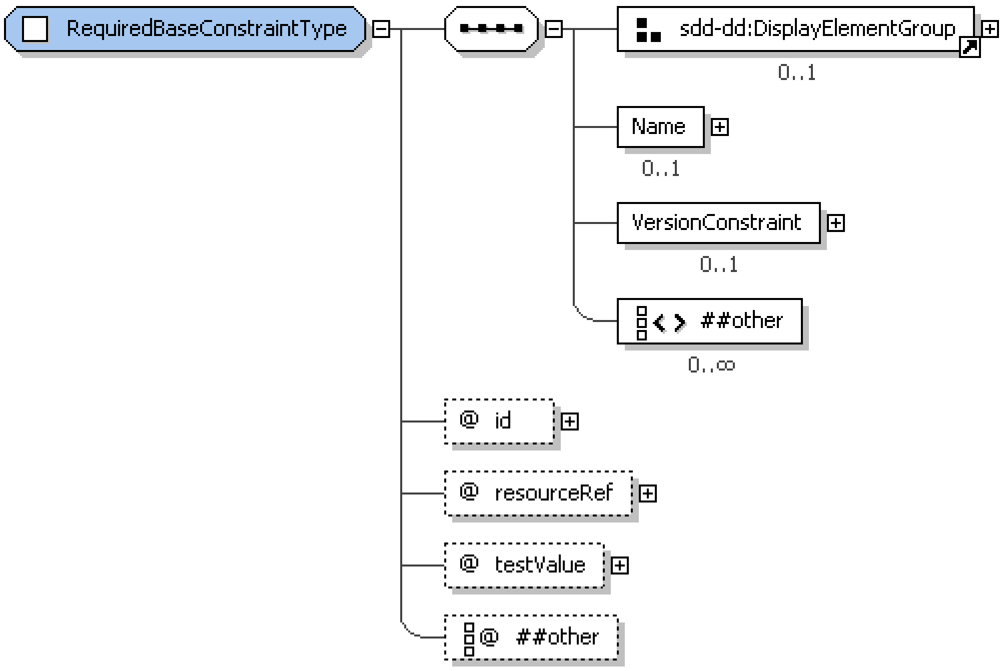


Figure 68: RequiredBaseConstraintType structure.

RequiredBaseConstraintType provides the type definition for the *ResourceConstraint* elements used in *RequiredBase* and *LocalizationBase* elements. A required base definition differs from a requirement definition in the limited nature of the constraints that can be specified. The purpose of constraints within a required base is to identify resource instances that can be correctly updated or localized by the content element. Only constraints related to the basic identity characteristics of the resource are allowed.

4.7.9.1 RequiredBaseConstraintType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	Name of the constraint.
Description	DisplayTextType	0..1	Description of the constraint.
ShortDescription	DisplayTextType	0..1	Short description of the constraint.

Name	VariableExpressionType	0..1	Name of the required base resource as understood in the deployment environment.
VersionConstraint	VersionConstraintType	0..1	Allowed versions for the required base resource.
	xsd:any	0..*	
id	xsd:ID	1	Constraint identifier scoped to the deployment descriptor.
resourceRef	xsd:IDREF	1	Reference to the resource representing the required base for an update operation.
testValue	xsd:boolean	0..1	Defines the desired result of the required base constraint **default value="true"
	xsd:anyAttribute	0..*	

4.7.9.2 RequiredBaseConstraintType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the constraint.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the constraint on the required base.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Name**: The *Name* element provides the name by which the resource is known in the deployment environment. The value of *Name* is compared to resource names found in the deployment environment as part of constraint evaluation.

  If the resource name is declared in the referenced resource definition, it SHOULD NOT be declared here. If the resource name is changed by application of the update, the original name SHOULD be declared here and the updated name SHOULD be declared in *ResultingResource*. The name declared here is always the one that represents the required value for the required base.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].
- **VersionConstraint**: The *VersionConstraint* element defines the set of versions that can serve as a base for the update.

  See the *VersionConstraintType* section for structure and additional usage details [4.4.7].
- **id**: The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.
- **resourceRef**: The *resourceRef* attribute value MUST reference the *id* of the resource element in *Topology* to which this constraint refers.
- **testValue**: The required base constraint is met when the boolean result of comparing the declared name and/or version to the actual name and/or version is equal to the boolean value specified in *testValue*.

  Because the purpose of a required base constraint is to positively identify one or more resources that can serve as the base for an update or localization, there MUST always be one *ResourceConstraint* that has *testValue* set to "true".

  Additional *ResourceConstraints* can be defined with *testValue* set to "false". These constraints identify characteristics of the same required base resource that must not be true for that resource to serve as the base.

4.7.10 AlternativeRequiredBaseConstraintType

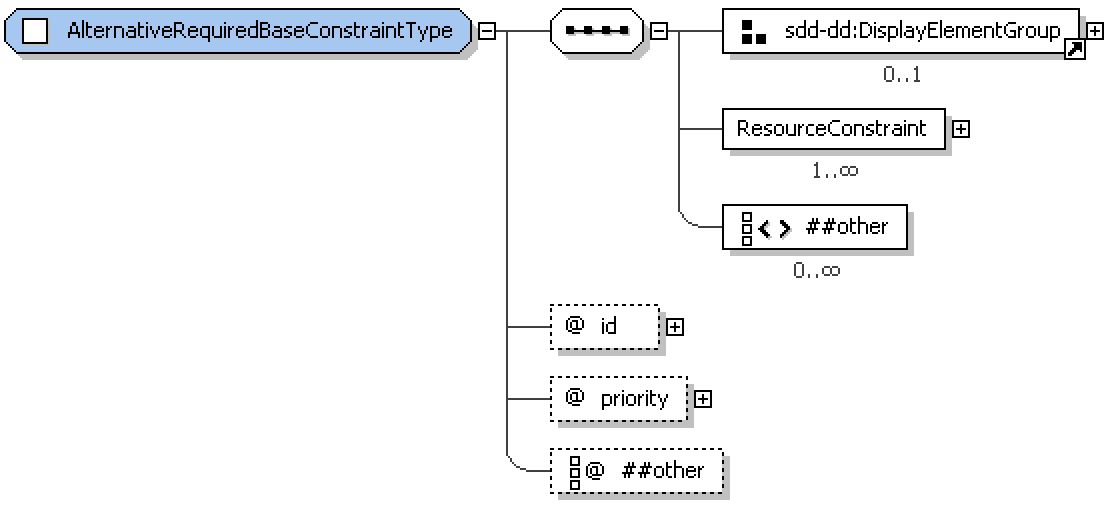

AlternativeRequiredBaseConstraintType
sdd-dd:DisplayElementGroup
0..1
ResourceConstraint
1..∞
##other
0..∞
id
priority
##other

Figure 69: AlternativeRequiredBaseConstraintType structure.

AlternativeRequiredBaseConstraintType provides the type definition for the *Alternative* elements used in *RequiredBase* and *LocalizationBase* elements.

4.7.10.1 AlternativeRequiredBaseConstraintType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	Name of the constraint.
Description	DisplayTextType	0..1	Description of the constraint.
ShortDescription	DisplayTextType	0..1	Short description of the constraint.
ResourceConstraint	RequiredBaseConstraintType	1..*	A set of requirements on one resource.
	xsd:any	0..*	
id	xsd:ID	1	Constraint identifier scoped to the deployment descriptor.
priority	xsd:positiveInteger	0..1	Assists in determining alternative selected when multiple alternatives evaluate to true. **default value="1"
	xsd:anyAttribute	0..*	

4.7.10.2 AlternativeRequiredBaseConstraintType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the alternative.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the alternative.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **ResourceConstraint**: *ResourceConstraints* defined here identify one or more particular resources that can serve as the update or localization base. If *ResourceConstraints* are defined for multiple resources, they are all updated or localized by application of the content element.

See the *RequiredBaseConstraintType* section for structure and additional usage details [4.7.9].

- **id**: The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.
- **priority**: If there are multiple satisfied alternatives during a particular solution deployment, one of the alternatives must be selected. The *priority* attribute communicates the SDD author's prioritization of the alternatives. A lower number represents a higher priority with "1" representing the highest priority. Other inputs may also be used to select an alternative. The criteria for making this selection are outside of the scope of the SDD.

4.8 Resulting and Changed Resources

Deployment of an SDD package creates or modifies software resources. These resources are included in the *Topology* definition and described in more detail in *ResultingResource* and *ResultingChange* elements.

The SDD author can choose to model resulting and modified resources at a very granular level, at a very coarse level; at any level in between, or not at all. An example of modeling resulting resources at a granular level would be modeling every file created by the deployment as a resulting resource. An example of modeling resulting resources at a very coarse level would be modeling the software product created by deployment as a single resulting resource. The choice depends on the needs of the solution deployment. If a resource is not modeled in the SDD, no requirements can be expressed on it, no conditions can be based on it and no variables can be set from values of its properties. It cannot play any of the roles described for resources in the *ResourceType* section of this document [4.2.2].

4.8.1 ResultingResourceType

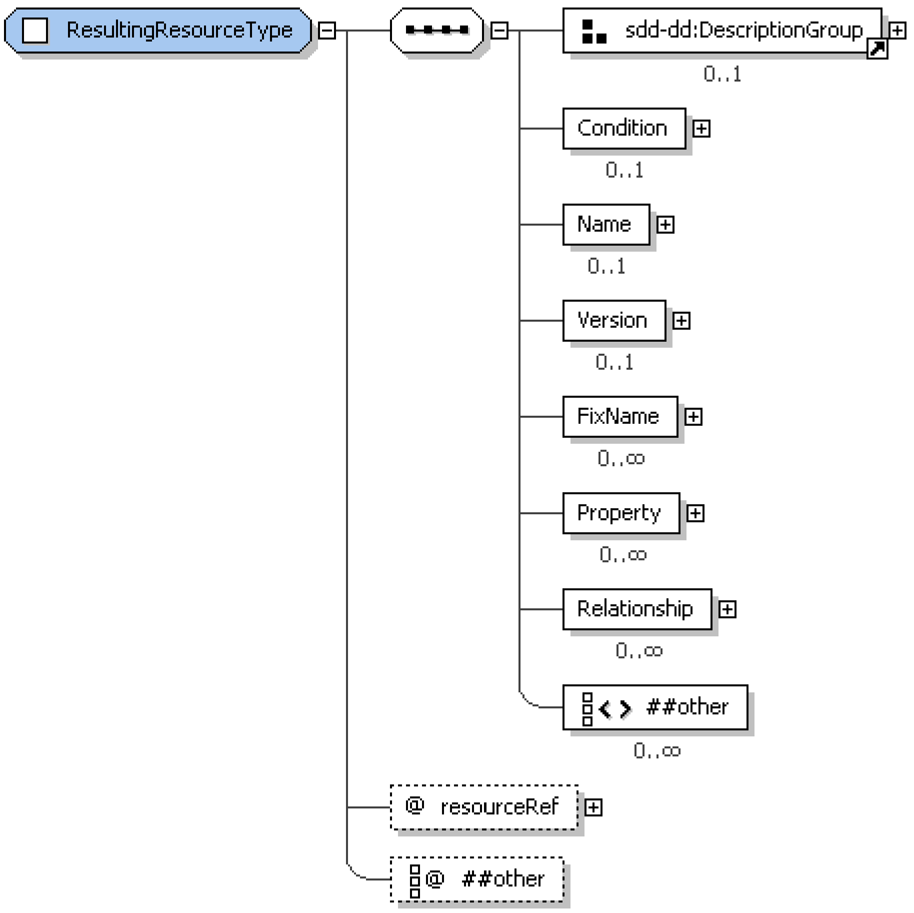


Figure 70: ResultingResourceType structure.

InstallableUnit and *LocalizationUnit* content elements can include zero or more *ResultingResource* elements that describe the key resources installed or updated when the content element's artifacts are processed. The type definition for these elements is provided by *ResultingResourceType*. *ResultingResource* elements refer to resources in topology and define characteristics of those resources that will become true when the artifact is applied. The deployment descriptor author MAY omit the *ResultingResource* element from the content element and the definition of the resource from *Topology* when no knowledge of their existence is required for deployment of the solution or for aggregation of the solution. Characteristics that exist in *ResultingResource* and elsewhere, such as *Topology* or *ResultingChange*, MUST NOT conflict.

For example, if *Topology* specifies a property that indicates that a file must be writable, it would be incorrect for *ResultingResource* to specify that the resulting file resource is read-only.

Example uses of the *ResultingResource* element are to:

- determine whether potentially resulting resources will actually be installed or updated;
- identify the resource associated with a content element that may be subsequently uninstalled using the uninstall information in this SDD;
- discover the components of a logical solution resource previously installed using this SDD;
- check whether or not a content element has already been installed.

4.8.1.1 ResultingResourceType Property Summary

Name	Type	*	Description
Description	DisplayTextType	0..1	Description of the effect of the content element on the resulting resource.
ShortDescription	DisplayTextType	0..1	Short description of the effect of the content element on the resulting resource.
Condition	ConditionType	0..1	A condition that determines if the resulting resource definition is relevant to a particular deployment.
Name	VariableExpressionType	0..1	Name of the resulting resource as known in the deployment environment.
Version	VersionType	0..1	Version of the resulting resource.
FixName	xsd:string	0..*	Name of a resulting fix.
Property	ResultingPropertyType	0..*	A resulting property setting of the resulting resource.
Relationship	RelationshipType	0..*	A relationship that will exist after creating or updating the resource.
	xsd:any	0..*	
resourceRef	xsd:IDREF	1	Reference to a resource in topology.
	xsd:anyAttribute	0..*	

4.8.1.2 ResultingResourceType Property Usage Notes

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the effect of the content element on the resulting resource.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DescriptionGroup* section for structure and additional usage details [4.14.1].
- **Condition**: A *Condition* is used when the resulting resource will be created by the content element only when certain conditions exist in the deployment environment.

  See the *ConditionType* section for structure and additional usage details [4.5.1].

- **Name**: The name of the resulting resource SHOULD be defined in the *ResultingResource* element and not in *Topology* when the content element installs the resulting resource. The resource name comes into existence when the resulting resource is created. When the content element updates the resulting resource without changing the resource name, *Name* SHOULD be defined in *Topology*. *Name* SHOULD NOT be defined in both places. If a resource name is defined in both *Topology* and *ResultingResource*, the values MUST match.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].

- **Version**: This is the version of the resource after processing the content element's artifacts. *Version* SHOULD be defined for all resulting resources.

  For example, when update artifacts are processed, this version describes the resource after the update is complete.

  See the *VersionType* section for structure and additional usage details [3.10].

- **FixName**: Multiple *FixName* elements MAY be included to identify the resulting resource fixes that will exist once the content element is applied. The *FixName* SHOULD match the names of fixes that can be detected on the system.

- **Property**: *Property* elements SHOULD be included to identify property values of the resulting resource that will exist after applying the content element.

  Properties of the resulting resource SHOULD be defined in the *ResultingResource* element and not in *Topology*. They SHOULD NOT be defined in both places. If a property is defined in both *Topology* and *ResultingResource*, the values MUST match.

  See the *ResultingPropertyType* section for structure and additional usage details [4.2.4].

- **Relationship**: *Relationship* elements SHOULD be included to identify relationships that will exist after applying the content element.

  See the *RelationshipType* section for structure and additional usage details [4.8.3].

- **resourceRef**: The *resourceRef* attribute MUST identify the resource in *Topology* that will be installed or updated when the defining content element is applied.

4.8.2 ResultingChangeType

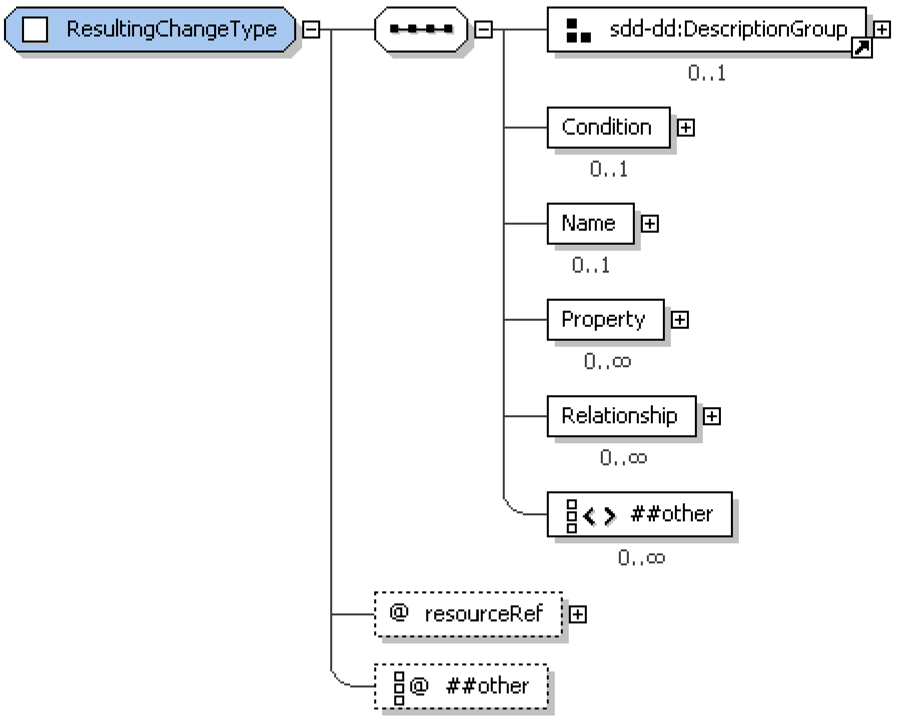


Figure 71: ResultingChangeType structure.

InstallableUnit and *ConfigurationUnit* content elements can include zero or more *ResultingChange* elements that describe the key resources whose configuration is modified when the content element's artifacts are processed. *ResultingChange* elements refer to resources in *Topology* and define characteristics of those resources that will become true when the content element is applied.

4.8.2.1 ResultingChangeType Property Summary

Name	Type	*	Description
Description	DisplayTextType	0..1	Description of the effect of the content element on the changing resource.
ShortDescription	DisplayTextType	0..1	Short description of the effect of the content element on the changing resource.
Condition	ConditionType	0..1	A condition that determines if the resulting change definition is relevant to a particular deployment.
Name	VariableExpressionType	0..1	Name of the resulting resource as known in the deployment environment.
Property	ResultingPropertyType	0..*	A resulting property setting of the changing resource.
Relationship	RelationshipType	0..*	Specifies a relationship(s) with another resource that will result from this deployment.
	xsd:any	0..*	
resourceRef	xsd:IDREF	1	Reference to the resource in topology that will be changed by application of the content element.
	xsd:anyAttribute	0..*	

4.8.2.2 ResultingChangeType Property Usage Notes

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the effect of the content element on the changing resource.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DescriptionGroup* section for structure and additional usage details [4.14.1].
- **Condition**: A *Condition* is used when the resulting change will be performed by applying the content element only when certain conditions exist in the deployment environment.

  See the *ConditionType* section for structure and additional usage details [4.5.1].
- **Name**: The *Name* corresponds with the name of the changed resource as known in the deployment environment. *Name* SHOULD be defined in *Topology* and not in *ResultingChange*, because the name is not changed by processing the content elements artifacts. If *Name* is defined in both places, the values MUST match.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].
- **Property**: *Property* elements MAY be included to identify property values of the identified resource as they will exist after applying the content element.

  Properties defined in *ResultingChange* MUST be properties that are modified by processing the content element's artifacts.

  See the *ResultingPropertyType* section for structure and additional usage details [4.2.4].
- **Relationship**: When application of the content element results in the creation or modification of relationships, the *Relationship* elements SHOULD be included to identify relationships as they will exist after application of the content element.

  See the *RelationshipType* section for structure and additional usage details [4.8.3].

- **resourceRef**: The *resourceRef* attribute MUST identify the resource whose configuration will be modified when the defining content element is applied.

  The value MUST reference the *id* of a resource specified in *Topology*.

4.8.3 RelationshipType

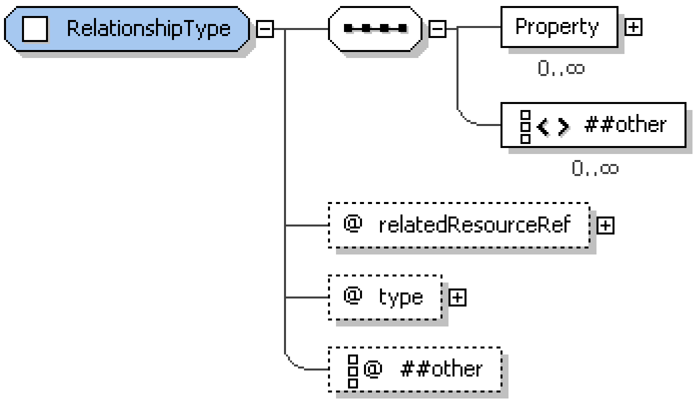


Figure 72: RelationshipType structure.

4.8.3.1 RelationshipType Property Summary

Name	Type	*	Description
Property	PropertyType	0..*	A property definition that further constrains the relationship.
	xsd:any	0..*	
relatedResourceRef	xsd:IDREF	1	The second resource in the relationship.
type	xsd:QName	1	The type of the relationship.
	xsd:anyAttribute	0..*	

4.8.3.2 RelationshipType Property Usage Notes

- **Property**: This element MAY be used to provide additional information about the relationship.

    For example, a connectivity relationship might specify additional information such as the specific protocol used (for instance, TCP/IP) and/or particular characteristics of a protocol (for instance, port number).

  See the *PropertyType* section for structure and additional usage details [4.2.3].
- **relatedResourceRef**: There are two resources in any relationship. The first is the resource defined in the *resourceRef* of the *ResultingResource* or *RelationshipConstraint* element that defines the *Relationship* element. The second resource is the one identified by *relatedResourceRef*.

  The value MUST reference the *id* of a resource specified in *Topology*.
- **type**: Values for relationship type are not defined by the SDD specification. This type may be specified in profiles [5.3].

4.9 Composite Content Elements

Composite content elements organize the content of an SDD but do not define artifacts used to deploy SDD content. There are three types of composite content elements: *CompositeInstallable*, *CompositeUnit* and *CompositeLocalizationUnit*.

CompositeInstallable is used any time that more than one content element is defined in support of one operation on the package; any time aggregation of SDDs is needed or any time the package includes selectable content.

CompositeInstallable is the root of a content hierarchy that supports a single deployment lifecycle operation. It can define a base content hierarchy, a localization content hierarchy, and/or a selectable content hierarchy and selection criteria. Base content defines content that is deployed by default. Selectable content defines content that can be selected or not by the deployer. Localization content defines content that provides language support. One SDD can have more than one *CompositeInstallable*–each supporting a different operation.

CompositeUnit is used to organize content elements within the base or selectable content hierarchies. *CompositeUnits* can define *InstallableUnits*, *ConfigurationUnits*, *ContainedPackages* and other *CompositeUnits*. Requirements, conditions and variables that are common to all content elements defined by the *CompositeUnit* can be defined on the *CompositeUnit* to avoid repetition. Within the selectable content hierarchy, a *CompositeUnit* can provide an efficient means for selection of a set of related content elements by a *Feature.*

CompositeLocalizationUnit is described in the Localization section [4.13].

4.9.1 CompositeInstallableType

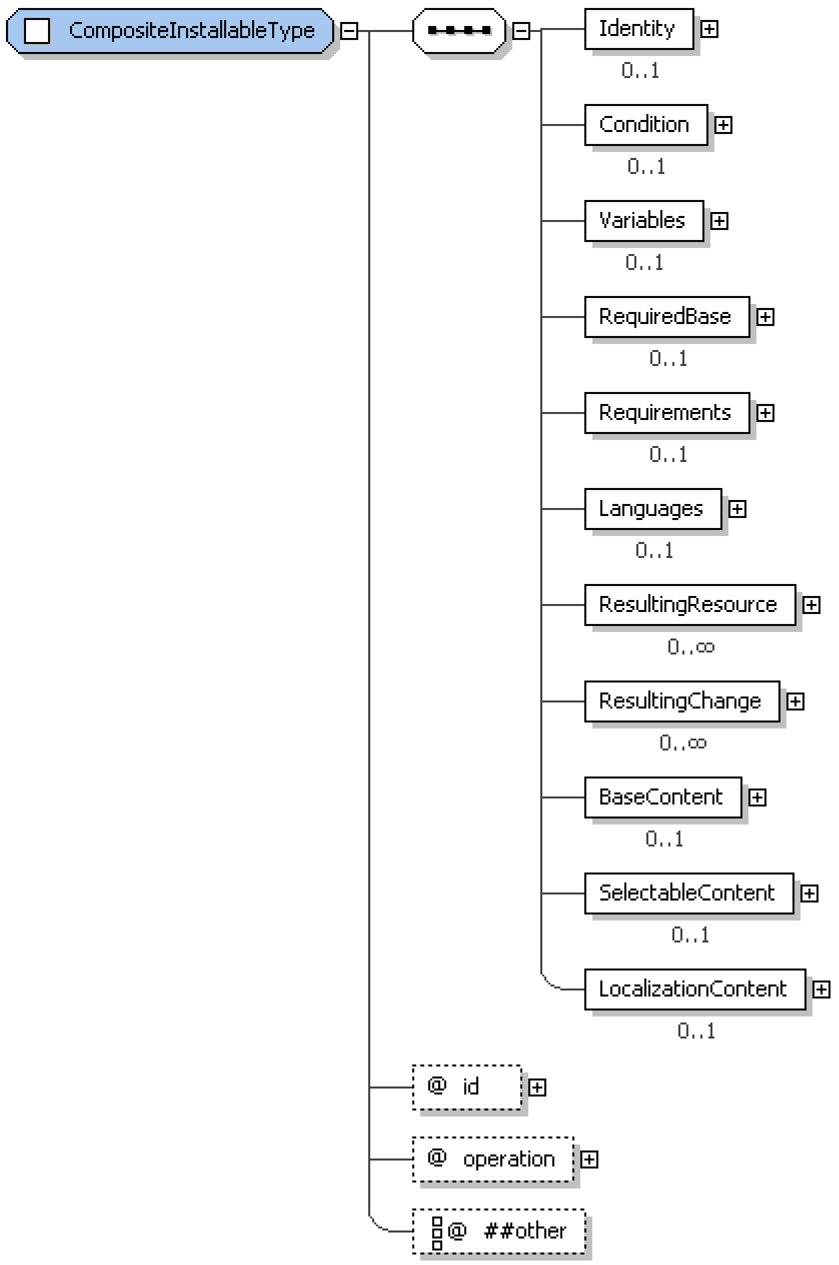


Figure 73: CompositeInstallableType structure.

A *CompositeInstallable* supports the definition of metadata about package content for one deployment lifecycle operation. One *CompositeInstallable* can be defined for each operation supported by the software package. When more than one *CompositeInstallable* is defined in an SDD, there MUST NOT be more than one *CompositeInstallable* in scope for a particular deployment defined for any one operation.

4.9.1.1 CompositeInstallableType Property Summary

Name	Type	*	Description
Identity	IdentityType	0..1	Human-understandable identity information about the CompositeInstallable.
Condition	ConditionType	0..1	A condition that determines if the content of the

			CompositeInstallable is relevant to a particular deployment.
Variables	VariablesType	0..1	Variables for use anywhere below the CompositeInstallable and in Topology.
RequiredBase	RequiredBaseType	0..1	Resource or resources that can be updated by the CompositeInstallable.
Requirements	RequirementsType	0..1	Requirements that must be met before successful application of the CompositeInstallable.
Languages	LanguageSelectionsType	0..1	Defines required and selectable languages and groups of languages.
ResultingResource	ResultingResourceType	0..*	Resources that result from applying the CompositeInstallable.
ResultingChange	ResultingChangeType	0..*	Configuration changes that result from applying the CompositeInstallable.
BaseContent	BaseContentType	0..1	Defines content describing the deployment of core resources.
SelectableContent	SelectableContentType	0..1	Defines content describing the deployment of selectable resources.
LocalizationContent	LocalizationContentType	0..1	Defines content whose sole purpose is to provide language support.
id	xsd:ID	1	A unique identifier for the CompositeInstallable element.
operation	OperationType	1	The deployment lifecycle operation described by the CompositeInstallable definition.
	xsd:anyAttribute	0..*	

4.9.1.2 CompositeInstallableType Property Usage Notes

- **Identity**: This identity MAY have values in common with the identity of a resulting resource created when artifacts defined by content of the composite are processed.

  If the unit of packaging described by the *CompositeInstallable* is known to a package management system, the *Identity* elements SHOULD correspond to values associated with that package in the package management system.

  See the *IdentityType* section for structure and additional usage details [3.4].

- **Condition**: When the condition defined in the *CompositeInstallable* is not met for a particular deployment, the *CompositeUnit* and all the content elements defined below the *CompositeUnit* are out of scope for that particular deployment.

  See the *ConditionType* section for structure and additional usage details [4.5.1].

- **Variables**: Variables defined here are visible throughout the *CompositeInstallable* and in *Topology*.

  See the *VariablesType* section for structure and additional usage details [4.6.3].

- **RequiredBase**: When a resource or resources corresponding to the overall software will be modified during deployment, that resource or those resources MAY be defined in the *RequiredBase* element. The *RequiredBase* definition represents a requirement that the described resource be available for modification to apply the single *operation* defined by the *CompositeInstallable*. When *RequiredBase* is defined, the *operation* defined by *CompositeInstallable* MUST be one of the following: *update*, *undo*, *uninstall*, or *repair*. By specifying the required base separately from other requirements, it is possible for consumers of the SDD to easily determine if the base is available before processing other requirements.

  See the *RequiredBaseType* section for structure and additional usage details [4.7.8].

- **Requirements**: These are requirements that must be met regardless of what content is selected for deployment and which conditions within the content hierarchy evaluates to true.

  Requirements that apply only to a portion of the content SHOULD be defined at the point in the content hierarchy where they apply.

  All requirements specified on content elements that are in scope for a particular deployment MUST be met. This represents a logical "AND" of the requirements. Care should be taken by the SDD author to ensure that conflicting requirements cannot be in scope for the same deployment.

  See the *RequirementsType* section for structure and additional usage details [4.7.1].

- **Languages**: When the SDD contains language support, the *Languages* element can be defined to describe the languages supported; which languages are required and which are selectable; and how language selections are grouped.

  Languages defined in the *Mandatory* element under *Languages* are always in scope. Languages defined in the *Optional* element under *Languages* are in scope if selected by the deployer.

  The *Languages* element is used to declare the mandatory and optional language support available in the package. Languages whose support is deployed by *LocalizationUnits* in *LocalizationContent* MUST be defined as either a mandatory language or an optional language. In addition, languages whose support is deployed along with other content by *InstallableUnits* in *BaseContent* or *SelectableContent* SHOULD be defined as a mandatory language.

  See the *LanguageSelectionsType* section for structure and additional usage details [4.13.4].

- **ResultingResource**: The software whose deployment is described by the SDD can be described in the *CompositeInstallable's ResultingResource* element. This software may consist of many resources that are described in the *ResultingResource* elements of the *InstallableUnits* and/or *LocalizationUnits* defined within the *CompositeInstallable*.

  See the *ResultingResourceType* section for structure and additional usage details [4.8.1].

- **ResultingChange**: Configuration changes that result from deployment regardless of selected content or condition evaluation can be described in the *CompositeInstallable's ResultingChange* element.

  Note that a *ResultingChange* is a change that is made to an existing resource. This is in contrast with *ResultingResource,* which describes newly created resources.

  See the *ResultingChangeType* section for structure and additional usage details [4.8.2].

- **BaseContent**: The base content hierarchy defines content elements that are in scope by default. These content elements MAY be conditioned out based on characteristics of the deployment environment, but are not optional from the deployer's perspective.

  See the *BaseContentType* section for structure and additional usage details [4.11.1].

- **SelectableContent**: Content that is selected by feature MUST be defined in the selectable content hierarchy. *Groups* and *Features* that select this content are also defined within *SelectableContent*.

  See the *SelectableContentType* section for structure and additional usage details [4.12.1].

- **LocalizationContent**: All *LocalizationUnits* and *ContainedLocalizationPackages* MUST be defined in the *LocalizationContent* hierarchy. Each *LocalizationUnit* contains information about the languages it supports and the resources it localizes. This information is evaluated to determine if the *LocalizationUnit* is in scope for a particular deployment.

  Each *LocalizationUnit* and *ContainedLocalizationPackage* defined in *LocalizationContent* MAY support any combination of *Mandatory* and *Optional* languages and can localize any combination of base and selectable resources, as well as resources already deployed.

  Some language support may be deployed incidentally by artifacts in an *InstallableUnit* along with deployment of other solution content. *LocalizationContent* holds only content elements whose sole purpose is to provide language support.

  LocalizationContent supports advanced management of language support, including definition of mandatory and optional languages and support of localization materials with a lifecycle that is somewhat independent of the resources localized. When an SDD author has no need for advanced management of language support, all language support MAY be delivered with other content in *InstallableUnits*.

See the *LocalizationContentType* section for structure and additional usage details [4.13.1].

- **id**: The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.
- **operation**: This is the *operation* that may be applied to the SDD package whose metadata is described by the *CompositeInstallable*.

See the *OperationType* section for enumeration values and their meaning [4.3.7].

4.9.2 CompositeUnitType

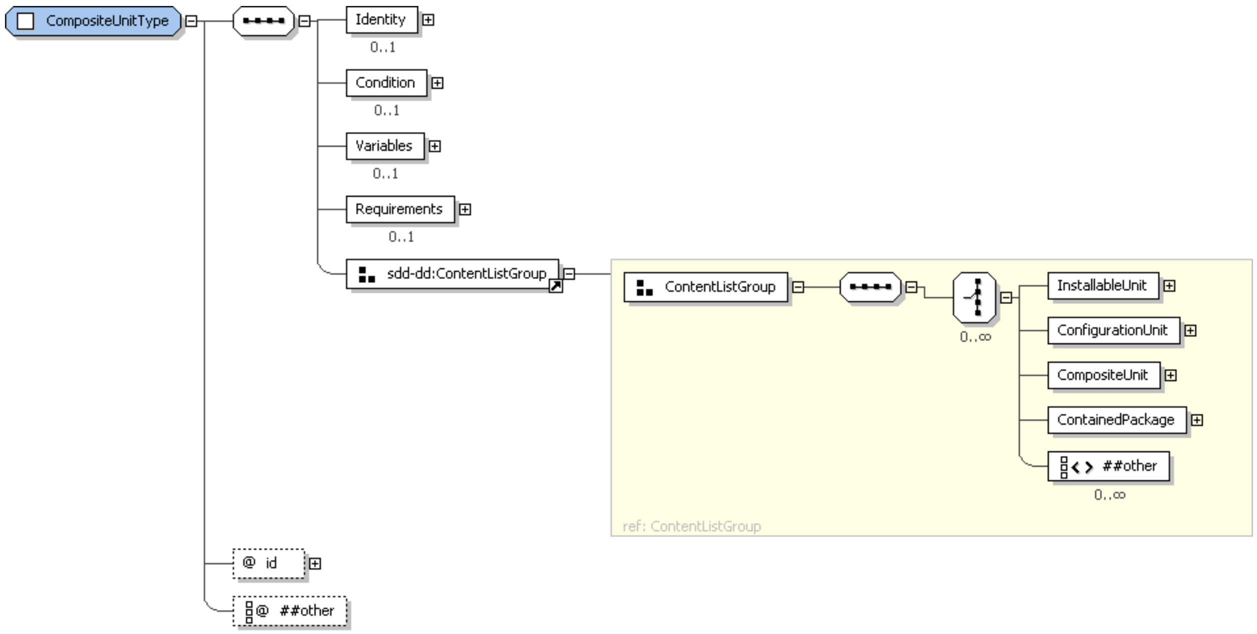


Figure 74: CompositeUnitType structure.

The *CompositeUnit* element is used to organize content elements within the base or selectable content hierarchies. It can define any number of *InstallableUnits*, *ConfigurationUnits*, *ContainedPackages* and other *CompositeUnits*. Composite units assist in organizing the deployment package. A composite unit can provide a convenient way to specify variables, requirements, conditions and other information that applies to every content element defined below the composite unit. Within the selectable content hierarchy, composite units can be used to group content elements that are selected by feature sets or groups. When a feature containing a composite unit is selected, all its child content elements are selected by association. Organization of content within a composite unit does not imply any relationships among the resources that result from deployment of the composite content.

4.9.2.1 CompositeUnitType Property Summary

Name	Type	*	Description
Identity	IdentityType	0..1	Human-understandable identity information about the CompositeUnit.
Condition	ConditionType	0..1	A condition that determines if the CompositeUnit and its child content elements are relevant to a particular deployment.
Variables	VariablesType	0..1	Variables for use within the CompositeUnit's and its child content elements' requirement and artifact definitions.

Requirements	RequirementsType	0..1	Requirements that must be met prior to successful processing of any of the CompositeUnit's content.
InstallableUnit	InstallableUnitType	0..*	An InstallableUnit that is part of the composite content.
ConfigurationUnit	ConfigurationUnitType	0..*	A ConfigurationUnit that is part of the composite content.
CompositeUnit	CompositeUnitType	0..*	A CompositeUnit that organizes a subset of the composite's content.
ContainedPackage	ReferencedPackageType	0..*	A ContainedPackage that is part of the composite content.
	xsd:any	0..*	
id	xsd:ID	1	An identifier for the CompositeUnit scoped to the deployment descriptor.
	xsd:anyAttribute	0..*	

4.9.2.2 CompositeUnitType Property Usage Notes

- **Identity**: This identity MAY have values in common with the identity of a resulting resource created when artifacts defined by content of the composite are processed.

  If the unit of packaging described by the *CompositeUnit* is known to a package management system, some of the identity elements MAY correspond to values associated with that package in the package management system.

  See the *IdentityType* section for structure and additional usage details [3.4].
- **Condition**: When the condition defined in the *CompositeInstallable* is not met for a particular deployment, the *CompositeUnit* and all the content elements defined below the *CompositeUnit* are out of scope for that particular deployment.

  See the *ConditionType* section for structure and additional usage details [4.5.1].
- **Variables**: Variables defined here are visible within the *CompositeUnit* and every content element defined below the *CompositeUnit*.

  These variables are in scope for a particular deployment only if the *CompositeUnit* is in scope for that deployment.

  See the *VariablesType* section for structure and additional usage details [4.6.3].
- **Requirements**: These are requirements that must be met before any of the artifacts in the *CompositeUnit* hierarchy can be processed.

  These requirements are in scope for a particular deployment only if the *CompositeUnit* is in scope for that deployment.

  The *operation* defined for a *Requirement* defined in a *CompositeUnit* MUST be the same as the *operation* defined by the *CompositeInstallable* containing the *CompositeUnit*.

  See the *RequirementsType* section for structure and additional usage details [4.7.1].
- **InstallableUnit**: See the *InstallableUnitType* section for structure and additional usage details [4.3.1].
- **ConfigurationUnit**: See the *ConfigurationUnitType* section for structure and additional usage details [4.3.2].
- **CompositeUnit**: A *CompositeUnit* element MAY contain child *CompositeUnits*.
- **ContainedPackage**: See the *ReferencedPackageType* section for structure and additional usage details [4.10.1].
- **id**: The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.

4.10 Aggregation

SDD packages can aggregate other SDD packages. Metadata about the aggregation is defined in *ContainedPackage*, *ContainedLocalizationPackage* and *Requisite* elements. *ContainedPackage* elements are content elements that can be defined anywhere in the base and selectable content hierarchies. *ContainedLocalizationPackages* are content elements that can be defined in the localization content hierarchy. *Requisites* are packages that can be deployed, if necessary, to satisfy requirements in the aggregating SDD. They are not content of the SDD package. The type of all three of these elements is *ReferencedPackageType*. The term *referenced package* is used in this specification when referring to these elements as a group. The term *referenced SDD* is used when referring to any aggregated SDD.

When an SDD aggregates other SDDs, the package descriptors of the aggregated SDDs are included in the *Contents* list in the package descriptor of the aggregating SDD (see Figure 75). The referenced package elements in the deployment descriptor identify a referenced SDD package by referencing its package descriptor definition in *Contents*. Each referenced package element can further constrain the deployment of the referenced SDD by defining additional requirements; by mapping resources defined in the aggregating SDD to those defined in the referenced SDD; and by determining feature selections for deployment of the referenced SDD.

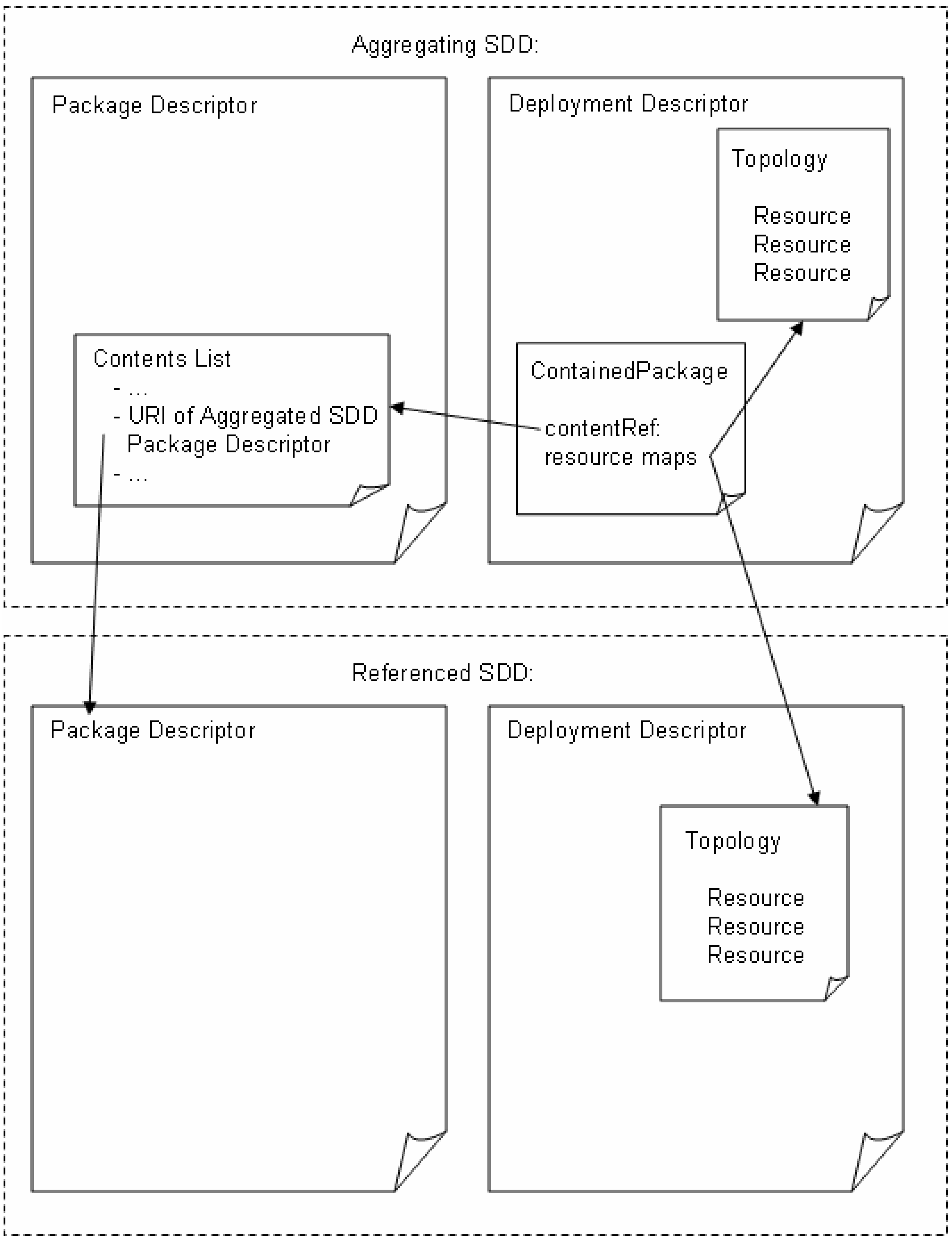


Figure 75: The aggregating SDD identifies the package descriptor of the aggregated SDD and maps resource definitions in the aggregating SDD to resource definitions in the aggregated SDD.

Referenced packages can create and modify software resources that may be required by the aggregating SDD or other SDDs in the aggregation. These resources are mapped to the associated resource definitions in the aggregating SDD by using the *ResultingResourceMap*, the *ResultingChangeMap* and the *RequiredResourceMap* elements of a referenced package element. The characteristics of these resources that other SDDs in the aggregation depend on in some way MUST be exposed in the *ResultingResourceMap,* the *ResultingChangeMap* and the *RequiredResourceMap* elements of the aggregating SDD (see Figure 76). These exposed characteristics are mapped to requirements, conditions and resource variables in the SDDs to determine if requirements are satisfied, conditions are met and to set the values of resource property variables (see Figure 77).

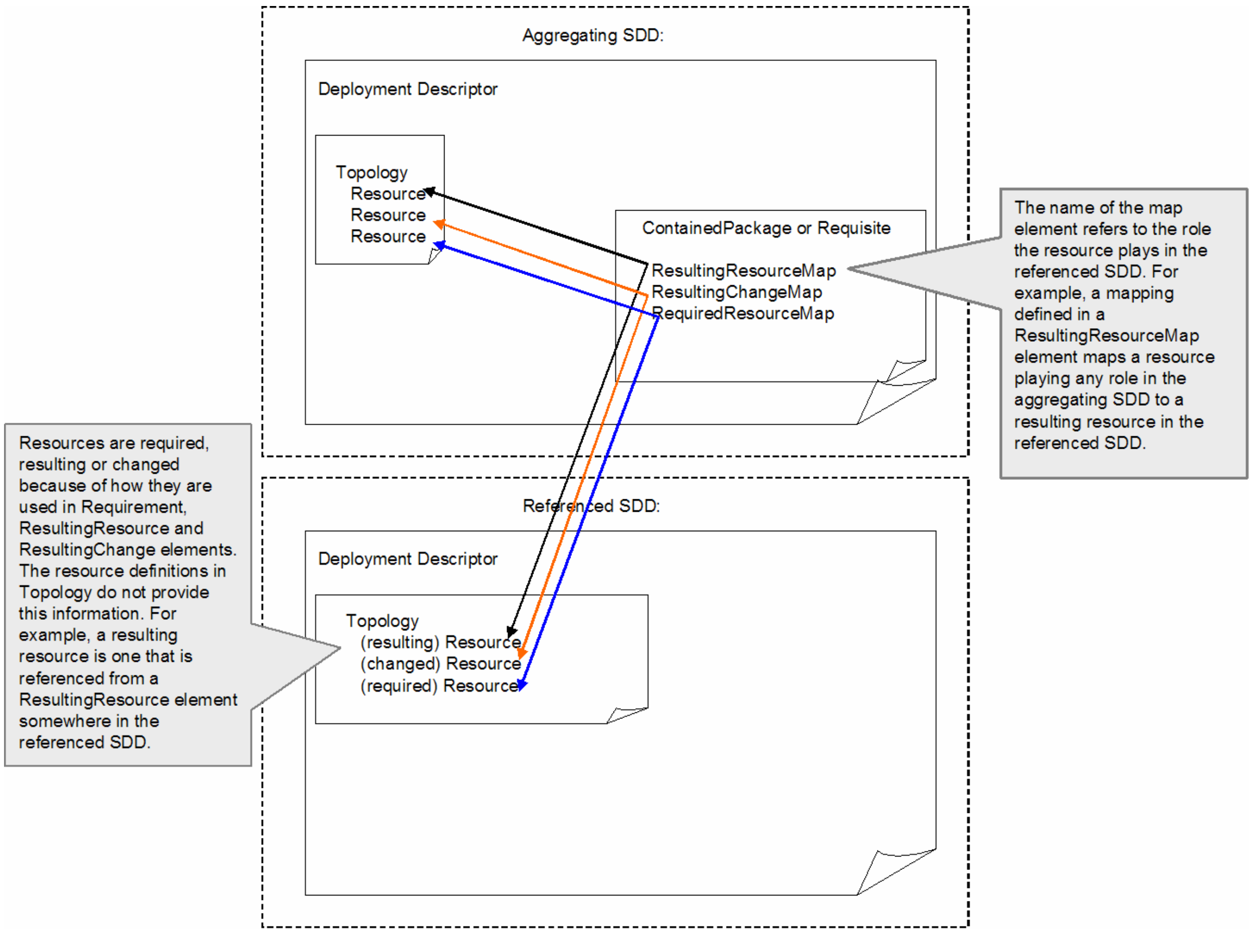
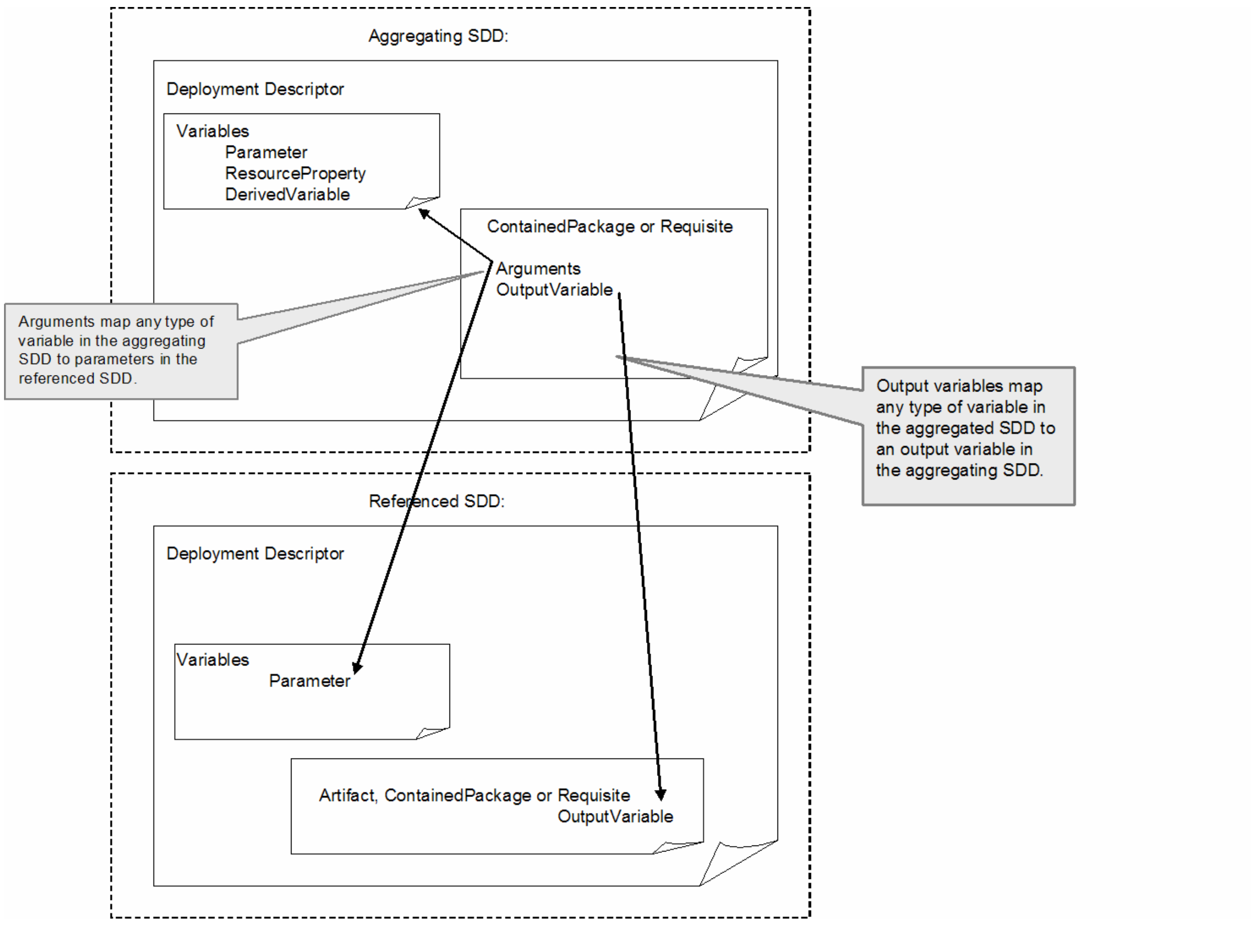

Aggregating SDD:
Deployment Descriptor
Topology
Resource
Resource
Resource
ContainedPackage or Requisite
ResultingResourceMap
ResultingChangeMap
RequiredResourceMap
The name of the map element refers to the role the resource plays in the referenced SDD. For example, a mapping defined in a ResultingResourceMap element maps a resource playing any role in the aggregating SDD to a resulting resource in the referenced SDD.
Resources are required, resulting or changed because of how they are used in Requirement, ResultingResource and ResultingChange elements. The resource definitions in Topology do not provide this information. For example, a resulting resource is one that is referenced from a ResultingResource element somewhere in the referenced SDD.
Referenced SDD:
Deployment Descriptor
Topology
(resulting) Resource
(changed) Resource
(required) Resource

Figure 76: The list of resource maps is segmented by the role the resource plays in the referenced SDD.



Aggregating SDD:
Deployment Descriptor
Variables
Parameter
ResourceProperty
DerivedVariable
ContainedPackage or Requisite
Arguments
OutputVariable
Arguments map any type of variable in the aggregating SDD to parameters in the referenced SDD.
Output variables map any type of variable in the aggregated SDD to an output variable in the aggregating SDD.
Referenced SDD:
Deployment Descriptor
Variables
Parameter
Artifact, ContainedPackage or Requisite
OutputVariable

Figure 77: Arguments and OutputVariables of ReferencedPackageType map variables in the aggregating SDD to variables in the referenced SDD.

4.10.1 ReferencedPackageType

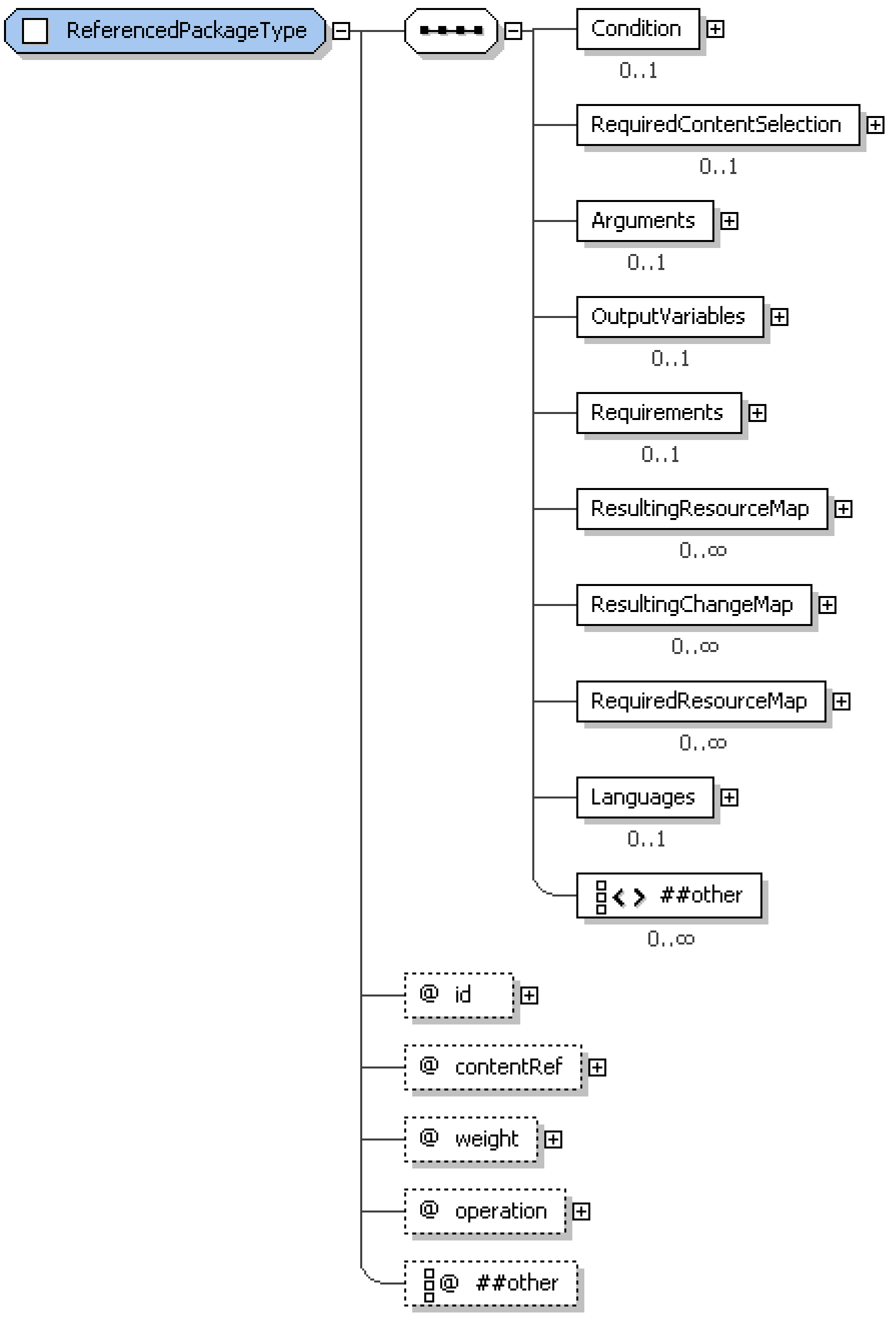


Figure 78: ReferencedPackageType structure.

A referenced package identifies an aggregated SDD and describes the conditions of its aggregation. *ReferencedPackageType* provides the type definition for *ContainedPackage* and *Requisite* elements. *ContainedPackage* elements identify an SDD package that is treated like a content element of the defining SDD. *Requisite* elements identify an SDD package that can be deployed, if necessary, to satisfy resource constraints.

4.10.1.1 ReferencedPackageType Property Summary

Name	Type	*	Description
Condition	ConditionType	0..1	A condition that determines if the referenced package

			is relevant to a particular deployment.
RequiredContentSelection	RequiredContentSelectionType	0..1	A list of groups and features that MUST be selected when the referenced package is deployed.
Arguments	ArgumentListType	0..1	Inputs to the reference package.
OutputVariables	OutputVariableListType	0..1	Outputs from the referenced package.
Requirements	RequirementsType	0..1	Additional requirements for deploying the referenced package as part of the aggregation.
ResultingResourceMap	ResultingResourceMapType	0..*	Maps resulting resources in the referenced package to resources in the referencing package and exposes properties of the resulting resource.
ResultingChangeMap	ResultingChangeMapType	0..*	Maps changed resources defined in the referenced package to resources in the referencing package and exposes changed properties of the resource.
RequiredResourceMap	ResourceMapType	0..*	Maps required resources in the referenced package to resources in the referencing package.
Languages	LanguagesType	0..1	Languages supported by the referenced package.
	xsd:any	0..*	
id	xsd:ID	1	Identifier for the referenced package element that is unique within the deployment descriptor.
contentRef	xsd:token	1	Reference to the identifier of the package Content defined in the package descriptor which identifies the package descriptor of the referenced package.
weight	xsd:positiveInteger	0..1	The time required to process the referenced package relative to all artifacts and other referenced packages in the SDD.
operation	OperationType	0..1	Specifies which operation in the referenced SDD is performed.
	xsd:anyAttribute	0..*	

4.10.1.2 ReferencedPackageType Property Usage Notes

- **Condition**: A *Condition* is used when the *ReferencedPackage's* content should only be deployed when certain conditions exist in the deployment environment.

  See the *ConditionType* section for structure and additional usage details [4.5.1].

- **RequiredContentSelection**: Certain *Groups* or *Features* may need to be selected when deploying the referenced package. These can be identified in the *RequiredContentSelection* element.

  If one particular aggregated SDD requires the selection of different groups or features, depending on other choices made during a particular deployment, different *Requisite* or *ContainedPackage* elements can be defined in a way that will cause the correct combination of *Groups* and *Features* to be used in each situation.

  See the *RequiredContentSelectionType* section for structure and additional usage details [4.12.13].

- **Arguments**: Arguments are used to provide values for input variables defined in the deployment descriptor of the referenced package. The argument name specified MUST reference the *id* of a parameter in the referenced package.

See the *ArgumentListType* section for structure and additional usage details [4.3.8].

- **OutputVariables**: The output variable mapping can be used to set variables to outputs created by processing the referenced SDD. The output variables in the referenced package are mapped to output variables in the aggregating SDD.

  Each output variable value specified MUST reference the *id* of an output variable in the referenced package. This can be an output variable from an artifact or an output variable from a referenced package defined within the referenced SDD.

  See the *OutputVariableListType* section for structure and additional usage details [4.3.10].

- **Requirements**: When the aggregating SDD has stricter requirements for the use of the referenced SDD than are defined by the referenced SDD itself, those requirements can be defined in *Requirements*. This is not intended to repeat requirements expressed in the referenced SDD, but rather to add additional stricter requirements.

  Requirements expressed in the referenced SDD need to be satisfied, in addition to the requirements expressed in the *Requisite* or *ContainedPackage* element of the aggregating SDD.

  Requirements expressed in the aggregating SDD MUST NOT conflict with requirements expressed in the referenced SDD. The requirements specified MUST further constrain the referenced package.

  See the *RequirementsType* section for structure and additional usage details [4.7.1].

- **ResultingResourceMap**: Resources created by the referenced package may be resources that are defined in the aggregating SDD. The *ResultingResourceMap* is used to identify the correspondence between resource definitions in the aggregating SDD and resulting resource definitions in the aggregated SDD.

  Characteristics of the resulting resources MAY be exposed in the *ResultingResourceMap* element. *ResourceConstraints* defined on those resources anywhere in the aggregation are mapped to the resource properties exposed in the resulting maps of the referenced package to determine if the referenced package will satisfy the constraints. Each individual constraint is considered met by the referenced package if a property exposed in the resulting resource map that is in scope for the particular deployment satisfies the constraint.

  > For example, a property constraint in a *ResourceConstraint* element states that the property named “FileAttributes” has the value “Writeable”. The *resourceRef* in the *ResourceConstraint* identifies a resource defined in *Topology* that is also identified in the *ResultingResourceMap* of a *Requisite* or *ContainedPackage* element that is in scope for the particular deployment. If the *ResultingResourceMap* element contains a statement that the property named “FileAttributes” has the value “Writeable”, then the *ResourceConstraint* is met when the *Requisite* or *ContainedPackage* is deployed.

  This same logic applies to *ResourceConstraints* in aggregated packages. If the SDD in the preceding example also aggregates another SDD and maps the same resource to a required resource in that aggregated SDD, then all *ResourceConstraints* in the aggregated SDD are met only if the *ResultingResourceMap* of the referenced SDD that creates that resource contains a *Name*, *Version* or *Property* definition that satisfies the constraint.

  See the *ResultingResourceMapType* section for structure and additional usage details [4.10.3].

- **ResultingChangeMap**: Resources configured by the referenced package may be resources that are defined in the aggregating SDD. The *ResultingChangeMap* is used to identify the correspondence between resource definitions in the aggregating SDD and changed resources defined in *ResultingChange* elements of the aggregated SDD.

  Characteristics of resources that are changed by the referenced SDD MAY be exposed in the *ResultingChangeMap*. These are correlated with *ResourceConstraints* on the changed resource in the same manner as the exposed characteristics of a resulting resource. See the property usage notes for *ResultingResourceMap* above.

  See the *ResultingChangeMapType* section for structure and additional usage details [4.10.4].

- **RequiredResourceMap**: When a resource required by the aggregated SDD is a resource also defined in the aggregating SDD, the *RequiredResourceMap* is used to identify the correspondence.

This element is a simple mapping of a resource in one SDD to a resource in another. There is no need to expose characteristics of the resource because it is not created or modified by the referenced package.

One resource MAY be required, resulting, changed, all three or any combination of these within one SDD. When a resource in the referenced SDD plays more than one role, the mapping MUST be repeated everywhere it applies. This allows exposure of all the created or modified properties in the *ResultingChangeMap* and *ResultingResourceMap*. In this situation–when one resource in the referenced SDD plays more than one of the roles identified earlier (required, resulting or changed)–all mappings MUST be to the same resource in the aggregating SDD. Only the exposed resulting and changed properties differ.

See the *ResourceMapType* section for structure and additional usage details [4.10.2].

- **Languages**: Languages supported by the referenced package MAY be identified here. This list does not identify mandatory versus optional languages; it is for informational purposes only. The SDD author is not limiting use of the referenced package to deployments where all in-scope languages are found in this list. There may be cases where aggregated packages are deployed even though they cannot support all of the languages supported by the aggregation as a whole.

  Each language specified MUST match a language in the referenced package.

  See the *LanguagesType* section for structure and additional usage details [4.13.6].

- **id**: The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.
- **contentRef**: The package descriptor of an SDD that aggregates other SDDs, either through *ContainedPackage* elements or *Requisite* elements, will list the package descriptor files of the aggregated SDDs in its content list. The *contentRef* attribute of a referenced package element MUST be a reference to the *id* of a *Content* element in the aggregating SDD's package descriptor that defines the aggregated package descriptor.
- **weight**: Defining weights for all artifacts and referenced packages in an SDD provides useful information to software that manages deployment. The weight of the referenced package refers to the relative time taken to deploy the referenced package with respect to other packages in this SDD.

  For example, if the referenced package takes twice as long to deploy as a particular install artifact whose weight is "4", then the weight of the referenced package would be "8". The weight numbers have no meaning in isolation and do not describe actual time elapsed. They simply provide an estimate of relative time.

- **operation**: The referenced SDD may support more than one deployment lifecycle operation. The *operation* attribute MUST include the operations that are applicable when this is the case.

  See the *OperationType* section for enumeration values and their meaning [4.3.7].

4.10.2 ResourceMapType

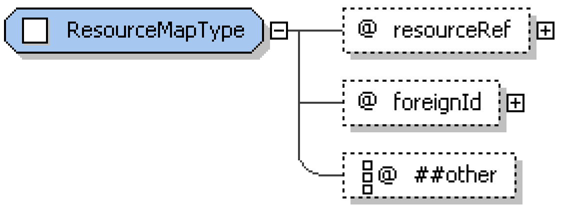


Figure 79: ResourceMapType structure.

ResourceMapType is used in the definition of elements that map resources in an SDD to resources in a referenced SDD. The purpose of a resource map is to identify when two resources in separate SDDs MUST resolve to the same resource instance during any particular deployment. The characteristics of a mapped resource that are defined in the topology sections of the two SDDs MUST NOT conflict.

For example, if a *Name* is defined for the resource in both topologies, it MUST be the same in both definitions and if a *Property* definition is included for the same property in both places, the value MUST be the same.

Additional characteristics of a mapped resource may be constrained by *Requirements* or *Conditions* in either SDD. All constraints on a mapped resource that are in scope for a particular deployment MUST NOT conflict.

Resources that are not mapped between the two SDDs MAY resolve to the same instance when their characteristics defined in topology do not conflict and when the constraints in scope for any particular deployment do not conflict.

The *RequiredResourceMap*, *ResultingResourceMap* and *ResultingChangeMap* elements all use *ResourceMapType*, either directly or as a base type that is extended.

4.10.2.1 ResourceMapType Property Summary

Name	Type	*	Description
resourceRef	xsd:IDREF	1	Reference to a resource defined in the deployment descriptor.
foreignID	xsd:NCName	0..1	Reference to a resource defined in a referenced deployment descriptor.
	xsd:anyAttribute	0..*	

4.10.2.2 ResourceMapType Property Usage Notes

- **resourceRef**: The value of the *resourceRef* MUST be set to the *id* of the resource in the SDD to be mapped to a resource in a referenced SDD.
- **foreignID**: The value MUST reference the *id* of a resource in the referenced package. This is the resource in the referenced SDD that MUST resolve to the same resource instance as the resource identified in *resourceRef*.

4.10.3 ResultingResourceMapType

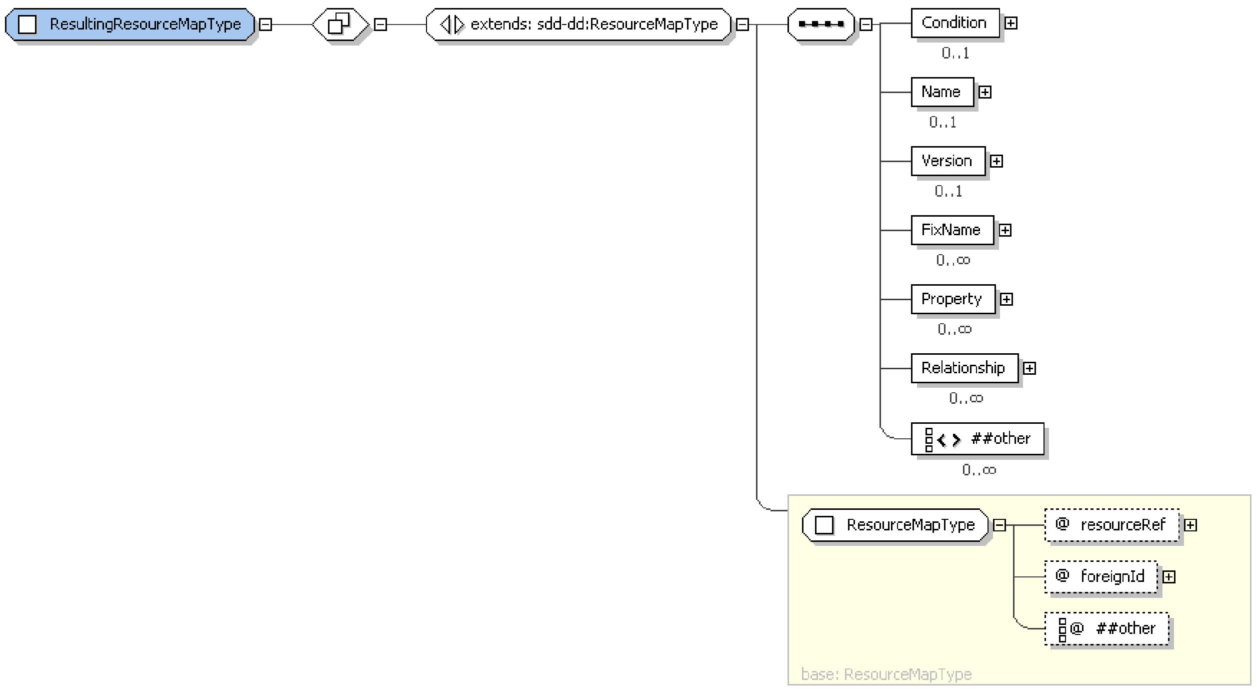


Figure 80: ResultingResourceMapType structure.

ResultingResourceMapType defines an element type that maps resources that result from deployment of the referenced SDD to a resource in the referencing SDD. In addition to identifying the two resources that MUST resolve to the same resource instance, the resulting resource map allows characteristics of the resulting resource to be exposed. There may be constraints defined on the mapped resource in the referencing SDD or any referenced SDD in the hierarchy of SDDs. These constraints can be evaluated by comparing the constraint to the exposed characteristics defined in the resulting resource map. The resulting resource map MUST expose sufficient characteristics of the resulting resource to support successful evaluation of constraints on that resource.

For example, say that the SDD defines a resource with id="Database" in its topology. The solution can work with Database Product A or Database Product B. Database Product A is created by a referenced SDD defined in a *Requisites* element. The SDD will contain *Requirements* and/or *Conditions* that have alternatives for each of the database products. All constraints on the Database resource that apply to Database Product A must be satisfied by a resource characteristic exposed in the *ResultingResourceMap* element of the *Requisite* element that points to the SDD that deploys Database Product A.

4.10.3.1 ResultingResourceMapType Property Summary

Name	Type	*	Description
	[extends] ResourceMapType		See the ResourceMapType section for additional properties [4.10.2].
Condition	ConditionType	0..1	A condition that determines if the resulting resource definition is relevant to a particular deployment.
Name	VariableExpressionType	0..1	The name of the resource created or updated by the referenced SDD.
Version	VersionType	0..1	The version of the resource created or updated by the referenced SDD.
FixName	xsd:string	0..*	Names of fixes to the mapped resource that are created by the referenced SDD.
Property	ResultingPropertyType	0..*	Properties set when the mapped resource is created or updated by the referenced SDD.
Relationship	RelationshipType	0..*	Relationship that will exist after creating or updating the resource.
	xsd:any	0..*	

4.10.3.2 ResultingResourceMapType Property Usage Notes

See the *ResourceMapType* section for details of the inherited attributes and elements [4.10.2].

- **Condition**: A *Condition* is used when the resulting resource will be created by the referenced package only when certain conditions exist in the deployment environment.

  See the *ConditionType* section for structure and additional usage details [4.5.1].

- **Name**: The *Name* of the resulting resource created or updated by the referenced SDD MUST be defined if it is not defined elsewhere and there are constraints on this resource that contain a *Name* element. "Defined elsewhere" means defined in the topology of the referencing SDD or in the topology of any other referenced SDD for a resource that is also mapped to the same resource. "Constraints on this resource" means a constraint that applies to the particular instantiation of the resource that is created or updated by the referenced SDD, for example a constraint that needs to successfully map to the referenced SDD for the referenced SDD to be used in a particular deployment.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].

- **Version**: The *Version* of the resulting resource created or updated by the referenced SDD MUST be defined if it is not defined elsewhere and there are version constraints defined on this resource. (See the usage note for *Name* above for a definition of "defined elsewhere".)

  See the *VersionType* section for structure and additional usage details [3.10].

- **FixName**: One or more names of fixes to the resulting resource created or updated by the referenced SDD MUST be defined if they are not defined elsewhere and there are version constraints defined on this resource that include fix names. (See the usage note for *Name* above for a definition of "defined elsewhere".)

- **Property**: A *Property* of the resulting resource created or updated by the referenced SDD MUST be defined if it is not defined elsewhere and there are property constraints on this property. (See the usage note for *Name* above for a definition of "defined elsewhere".)

  See the *ResultingPropertyType* section for structure and additional usage details [4.2.4].
- **Relationship**: Any number of *Relationship* elements can be included to identify relationships that will exist after applying the referenced package.

  See the *RelationshipType* section for structure and additional usage details [4.8.3].

4.10.4 ResultingChangeMapType

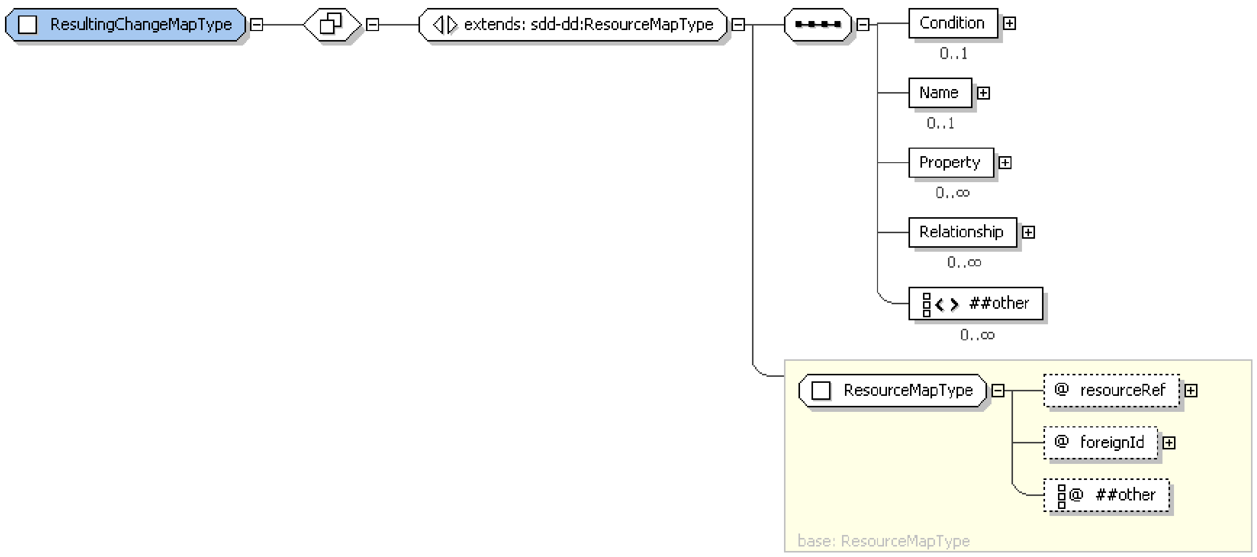


Figure 81: ResultingChangeMapType structure.

ResultingChangeMapType is very similar to *ResultingResourceMapType*. It defines an element type that maps resources that are changed by deployment of the referenced SDD to a resource in the referencing SDD. In addition to identifying the two resources that MUST resolve to the same resource instance, the resulting change map allows characteristics of the modified resource to be exposed. There may be constraints defined on the mapped resource in the referencing SDD or any referenced SDD in the hierarchy of SDDs. These constraints can be evaluated by comparing the constraint to the exposed characteristics defined in the resulting change map. The resulting change map MUST expose sufficient characteristics of the resulting change to support successful evaluation of constraints on that resource.

For example, say that the SDD defines a resource with id="OS" in its topology. The solution can work with Windows or Linux. Linux is configured by a referenced SDD defined in a *Requisites* element. The SDD will contain *Requirements* and/or *Conditions* that have alternatives for Windows and for Linux. All constraints on the modified characteristics of Linux must be satisfied by a resource characteristic exposed in the *ResultingChangeMap* element of the *Requisite* element that points to the SDD that configures Linux.

4.10.4.1 ResultingChangeMapType Property Summary

Name	Type	*	Description
	[extends] ResourceMapType		See the ResourceMapType section for additional properties [4.10.2].
Condition	ConditionType	0..1	A condition that determines if the resulting change definition is relevant to a particular deployment.

Name	VariableExpressionType	0..1	The name of the modified resource.
Property	ResultingPropertyType	0..*	A modified property of the resource.
Relationship	RelationshipType	0..*	Relationship that will exist after the change is applied to the resource.
	xsd:any	0..*	

4.10.4.2 ResultingChangeMapType Property Usage Notes

See the *ResourceMapType* section for details of the inherited attributes and elements [4.10.2].

- **Condition**: A *Condition* is used when the resource mapped from the external package will be changed only when certain conditions exist in the deployment environment.

  See the *ConditionType* section for structure and additional usage details [4.5.1].

- **Name**: The *Name* of the resource that is modified by the referenced SDD is defined here to assist with identifying the resource instance that is changed. It is not an indication that the resource name itself is modified by the referenced SDD. If resource characteristics defined in the topology of any SDD defining a resource mapped to the changed resource are sufficient to identify the resource, then *Name* SHOULD NOT be defined in the *ResultingChangeMap*.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].

- **Property**: A modified property MUST be exposed in a *ResultingChangeMap* if it is not defined elsewhere and there are property constraints on the modified property. “Defined elsewhere” means defined in the topology of the referencing SDD or in the topology of any other referenced SDD for a resource that is also mapped to the same resource. “Constraints on the modified property” means a property constraint that applies to the particular instantiation of the resource that is modified by the referenced SDD, for example a constraint that needs to successfully map to the referenced SDD for the referenced SDD to be used in a particular deployment.

  See the *ResultingPropertyType* section for structure and additional usage details [4.2.4].

- **Relationship**: *Relationship* elements SHOULD be included to identify relationships that will exist after the application of the referenced package.

  Relationships that need to be known by the aggregate MUST be mapped. Relationships need to be known when they are referred to in one or more resource constraints.

  See the *RelationshipType* section for structure and additional usage details [4.8.3].

4.10.5 RequisitesType

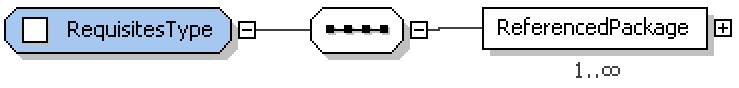


Figure 82: RequisitesType structure.

The *Requisites* element contains a list of references to SDD packages that can be used to satisfy one or more of the requirements defined by content elements. The definition of a requisite does not imply that it must be used; only that it is available for use if needed.

Requisite definitions can map values and resources defined in the SDD to inputs and resources defined in the requisite SDD.

4.10.5.1 RequisitesType Property Summary

Name	Type	*	Description
ReferencedPackage	ReferencedPackageType	1..*	An SDD package that can, but is not required to, be deployed to satisfy a requirement.

4.10.5.2 RequisitesType Property Usage Notes

- **ReferencedPackage**: See the *ReferencedPackageType* section for structure and additional usage details [4.10.1].

4.11 Base Content

Base content is the default content for the deployment lifecycle operation associated with the *CompositeInstallable* that contains the base content. This is content that is deployed whenever the associated operation is performed on the SDD package. Base content may be conditioned on characteristics of the deployment environment but it is not selectable by the deployer.

Resources associated with base content for one operation may be different from resources associated with base content for a different operation in the same SDD package.

For example, base content in the *CompositeInstallable* for the configuration operation may configure resources that were created by selectable content in the *CompositeInstallable* for the install operation. In this example, the configuration is in base content because it must be done if the resource exists. It is not selectable by the deployer during the configuration operation.

4.11.1 BaseContentType

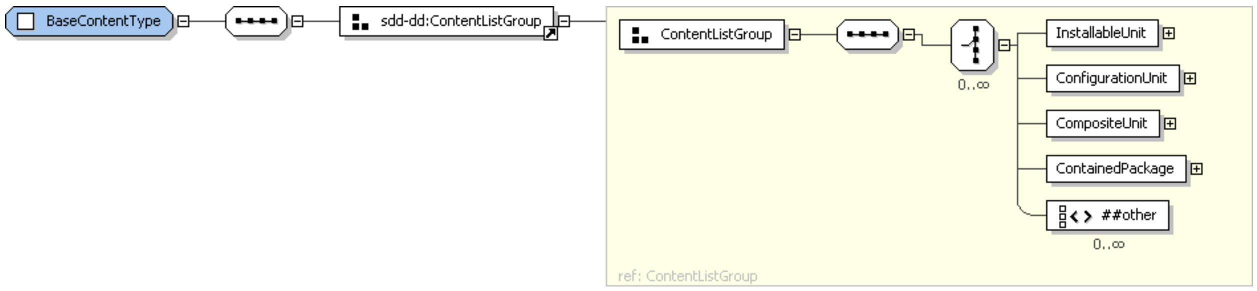


Figure 83: BaseContentType structure.

The *BaseContent* hierarchy defines the default content for the deployment operation described by the *CompositeInstallable*. This content MAY be conditioned.

4.11.1.1 BaseContentType Property Summary

Name	Type	*	Description
InstallableUnit	InstallableUnitType	0..*	An InstallableUnit that defines base content.
ConfigurationUnit	ConfigurationUnitType	0..*	A ConfigurationUnit that defines base configuration content.
CompositeUnit	CompositeUnitType	0..*	A CompositeUnit that organizes base content.
ContainedPackage	ReferencedPackageType	0..*	An SDD whose content is considered to be base content in the context of this aggregation.
	xsd:any	0..*	

4.11.1.2 BaseContentType Property Usage Notes

- **InstallableUnit**: See the *InstallableUnitType* section for structure and additional usage details [4.3.1].
- **ConfigurationUnit**: See the *ConfigurationUnitType* section for structure and additional usage details [4.3.2].
- **CompositeUnit**: See the *CompositeUnitType* section for structure and additional usage details [4.9.2].

- **ContainedPackage**: See the *ReferencedPackageType* section for structure and additional usage details [4.10.1].

4.12 Content Selectability

The SDD author MAY define selectable subsets of content using *Groups* and *Features*. Selectability, as used in the SDD, is a characteristic of the deployment lifecycle operation and the package. The decision to provide selectability for one operation in one package has no semantic relationship to the selectability provided in another package related to the same software. It also has no semantic relationship to the selectability provided for a different operation within the same package.

> For example, when the SDD author chooses to create a feature in a maintenance package, that feature is designed to allow selectable application of the maintenance, not to reflect the original set of features for the base content.

4.12.1 SelectableContentType

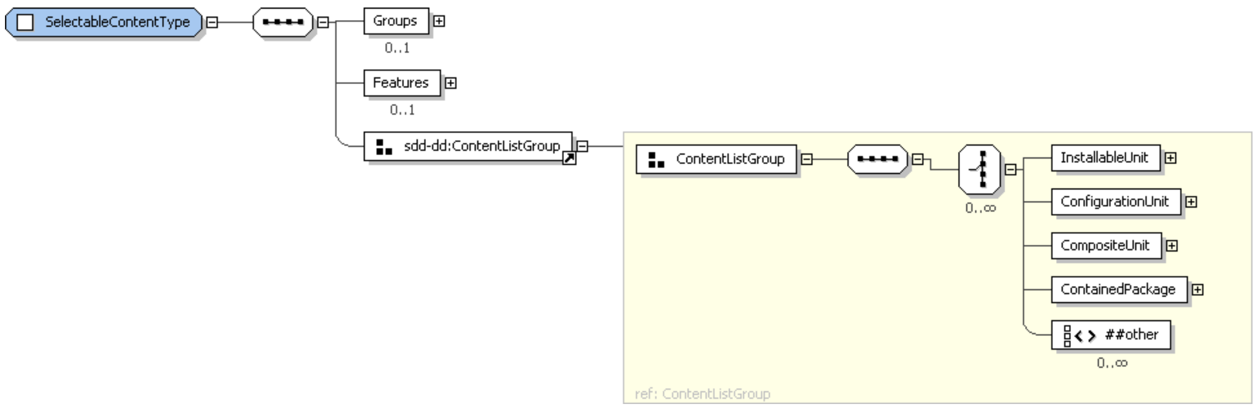


Figure 84: SelectableContentType structure.

Content elements defined here make up the selectable content hierarchy. These elements are selected via *Groups* and *Features* also defined under *SelectableContent*.

4.12.1.1 SelectableContentType Property Summary

Name	Type	*	Description
Groups	GroupsType	0..1	Groups of features that can be selected as a unit.
Features	FeaturesType	0..1	A definition of user-selectable content.
InstallableUnit	InstallableUnitType	0..*	An InstallableUnit that defines selectable content.
ConfigurationUnit	ConfigurationUnitType	0..*	A ConfigurationUnit that defines selectable configuration.
CompositeUnit	CompositeUnitType	0..*	A CompositeUnit that organizes content elements that define selectable content.
ContainedPackage	ReferencedPackageType	0..*	An SDD package whose content is selectable in the context of the aggregating SDD.
	xsd:any	0..*	

4.12.1.2 SelectableContentType Property Usage Notes

- **Groups**: *Groups* can be used by the SDD author to define a convenient way for deployers to select a group of features.

"Typical" and "Custom" are examples of groups that are commonly presented in installation interfaces.

See the *GroupsType* section for structure and additional usage details [4.12.2].

- **Features**: *Features* can be used to organize optional functionality into meaningful selections. *Features* should be meaningful from the deployer's point of view.

  See the *FeaturesType* section for structure and additional usage details [4.12.4].
- **InstallableUnit**: See the *InstallableUnitType* section for structure and additional usage details [4.3.1].
- **ConfigurationUnit**: See the *ConfigurationUnitType* section for structure and additional usage details [4.3.2].
- **CompositeUnit**: See the *CompositeUnitType* section for structure and additional usage details [4.9.2].
- **ContainedPackage**: See the *ReferencedPackageType* section for structure and additional usage details [4.10.1].

4.12.2 GroupsType

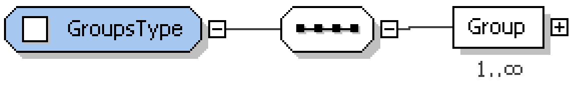


Figure 85: Groups structure.

GroupsType is used in *SelectableContent* to provide a list of one or more *Group* elements.

4.12.2.1 GroupsType Property Summary

Name	Type	*	Description
Group	GroupType	1..*	A group of features that can be selected together.

4.12.2.2 GroupsType Property Usage Notes

- **Group**: Associating features in a *Group* is based on the characteristics of the package and the ways in which the SDD author chooses to expose function variability to the deployer.

  One example is a "Typical" group that allows easy selection of the most common grouping of features, along with a "Custom" group that allows an advanced user to select from among all features. Another example is a "Client" group that selects features that deploy the client software for an application, along with a "Server" group that selects features that deploy the server software for the same application.

  If alternative sets of selections are desired, Groups MUST be used to define these sets. Zero or one set can be selected for any particular deployment

  See the *GroupType* section for structure and additional usage details [4.12.3].

4.12.3 GroupType

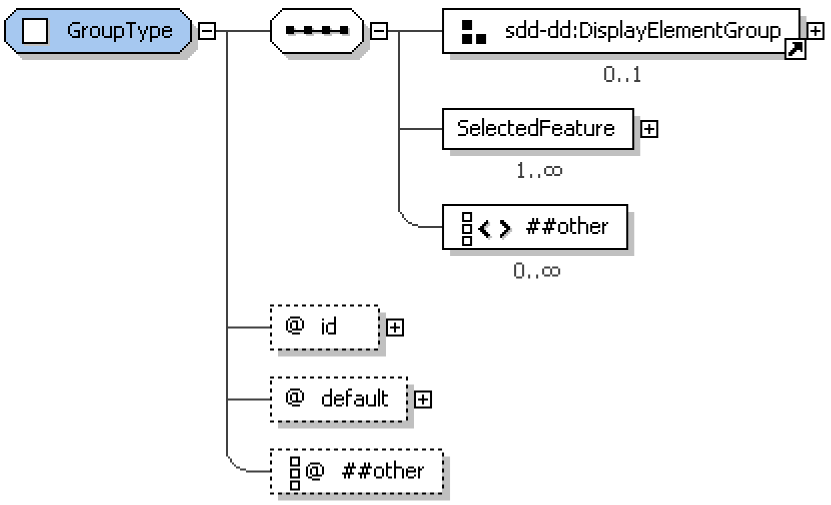


Figure 86: GroupType structure.

GroupType provides the type definition for each *Group* element in *SelectableContent's* list of *Groups*. For a particular deployment, zero or one groups may be selected by the deployer.

4.12.3.1 GroupType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	A human-readable name for the group.
Description	DisplayTextType	0..1	A human-readable description of the group.
ShortDescription	DisplayTextType	0..1	A human-readable short description of the group.
SelectedFeature	FeatureReferenceType	1..*	A feature that is part of the group.
	xsd:any	0..*	
id	xsd:ID	1	An identifier of the group that is unique within the descriptor.
default	xsd:boolean	0..1	Indicates that the group is selected by default when no selections are provided by the deployer. **default value="false"
	xsd:anyAttribute	0..*	

4.12.3.2 GroupType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the group.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the group.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **SelectedFeature**: Each *SelectedFeature* is considered selected if inputs identify the group as selected.

  Selection of a nested feature causes its parent feature to be selected.

See the *FeatureReferenceType* section for structure and additional usage details [4.12.8].

- **id**: The group's *id* may be used to refer to the group when aggregating the SDD into another SDD.

  The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.
- **default**: Multiple default *Groups* MUST NOT be defined.

4.12.4 FeaturesType

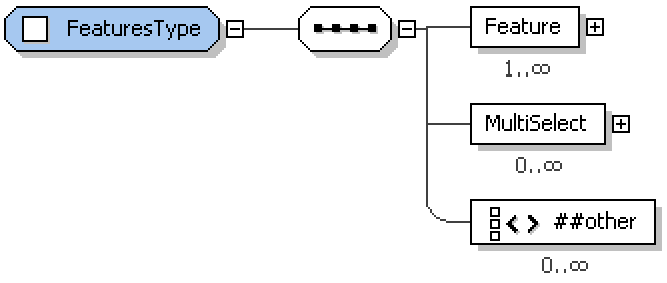


Figure 87: FeaturesType structure.

FeaturesType provides the type definition for the single, optional, *Features* element in *SelectableContent*. Features defined directly under the *Features* element in *SelectableContent* are the top level features. A *Features* element may also include a *MultiSelect* element that refers to features whose selections are interdependent.

4.12.4.1 FeaturesType Property Summary

Name	Type	*	Description
Feature	FeatureType	1..*	A top level feature in the hierarchy of features defined in SelectableContent.
MultiSelect	MultiSelectType	0..*	A list of feature references whose selection is controlled as a multi-select list with defined minimum and maximum selections.
	xsd:any	0..*	

4.12.4.2 FeaturesType Property Usage Notes

- **Feature**: Each top level *Feature* can define *NestedFeatures*. All features can define required relationships with other features that cause the required feature to be selected.

  See the *FeatureType* section for structure and additional usage details [4.12.5].
- **MultiSelect**: The *MultiSelect* element MUST refer to *Feature* or *NestedFeature* elements.

  See the *MultiSelectType* section for structure and additional usage details [4.12.15].

4.12.5 FeatureType

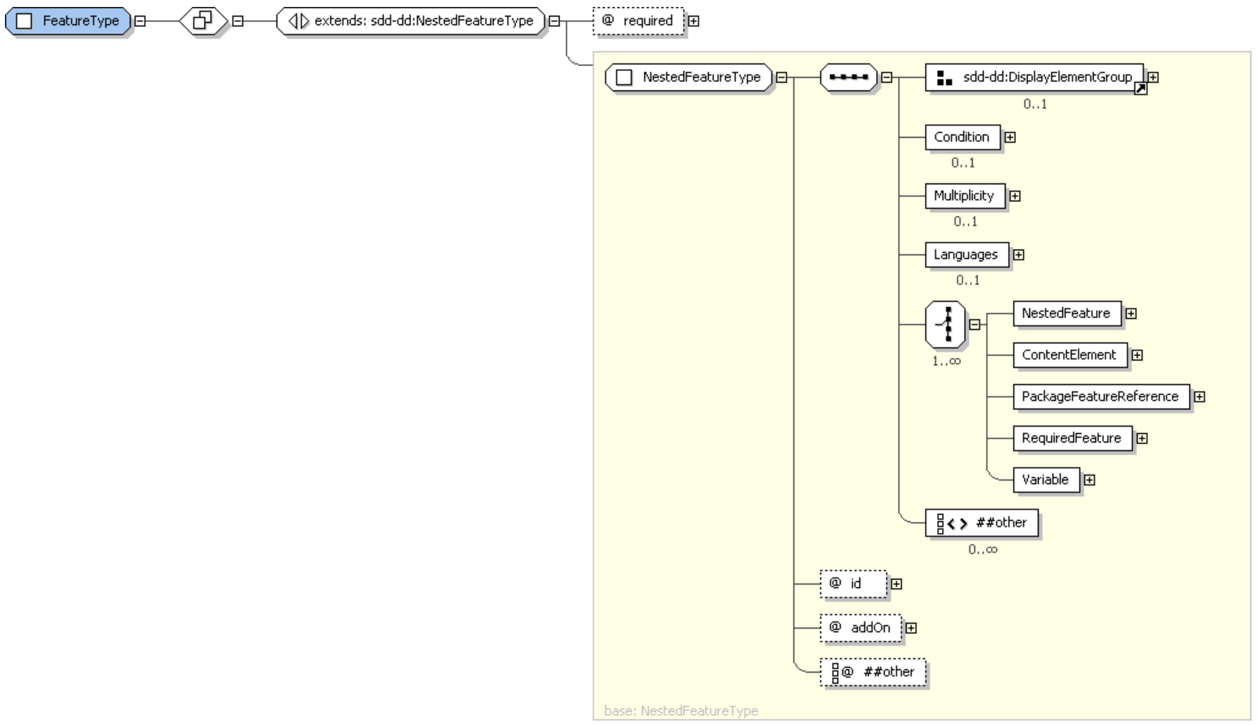


Figure 88: FeatureType structure.

FeatureType provides the type definition for each feature defined directly below *SelectableContent*. A *Feature* can define *NestedFeatures* and identify *ContentElements* and other features that will be selected when the feature is selected. A feature can also be defined to be available for selection only under certain conditions.

4.12.5.1 FeatureType Property Summary

Name	Type	*	Description
	[extends] NestedFeatureType		See the NestedFeatureType section for additional properties [4.12.6].
required	xsd:boolean	0..1	Indicates the feature must be selected. **default value="false"

4.12.5.2 FeatureType Property Usage Notes

See the *NestedFeatureType* section for details of the inherited attributes and elements [4.12.6].

- **required**: A top level *Feature* MUST be selected when the value of the *required* attribute is "true". In this case, the user cannot choose to deselect this top level *Feature*.

  In *Features* that define *Multiplicity,* the SDD author can state a minimum number of instances of the *Feature*. This minimum applies only if the *Feature* is selected. The *required* attribute can be used to indicate that the *Feature* is always selected and so the minimum number of instances applies.

  The *required* attribute SHOULD be used only when *Multiplicity* is applied to the *Feature*.

4.12.6 NestedFeatureType

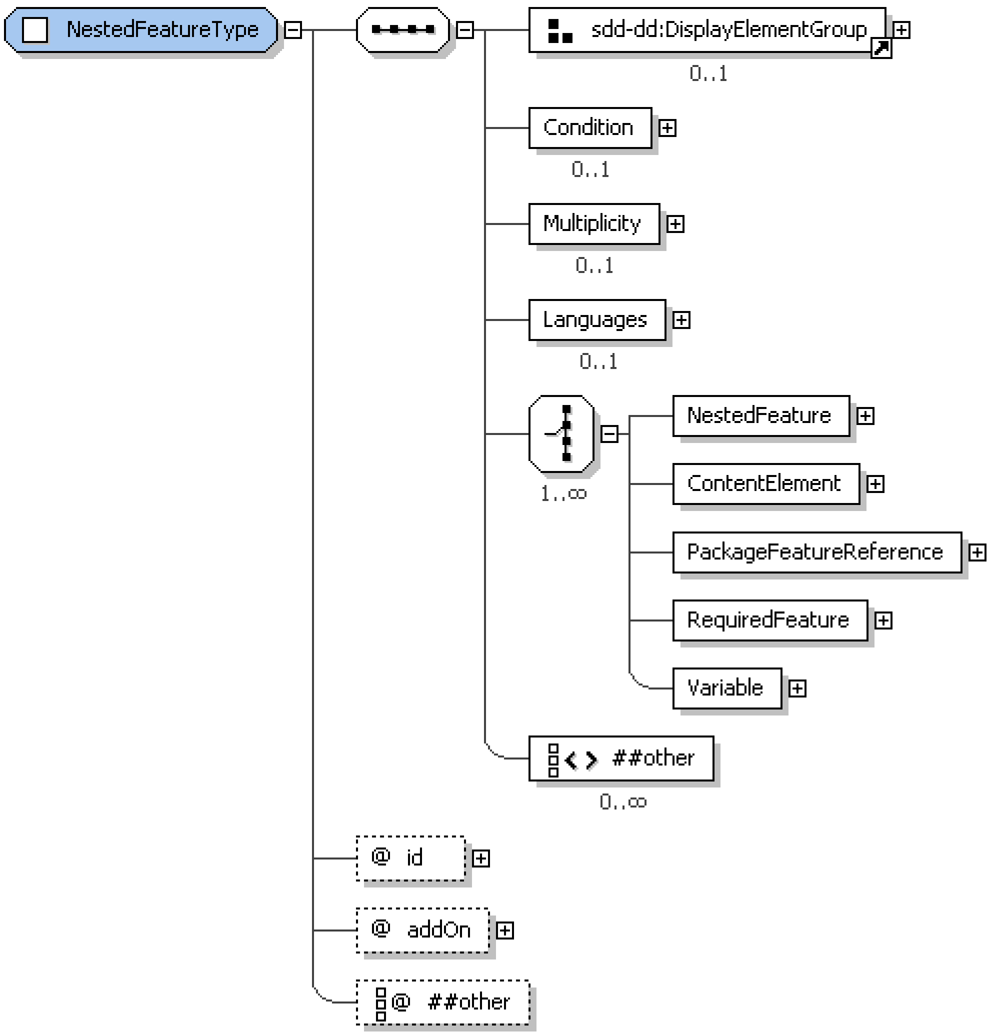


Figure 89: NestedFeatureType structure.

NestedFeatureType is identical to *FeatureType* except that *NestedFeatureType* does not define a *required* attribute. All features other than those defined directly below *SelectableContent* use the *NestedFeatureType*.

4.12.6.1 NestedFeatureType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	A human-readable name for the feature.
Description	DisplayTextType	0..1	A human-readable description of the feature.
ShortDescription	DisplayTextType	0..1	A human-readable short description of the feature.
Condition	ConditionType	0..1	A condition that determines if the feature is relevant to a particular deployment.
Multiplicity	MultiplicityType	0..1	Both an indication that multiple instances of the feature can be selected and the specification of their constraints.

Languages	LanguageSelectionsType	0..1	A list of language support available for the feature's content.
NestedFeature	NestedFeatureType	0..*	A nested feature.
ContentElement	ContentElementReferenceType	0..*	A reference to a content element to be deployed when the feature is selected.
PackageFeatureReference	PackageFeatureReferenceType	0..*	A reference to a feature to be selected in a ContainedPackage defined in either the BaseContent or SelectableContent hierarchies.
RequiredFeature	FeatureReferenceType	0..*	A reference to a feature that is required when the defining feature is selected and so is selected automatically.
Variable	DerivedVariableType	0..*	The definition of a variable that can be used anywhere in any variable expression in the SDD.
	xsd:any	0..*	
id	xsd:ID	1	Used within the SDD to refer to the feature.
addOn	xsd:boolean	0..1	A "true" value indicates that the feature can be added to a deployed instance of the solution. **default value="false"
	xsd:anyAttribute	0..*	

4.12.6.2 NestedFeatureType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the nested feature.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the nested feature.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Condition**: If the features and its nested features are only applicable in certain environments, a *Condition* can be defined. When the *Condition* is not met, the feature and its nested features are not in scope.

  > For example, some features may be available only on a Linux operating system, even though the software can be applied on other operating systems. In this case, a *Condition* can be defined to cause the feature to be ignored when the operating system is not Linux.

  See the *ConditionType* section for structure and additional usage details [4.5.1].
- **Multiplicity**: When multiple instances of a feature can be selected, a *Multiplicity* element MUST be defined.

  > For example, a solution that includes a server and a client may allow the deployment of multiple clients. In this situation, a feature that defines a *Multiplicity* element would select the content elements that deploy the client software.

  See the *MultiplicityType* section for structure and usage details [4.12.7].
- **Languages**: Sometimes language support for a feature is different than that available for the overall solution. This is especially likely when features are implemented by aggregation of packages

provided by different teams. When language support differs, the *Languages* element of the feature MUST be defined to state which languages are supported for the feature.

When *Languages* is defined in a feature, it overrides the global declaration of supported languages and MUST declare the complete set of language support available for that feature.

If *Languages* is not defined, the global declaration of supported languages in *CompositeInstallable* applies for the feature.

See the *LanguageSelectionsType* section for structure and additional usage details [4.13.4].

- **NestedFeature**: A *NestedFeature* must be explicitly selected. It is not assumed to be selected when the parent feature is selected. Selection of a nested feature causes its parent feature to be selected, but not vice-versa. The definition of a *NestedFeature* indicates that application of the *NestedFeature* is dependent on application of the parent feature.
- **ContentElement**: The *ContentElement* referred to MUST be in the selectable content hierarchy defined by the *SelectableContent* element.

  When the content reference is to a *CompositeUnit*, the composite and all content elements below it in the content hierarchy are considered to be in scope when the feature is selected. Ease of referencing a group of content from a feature can be one reason for using a composite in the content hierarchy.

  See the *ContentElementReferenceType* section for structure and additional usage details [4.12.9].
- **PackageFeatureReference**: Selection of a feature may result in selection of an aggregated package's feature identified by a *ContainedPackage* element anywhere in the *BaseContent* or *SelectableContent* hierarchies. A *PackageFeatureReference* identifies both the *ContainedPackage* and the applicable features to be selected in that package.

  See the *PackageFeatureReferenceType* section for structure and additional usage details [4.12.10].
- **RequiredFeature**: When the selection of one feature requires the selection of another feature, the *RequiredFeature* can be used to specify this requirement.

  When two features identify each other as required features, they are always selected together.

  The selection of the defining feature MUST cause the required feature to be selected.

  See the *FeatureReferenceType* section for structure and additional usage details [4.12.8].
- **Variable**: *Variables* defined in features are useful when inputs to an artifact need to vary based on which features are selected for a particular deployment. Artifact arguments can be defined in terms of feature *Variables* to allow for this variation. When an artifact deploys selectable content, inputs to the artifact that indicate the selections for a particular deployment can be associated with feature selection in the SDD via feature *Variables.*

  > For example, a *Feature* that deploys a trace facility might define a *Variable* called "TraceSettings". The value of an argument to a base content artifact might define its value as "$(TraceSettings)". If the feature is selected, this argument would be used and its value would be taken from the feature *Variable*. If the feature is not selected, the argument would be ignored.

  A *Variable* defined in a feature differs from *Variable* elements defined in content elements in one important way. A reference to an undefined feature *Variable* is treated as an empty string and is considered to be defined.

  See the *DerivedVariableType* section for structure and additional usage details [4.6.13].
- **id**: Provides the means to reference a feature from other features.

  The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.
- **addOn**: When a solution and the artifacts that deploy the various parts of the solution are designed in a way that supports the addition of a particular feature at a later time (after the deployment of the base solution), the *addOn* attribute is set to "true".

4.12.7 MultiplicityType

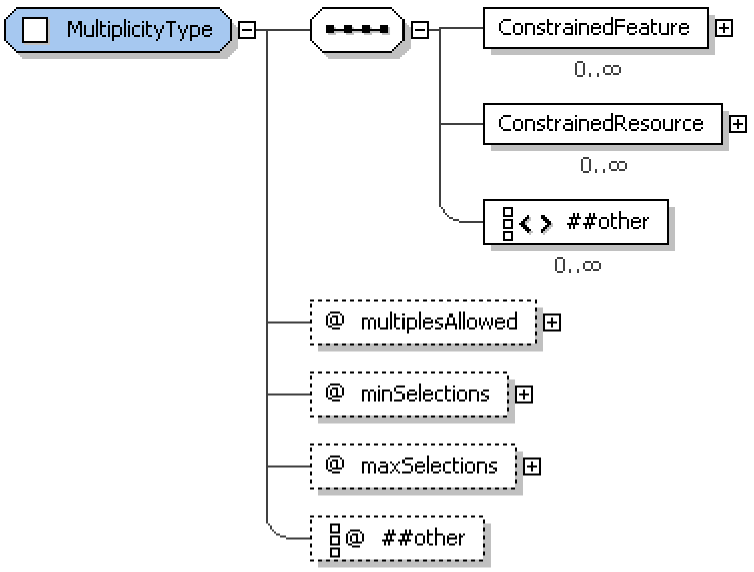


Figure 90: MultiplicityType structure.

Some solutions allow multiple instances of some portion of the solution's resources to be deployed as part of the solution.

> For example, a solution that includes a server and a client may allow the deployment of multiple clients. The deployment of each client may involve content elements that represent several different resulting resources, features that control optional functionality of the client and configuration elements that configure the client. All of these can be defined within a "Client" feature that declares a *Multiplicity* element that indicates that multiple clients are allowed. Each selection or "instance" of the feature results in the deployment of a client.

The phrase "feature instance" is used to refer to the set of instances of all resources deployed when the feature is selected. It does not imply that features themselves are represented as having lifecycle or that features in the SDD correspond with feature instances in the deployment environment.

4.12.7.1 MultiplicityType Property Summary

Name	Type	*	Description
ConstrainedFeature	FeatureReferenceType	0..*	A nested feature whose selection must be the same for all instances of the defining feature in a particular deployment.
ConstrainedResource	ConstrainedResourceType	0..*	A resource that must resolve to the same resource instance for all instances of the feature in a particular deployment.
	xsd:any	0..*	
multiplesAllowed	xsd:boolean	1	Indicates that multiple instances of the feature are allowed. **fixed value="true"
minSelections	xsd:positiveInteger	0..1	The minimum number of instances of the feature that must be selected if the feature is selected at all. **default value="1"
maxSelections	xsd:positiveInteger	0..1	That maximum number of instances of the feature that can be selected.
	xsd:anyAttribute	0..*	

4.12.7.2 MultiplicityType Property Usage Notes

- **ConstrainedFeature**: A feature with multiplicity may contain *NestedFeature* elements. When a *NestedFeature* is identified in a *ConstrainedFeature*, then all instances of the defining *Feature* MUST make the same selection choice for that *NestedFeature*.

  See the *FeatureReferenceType* section for structure and additional usage details [4.12.8].
- **ConstrainedResource**: The content elements selected by a feature may express constraints on resources. When the resource constraints for each instance of a feature must resolve to the same resource instance, or when all must resolve to unique resource instances, the resource is referred to and the constraint type is identified in the *ConstrainedResource* element.

  See the *ConstrainedResourceType* section for structure and additional usage details [4.12.11].
- **multiplesAllowed**: This is an attribute with a fixed value of “true”. It is included because all other elements and attributes of *MultiplicityType* are optional. A feature that allows multiples but has no need to define constraints on resources, features or number of instances would define a *Multiplicity* element that had only the *multiplesAllowed* attribute.
- **minSelections**: When a feature is selected, if more than one instance of the feature is required, *minSelections* MUST be specified.
- **maxSelections**: When a feature is selected, if there is a limit on the number of instances of the feature that can be selected, *maxSelections* MUST be specified. If *maxSelections* is defined, it MUST be equal to or greater than *minSelections*.

4.12.8 FeatureReferenceType

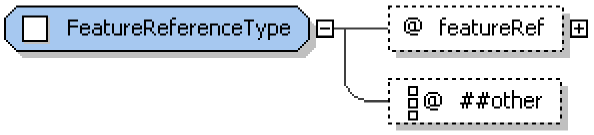


Figure 91: FeatureReferenceType structure.

FeatureReferenceType provides a way to reference a feature defined in the SDD from within the SDD.

4.12.8.1 FeatureReferenceType Property Summary

Name	Type	*	Description
featureRef	xsd:IDREF	1	Reference to a feature defined in the deployment descriptor.
	xsd:anyAttribute	0..*	

4.12.8.2 FeatureReferenceType Property Usage Notes

- **featureRef**: The value MUST reference the *id* of a feature in the deployment descriptor.

4.12.9 ContentElementReferenceType

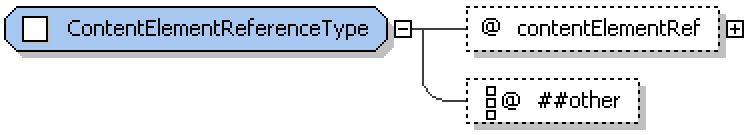


Figure 92: ContentElementReferenceType structure.

ContentElementReferenceType provides a way to reference a content element defined in the SDD from within a feature.

4.12.9.1 ContentElementReferenceType Property Summary

Name	Type	*	Description
contentElementRef	xsd:IDREF	1	Reference to a content element in the deployment descriptor's selectable content.
	xsd:anyAttribute	0..*	

4.12.9.2 ContentElementReferenceType Property Usage Notes

- **contentElementRef**: The value MUST reference the *id* of a content element in the deployment descriptor.

4.12.10 PackageFeatureReferenceType

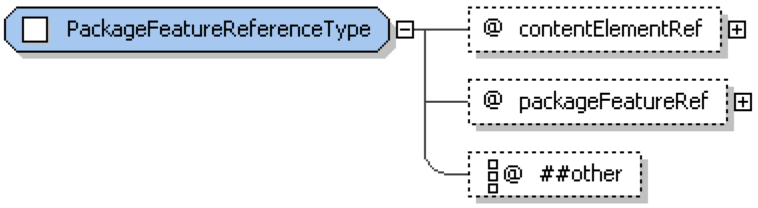


Figure 93: PackageFeatureReferenceType structure.

PackageFeatureReferenceType provides a way to reference a feature defined in a referenced SDD. It identifies the *ContainedPackage* element that references the SDD and the feature in the referenced SDD.

4.12.10.1 PackageFeatureReferenceType Property Summary

Name	Type	*	Description
contentElementRef	xsd:IDREF	1	Reference to a content element in the deployment descriptor.
packageFeatureRef	xsd:NCName	1	The feature's id as defined in the referenced package's deployment descriptor.
	xsd:anyAttribute	0..*	

4.12.10.2 PackageFeatureReferenceType Property Usage Notes

- **contentElementRef**: This value MUST reference the *id* of a *ContainedPackage* element in *SelectableContent* or *BaseContent.* This reference does not cause the *ContainedPackage* to be in scope.
- **packageFeatureRef**: Specifies the value of the *id* of a feature element from the SDD of the *ContainedPackage* identified in *contentElementRef*. This feature reference is ignored when the *ContainedPackage* identified in *contentElementRef* is not in scope for a particular deployment.

4.12.11 ConstrainedResourceType

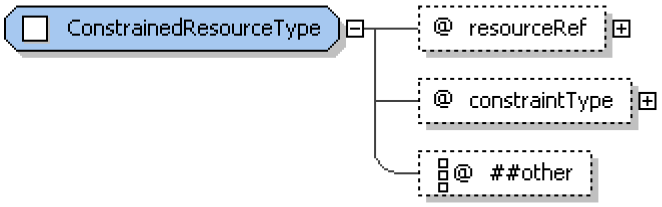


Figure 94: ConstrainedResourceType structure.

A resource may be required during deployment of the content selected by a *Feature* instance. The requirement may exist because the resource is used in a *Requirement* statement, referred to in a *Variable* whose value is in scope for the particular deployment or referred to in a constraint in a *Condition* that is satisfied for the particular deployment. This is an in-scope, required resource for the particular deployment. The SDD author may wish to constrain in-scope, required resources to resolve to the same resource instance for all *Feature* instances or to resolve to unique resource instances for each *Feature* instance. This is done using a *ConstrainedResource* element.

4.12.11.1 ConstrainedResourceType Property Summary

Name	Type	*	Description
resourceRef	xsd:IDREF	1	A reference to the constrained resource.
constraintType	MultiplicityConstraintType	0..1	Indicates whether the constraint requires every instance of the resource to be the same or requires every instance to be different. **default value="same"
	xsd:anyAttribute	0..*	

4.12.11.2 ConstrainedResourceType Property Usage Notes

- **resourceRef**: The value MUST reference the *id* of a resource element in *Topology*.
- **constraintType**: If there is a constraint, *constraintType* indicates that all resource instances be unique or that all resource instances be the same.

  For example, all clients for a particular solution may need to connect to the same database. In this case, *constraintType* would be set to *same*. In other cases, each of the deployed resources might need to use its own unique instance of a required resource. If there could be only one client per operating system, a constraint on the operating system resource would set *constraintType* to *unique*.

  See the *MultiplicityConstraintType* section for the enumeration values for *constraintType* [4.12.12].

4.12.12 MultiplicityConstraintType

This is a simple type that is used to indicate how resources declared in the *Multiplicity* element should be treated. Enumeration values are *same*, *unique*, or if a value is not specified, the SDD author is indicating that it doesn't matter.

4.12.12.1 MultiplicityConstraintType Property Usage Notes

- **same**: The value *same* is used to indicate that the constraint requires all resource instances MUST be the same.
- **unique**: The value *unique* is used to indicate that each resource instance MUST be unique.

4.12.13 RequiredContentSelectionType

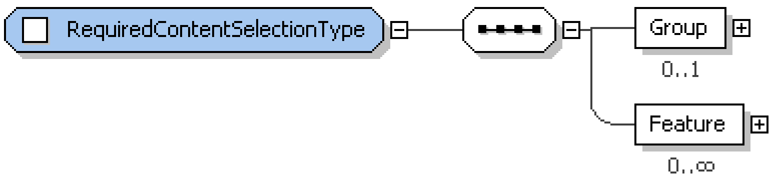


Figure 95: RequiredContentSelectionType structure.

When one SDD aggregates another, there needs to be an indication of which *Groups* and/or *Features* in the aggregated SDD should be selected. The *RequiredContentSelection* of the referenced package element identifies which elements MUST be selected when the defining package is selected.

4.12.13.1 RequiredContentSelectionType Property Summary

Name	Type	*	Description
Group	xsd:token	0..1	A reference to the group to be selected.
Feature	ContentSelectionFeatureType	0..*	A reference to a feature to be selected.

4.12.13.2 RequiredContentSelectionType Property Usage Notes

- **Group**: The *Group* value is the identifier of a *Group* in the aggregated SDD. This value MUST reference the *id* of a *Group* element in the deployment descriptor denoted by the referenced package.
- **Feature**: The *Feature* element value is the identifier of the feature in the aggregated SDD. Attributes indicating the number of selections to be made can be included. The feature value MUST be the *id* of a feature element in the deployment descriptor denoted by the referenced package.

  If *Group* is also defined, *Feature* SHOULD be a feature that is not selected by the *Group*.

  See the *ContentSelectionFeatureType* section for structure and additional usage details [4.12.14].

4.12.14 ContentSelectionFeatureType

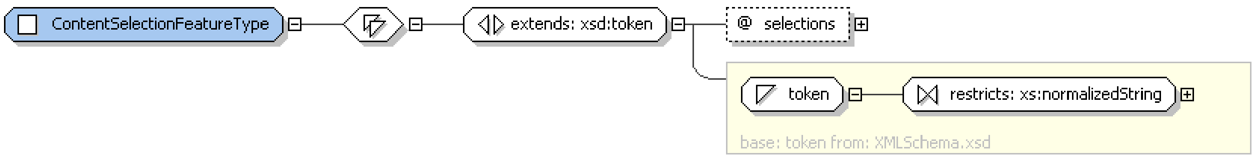

ContentSelectionFeatureType
extends: xsd:token
selections
token
restricts: xs:normalizedString
base: token from: XMLSchema.xsd

Figure 96: ContentSelectionFeatureType structure.

The *ContentSelectionFeatureType* allows for the definition of the number of times a feature can be referenced if that feature includes a *Multiplicity* element.

> For example, a software package has a server and client; the server can be deployed only on one machine, but the client can be deployed on multiple machines and configured to reference the one server. The server, for performance reasons, is limited to 10 client connections. To limit the number of times the client can be deployed, the *selections* attribute should be set to “10”.

4.12.14.1 ContentSelectionFeatureType Property Summary

Name	Type	*	Description
	[extends] xsd:token		See the xsd:token definition in **[XSD].**
selections	VariableExpressionType	0..1	The number of times a feature with Multiplicity in the referenced package should be deployed.

4.12.14.2 ContentSelectionFeatureType Property Usage Notes

See the `xsd:token` definition in **[XSD]** for inherited attributes and elements.

- **selections**: The value of *selections* MUST be, or resolve to, a positive integer that is within the bounds of the *minSelections* and *maxSelections* attributes defined in the *Multiplicity* element of the referenced feature.

  See the *VariableExpressionType* section for structure and additional usage details [4.6.1].

4.12.15 MultiSelectType

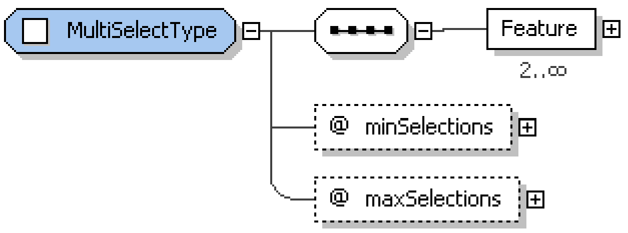


Figure 97: MultiSelectType structure.

MultiSelectType defines a way to associate features with a defined minimum and maximum number of selections allowed. A *MultiSelect* element MAY be used to support identification of mutually exclusive features.

4.12.15.1 MultiSelectType Property Summary

Name	Type	*	Description
Feature	FeatureReferenceType	2..*	A reference to a feature in the list of features defined in the MultiSelect element.
minSelections	xsd:nonNegativeInteger	0..1	Minimum number of features that must be selected. **default value="0"
maxSelections	xsd:positiveInteger	0..1	Maximum number of features that can be selected.

4.12.15.2 MultiSelectType Property Usage Notes

- **Feature**: The value MUST reference the *id* of a feature element.

  See the *FeatureReferenceType* section for structure and additional usage details [4.12.8].
- **minSelections, maxSelections**: When it is not necessary that any of the features in the *MultiSelect* list be selected, the default of "0" can be used.

  Mutually exclusive features can be defined using a *MultiSelect* element with two features, *minSelections* set to "0" and *maxSelections* set to "1".

  If multiple instances of a single feature are selected via multiplicity, the set of multiple instances count only once toward the minimum and maximum. In other words, the count is based solely on the features selected, not on how many instances of each feature are selected.

  When *maxSelections* is not defined, all of the features in the *MultiSelect* MAY be selected for a particular deployment.

  If defined, the *maxSelections* value MUST be greater than or equal to the *minSelections* value and MUST be less than or equal to the number of referenced features.

4.13 Localization

Localization refers to enabling a particular piece of software to support one or more languages. Anything that needs to be deployed to provide support for a particular language in that software is considered localization content. Translated materials are a primary, but not the only, example of localization content.

Localization content is similar in many ways to other content, but there are important differences in how localization content is selected for deployment that lead to the need for a separate content hierarchy and separate types. Two criteria determine whether or not localization content is in scope for a particular deployment:

- The first criterion has to do with the language or languages supported by the localization content. At least one of the languages must be in scope for the content to be selected.

- The second criterion has to do with the availability of the resources to be localized–the localization base. The localization base may be a resource deployed by base or selectable content, or it may be a resource previously deployed and found in the deployment environment.

The types described in this section support definition of metadata describing the criteria for determining when localization content is in scope.

4.13.1 LocalizationContentType

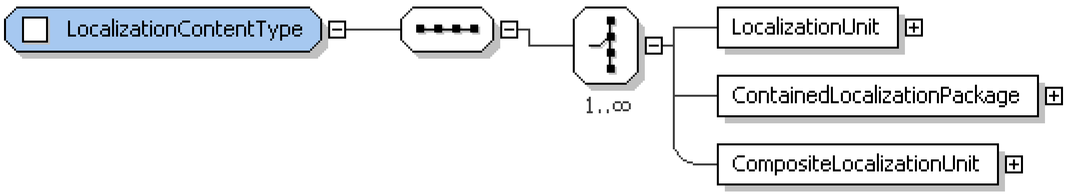


Figure 98: LocalizationContentType structure.

The *LocalizationContent* tree contains all content created specifically to provide localization by deploying language-specific materials for a particular location. The localization support provided can be for content defined in the SDD or it can be for resources in the deployment environment that are not created or modified by deployment of the SDD. Each element defined in the *LocalizationContent* hierarchy is in scope for a particular deployment when it supports a language that is in scope for that deployment and when its localization base, if any, is available.

4.13.1.1 LocalizationContentType Property Summary

Name	Type	*	Description
LocalizationUnit	LocalizationUnitType	0..*	Contains artifacts that create, modify or delete language support.
ContainedLocalizationPackage	ReferencedPackageType	0..*	Identifies an SDD whose contents are aggregated to create, modify or delete language support.
CompositeLocalizationUnit	CompositeLocalizationUnitType	0..*	An organizational element that groups localization content and defines metadata common to all the grouped content.

4.13.1.2 LocalizationContentType Property Usage Notes

- **LocalizationUnit**: When there is no need to group a *LocalizationUnit* with other units that have common metadata, the *LocalizationUnit* is defined at the top level of the hierarchy. A *LocalizationUnit* defined at the top level of the *LocalizationContent* hierarchy is in scope for a particular deployment when its *Condition* and *LocalizationBase*, if any, evaluate to true and its *Languages* element, if any, defines a language that is in scope for the deployment.

  See the *LocalizationUnitType* section for structure and additional usage details [4.13.2].

- **ContainedLocalizationPackage**: *ContainedLocalizationPackage* definitions include a list of languages supported by the contained package. The package need not be processed if none of those languages is in scope for a particular deployment.

  See the *ReferencedPackageType* section for structure and additional usage details [4.10.1].

- **CompositeLocalizationUnit**: *CompositeLocalizationUnit* is a construct that allows organization of localization content in a way that is meaningful to the SDD author.

  One example use of a *CompositeLocalizationUnit* is to group a set of *LocalizationUnits* that provide support for a variety of languages for the same resource. This eliminates the need to define identical *LocalizationBase* elements in every *LocalizationUnit*. It can be defined once in the *CompositeLocalizationUnit*.

If evaluation of the *CompositeLocalizationUnit's Condition*, *Languages* and *LocalizationBase* determines that it is not selected for deployment, none of the content elements defined below it in the hierarchy are selected.

Requirements, *Variables*, *Conditions* and *Completion* elements common to all child content elements MAY be defined once in the *CompositeLocalizationUnit* rather than once in each nested element.

See the *CompositeLocalizationUnitType* section for structure and additional usage details [4.13.3].

4.13.2 LocalizationUnitType

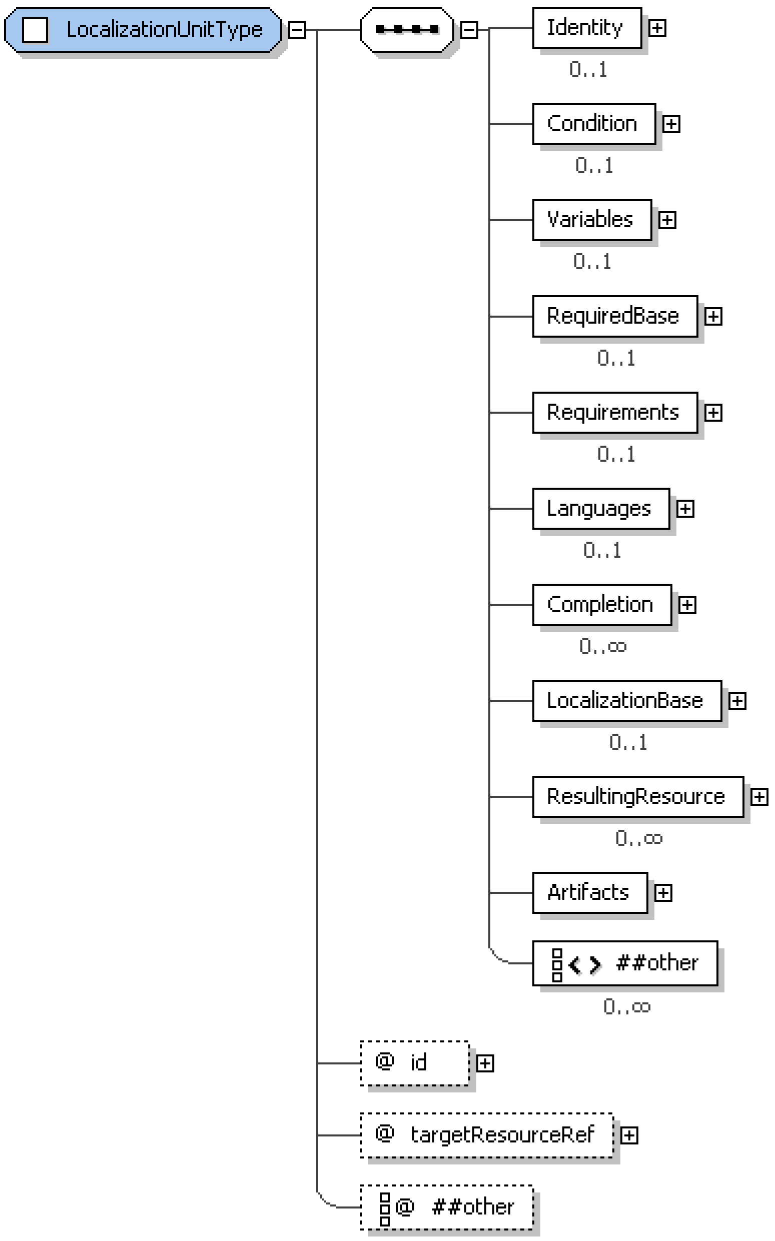


Figure 99: LocalizationUnitType structure.

The *LocalizationUnit* element defines artifacts that deploy localization content for one group of resources whose translations are packaged together. Localization content consists of materials that have been translated into one or more languages.

4.13.2.1 LocalizationUnitType Property Summary

Name	Type	*	Description
Identity	IdentityType	0..1	Human-understandable identity information about the LocalizationUnit.
Condition	ConditionType	0..1	A condition that determines if the content element is relevant to a particular deployment.
Variables	VariablesType	0..1	Variables that can be referenced in the LocalizationUnit's requirement and artifact definitions.
RequiredBase	RequiredBaseType	0..1	A resource that will be updated when the LocalizationUnit's UpdateArtifact is processed.
Requirements	RequirementsType	0..1	Requirements that must be met prior to successful processing of the LocalizationUnit's artifacts.
Languages	LanguagesType	0..1	The LocalizationUnit's artifacts contain materials translated into these languages.
Completion	CompletionType	0..*	Describes completion actions such as restart and the conditions under which the action is applied.
LocalizationBase	RequiredBaseType	0..1	A resource whose translatable characteristics will be localized by processing the LocalizationUnit's InstallArtifact.
ResultingResource	ResultingResourceType	0..*	A resource that will be installed or updated by processing the LocalizationUnit's artifacts.
Artifacts	InstallationArtifactsType	1	The set of artifacts associated with the LocalizationUnit.
	xsd:any	0..*	
id	xsd:ID	1	An identifier for the LocalizationUnit scoped to the deployment descriptor.
targetResourceRef	xsd:IDREF	1	Reference to the resource that can process the LocalizationUnit's artifacts.
	xsd:anyAttribute	0..*	

4.13.2.2 LocalizationUnitType Property Usage Notes

- **Identity**: The *Identity* element defines human-understandable information that reflects the identity of the provided localization resources as understood by the end user of the solution. *Identity* has elements that are common with elements in the corresponding *PackageDescriptor's PackageIdentity* element, for example, *Name* and *Version*. The values of these common elements SHOULD be the same as the corresponding *PackageIdentity* element values.

  See the *IdentityType* section for structure and additional usage details [3.4].
- **Condition**: A *Condition* is used when the *LocalizationUnit's* content should be deployed only when certain conditions exist in the deployment environment.

  > For example, for a package that has one artifact that should be processed when the operating system is Linux and another artifact that should be processed when the operating system is Windows, the *LocalizationUnit* defining metadata for the Linux artifact would have a condition on the operating system being Linux. The *LocalizationUnit* defining metadata for the Windows artifact would have a condition on the operating system being Windows.

Conditions should not be used to identify the resource that will be localized by the *LocalizationUnit*. The *LocalizationBase* element is used for that purpose. A *LocalizationUnit* can have both a *Condition* and a *LocalizationBase*.

See the *ConditionType* section for structure and additional usage details [4.5.1].

- **Variables**: A *Variables* element defines variables that can be used in the definition of requirements and artifact parameters.

  When the deployment descriptor defines a single *LocalizationUnit* at the top level, that is, not inside a *CompositeInstallable*, the variables it defines can also be referred to in any element under *Topology*.

  See the *VariablesType* section for structure and additional usage details [4.6.3].

- **RequiredBase**: *RequiredBase* identifies the resource that must exist prior to applying the *LocalizationUnit's* update artifact.

  See the *RequiredBaseType* section for structure and additional usage details [4.7.8].

- **Requirements**: *Requirements* MUST be met prior to processing the *LocalizationUnit's* artifacts.

  See the *RequirementsType* section for structure and additional usage details [4.7.1].

- **Languages**: *Languages* lists the languages of the translated material deployed by the *LocalizationUnit*.

  See the *LanguagesType* section for structure and additional usage details [4.13.6].

- **Completion**: A *Completion* element MUST be included if the artifact being processed requires a system operation such as a reboot or logoff to occur to function successfully after deployment or if the artifact executes a system operation to complete deployment of the contents of the artifact.

  There MUST be an artifact associated with the operation defined by a *Completion* element.

  > For example, if there is a *Completion* element for the *install* operation, the *LocalizationUnit* must define an *InstallArtifact*.

  See the *CompletionType* section for structure and additional usage details [4.3.14].

- **LocalizationBase**: *LocalizationBase* identifies the resource or resources that can be localized by processing the *LocalizationUnit*. A resource that satisfies the constraints defined in the *LocalizationBase* is one that can be localized by applying the *LocalizationUnit*.

  If no resource is found that meets the constraints defined in *LocalizationBase* during a particular deployment, then the *LocalizationUnit* is not considered to be in scope for that deployment. This does not represent an error.

  Translations created or modified by the *LocalizationUnit* are for human-readable text included with the *LocalizationBase* resources.

  See the *RequiredBaseType* section for structure and additional usage details [4.7.8].

- **ResultingResource**: The *ResultingResources* for a *LocalizationUnit* MUST NOT identify resources other than localization resources.

  See the *ResultingResourceType* section for structure and additional usage details [4.8.1].

- **Artifacts**: When the *LocalizationUnit* is a singleton defined outside of a *CompositeInstallable*, it MUST define at least one artifact element and MAY define one of each type of artifact element allowed for its type. The inclusion of an artifact element in a singleton *LocalizationUnit* implies support for the associated operation.

  When the *LocalizationUnit* is defined within a *CompositeInstallable*, it MUST define exactly one artifact. The artifact defined MAY be any artifact allowed in a *LocalizationUnit* and it MUST support the single top level *operation* defined by the *CompositeInstallable*. This does not mean the operation associated with the artifact has to be the same as the one defined by the *CompositeInstallable*.

  > For example, an install of a localization resource may be required during the update of the overall solution, in which case the *LocalizationUnit* would define an *InstallArtifact* to support the top level update operation.

  See the *InstallationArtifactsType* section for structure and additional usage details [4.3.4].

- **id**: The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages.
- **targetResourceRef**: The *targetResourceRef* attribute MUST reference the *id* of a resource element in *Topology* that will process the *LocalizationUnit's* artifacts to create or modify the localization resources identified in the *LocalizationUnit's ResultingResource* elements.

4.13.3 CompositeLocalizationUnitType

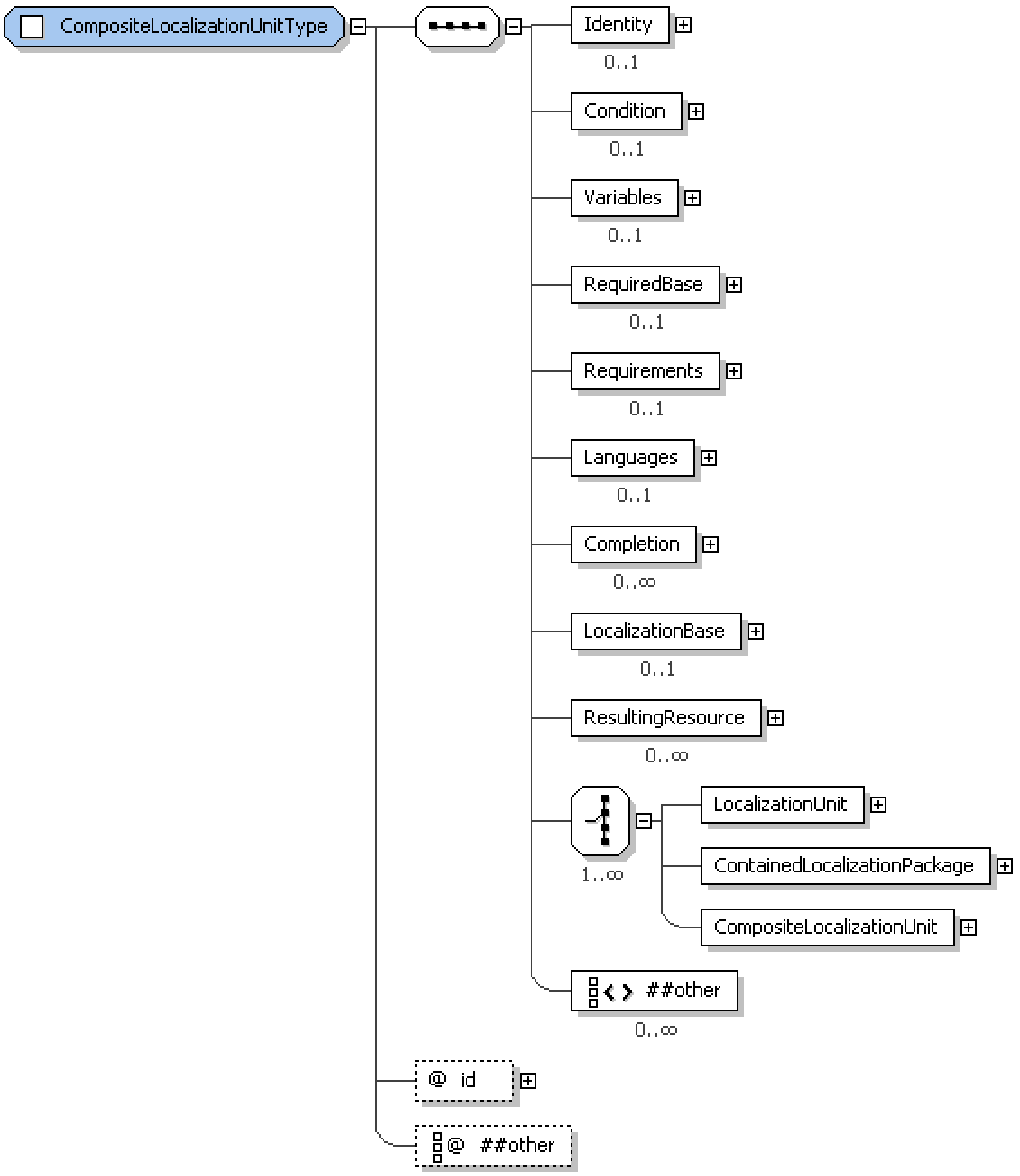


Figure 100: CompositeLocalizationUnitType structure

CompositeLocalizationUnitType provides the type definition for all *CompositeLocalizationUnit* elements in the *LocalizationContent* hierarchy. *CompositeLocalizationUnit* elements define nested localization content elements and metadata that applies to all of the nested elements.

4.13.3.1 CompositeLocalizationUnitType Property Summary

Name	Type	*	Description
Identity	IdentityType	0..1	Human-understandable identity information about the CompositeLocalizationUnit.
Condition	ConditionType	0..1	A condition that determines if the CompositeLocalizationUnit is relevant to a particular deployment.
Variables	VariablesType	0..1	Variables for use within the CompositeLocalizationUnit and content elements nested beneath it in the hierarchy.
RequiredBase	RequiredBaseType	0..1	A resource that will be updated when the nested elements are processed.
Requirements	RequirementsType	0..1	Requirements that must be met prior to successful processing of the nested content elements.
Languages	LanguagesType	0..1	Localization elements defined within CompositeLocalizationUnit contain materials translated into these languages.
Completion	CompletionType	0..*	Describes completion actions such as restart and the conditions under which the action is applied.
LocalizationBase	RequiredBaseType	0..1	A resource whose translatable characteristics will be localized by processing the nested content elements.
ResultingResource	ResultingResourceType	0..*	A localization resource that will be installed or updated by processing the nested content elements.
LocalizationUnit	LocalizationUnitType	0..*	Contains artifacts that will create, modify or delete language support.
ContainedLocalizationPackage	ReferencedPackageType	0..*	Identifies an SDD whose contents are aggregated to create, modify or delete language support.
CompositeLocalizationUnit	CompositeLocalizationUnitType	0..*	An organizational element that groups localization content and defines metadata common to all the grouped content.
	xsd:any	0..*	
id	xsd:ID	1	An identifier for the CompositeLocalizationUnit that is unique within the deployment descriptor.
	xsd:anyAttribute	0..*	

4.13.3.2 CompositeLocalizationUnitType Property Usage Notes

- **Identity**: The *CompositeLocalizationUnit*, like all content elements, is a unit of packaging. Its identity is the identity of a unit of packaging and may be useful to package management tools. The identity MAY be similar or identical to the identity of the *ResultingResource(s)*.

See the *IdentityType* section for structure and additional usage details [3.4].

- **Condition**: If the composite and the elements nested beneath it are applicable only in certain environments, a *Condition* can be defined. When the *Condition* is not met, the composite and its nested elements are not in scope.

  See the *ConditionType* section for structure and additional usage details [4.5.1].

- **Variables**: *Variables* used by more than one nested element can be defined in the *CompositeLocalizationUnit* for efficiency both in composing and processing the SDD. *Variables* are visible to all nested content elements.

  See the *VariablesType* section for structure and additional usage details [4.6.3].

- **RequiredBase**: If the processing of all the update artifacts in the nested content elements results in a single resource being updated, that resource can be defined in the *CompositeLocalizationUnit's RequiredBase* element.

  See the *RequiredBaseType* section for structure and additional usage details [4.7.8].

- **Requirements**: When a *CompositeLocalizationUnit* is in scope for a particular deployment–as determined by evaluation of its *LocalizationBase* and *Languages* properties–then its requirements MUST be met.

  See the *RequirementsType* section for structure and additional usage details [4.7.1].

- **Languages**: The *Languages* element in the *CompositeLocalizationUnit* MUST NOT be defined or MUST define the union of all languages supported by the nested content elements. For nested content elements to be evaluated to determine if they are in scope, the *CompositeLocalizationUnit* must be in scope. When *Languages* is present in the *CompositeLocalizationUnit*, it must define one of the languages in scope for the particular deployment if any of the nested elements are to be evaluated. If *Languages* is not present in a *CompositeLocalizationUnit*, evaluation of all the child elements still is required, as long as the other elements of *CompositeLocalizationUnit* have evaluated to true. When the *Languages* and/or the *LocalizationBase* element in a *CompositeLocalizationUnit* is not defined, the nested content elements must be evaluated to determine if they are in scope.

  See the *LanguagesType* section for structure and additional usage details [4.13.6].

- **Completion**: When a particular completion action applies to all nested elements and should be performed only once for the entire group, it can be defined in the *CompositeLocalizationUnit* rather than in each individual element.

  See the *CompletionType* section for structure and additional usage details [4.3.14].

- **LocalizationBase**: A *LocalizationBase* element evaluates to true when the resource identified in the base is created by a content element that is in scope for the deployment or it already exists in the deployment environment.

  When the *LocalizationBase* is defined it must evaluate to true for any of the nested content elements to be evaluated. If it evaluates to false, none of the nested content elements are in scope. If it evaluates to true, the nested content elements may be in scope.

  When the *LocalizationBase* and/or the *Languages* element in a *CompositeLocalizationUnit* is not defined, the nested content elements must be evaluated to determine if they are in scope.

  See the *RequiredBaseType* section for structure and additional usage details [4.7.8].

- **ResultingResource**: If there are one or more resources that will be created when the nested content elements are processed, they can be defined here.

  See the *ResultingResourceType* section for structure and additional usage details [4.8.1].

- **LocalizationUnit**: *LocalizationUnits* defined within the composite typically have common metadata. Metadata defined in the composite does not need to be repeated in the nested element. Definitions in the nested *LocalizationUnit* are additions to those defined in the composite.

  See the *LocalizationUnitType* section for structure and additional usage details [4.13.2].

- **ContainedLocalizationPackage**: A *ContainedLocalizationPackage* is defined in a *CompositeLocalizationUnit* for the same reasons that a *LocalizationUnit* is–because it has metadata in common with other elements defined in the composite.

See the *ReferencedPackageType* section for structure and additional usage details [4.10.1].

- **CompositeLocalizationUnit**: A *CompositeLocalizationUnit* can be nested inside another *CompositeLocalizationUnit* when some of the metadata is shared only by a subset of the elements nested in the higher level composite.

    For example, the higher level composite might contain operating system requirements that apply to all localization content and nested composites might group localization content by localization base.

- **id**: This *id* is not referred to by any other element in the deployment descriptor.

  The *id* attribute may be useful to software that processes the SDD, for example, for use in creating log and trace messages. It also may be useful for associating custom discovery logic with the *CompositeLocalizationUnit's* resource-related elements.

4.13.4 LanguageSelectionsType

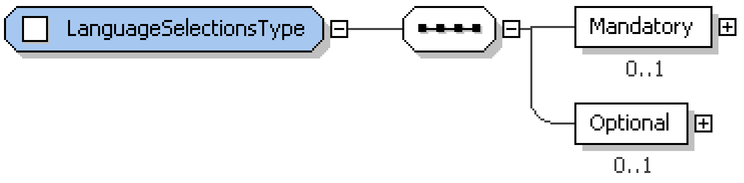


Figure 101: LanguageSelectionsType structure.

LanguageSelectionsType provides the type definition for the *Languages* element in *CompositeInstallable* that describes the languages supported by the SDD as a whole. It also provides the type definition for the *Languages* element in features that allows a feature to override the SDD-wide definitions.

4.13.4.1 LanguageSelectionsType Property Summary

Name	Type	*	Description
Mandatory	LanguagesType	0..1	The set of languages that will be deployed.
Optional	OptionalLanguagesType	0..1	The set of language selections available to the deployer.

4.13.4.2 LanguageSelectionsType Property Usage Notes

- **Mandatory**: The deployer has no ability to determine if a mandatory language will be deployed.

  See the *LanguagesType* section for structure and additional usage details [4.13.6].

- **Optional**: Each language group in the list of optional languages defines a list of one or more languages that can be selected together.

  Language groups defined in *LanguageSelections* MAY be used to allow the deployer to select individual languages or to allow selection of multiple languages as a single choice.

  See the *OptionalLanguagesType* section for structure and additional usage details [4.13.5].

4.13.5 OptionalLanguagesType

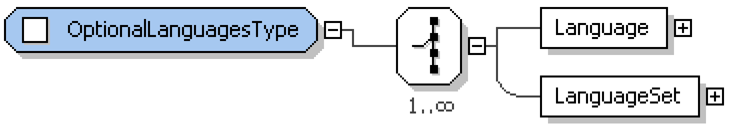


Figure 102: OptionalLanguagesType structure

OptionalLanguagesType supports definition of a language or sets of languages that the deployer can optionally choose for deployment. This type is used to define the global set of optional languages in *CompositeInstallable* as well as any *Feature*-specific set that overrides the global set for a particular *Feature*.

4.13.5.1 OptionalLanguagesType Property Summary

Name	Type	*	Description
Language	LanguageType	1..*	A single language that can be chosen individually.
LanguageSet	LanguageSetType	1..*	A set of languages that can be chosen together.

4.13.5.2 OptionalLanguagesType Property Usage Notes

- **Language**: When the SDD author allows the deployer to individually select a language for deployment, it is defined in a *Language* element within *OptionalLanguages*.

  See the *LanguageType* section for structure and usage details [4.13.7].

- **LanguageSet**: When the SDD author allows the deployer to select languages for deployment as a set, it is defined in a *LanguageSet* element within *OptionalLanguages*.

  > One example of a reason to define optional languages in a set rather than individually is for a group of languages that are packaged together and whose deployment cannot be separated.

  See the *LanguageSetType* section for structure and additional usage details [4.13.8].

4.13.6 LanguagesType

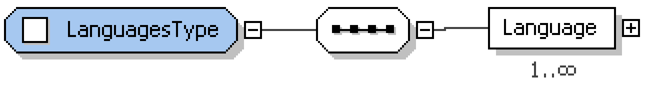


Figure 103: LanguagesType structure.

LanguagesType supports expression of a list of languages. It is used in the *Languages* elements of content elements to list languages supported by that content element. It is also used as the type of the *Mandatory* element that lists languages that are deployed by default.

4.13.6.1 LanguagesType Property Summary

Name	Type	*	Description
Language	LanguageType	1..*	A single language definition.

4.13.6.2 LanguagesType Property Usage Notes

- **Language**: Each language definition MAY include display information as well as the language code that identifies the language.

  See the *LanguageType* section for structure and additional usage details [4.13.7].

4.13.7 LanguageType

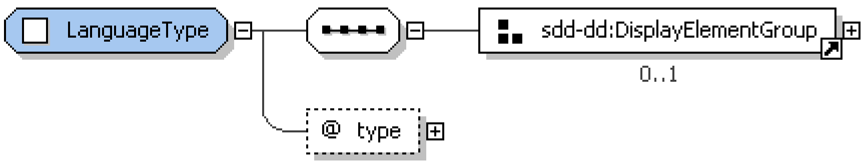


Figure 104: LanguageType structure.

LanguageType supports the definition of display information and the language code for one language. It is used everywhere a language is defined in the SDD.

4.13.7.1 LanguageType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	A name for the language.
Description	DisplayTextType	0..1	A description of the language.
ShortDescription	DisplayTextType	0..1	A short description of the language.
type	xsd:language	1	The locale code for the language.

4.13.7.2 LanguageType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the language.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the language.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **type**: The *type* attribute MUST be defined as a value that conforms to the set of language codes defined by **[RFC3066]**.

  For example, “de” is a locale code for German and “en-US” is the locale code for English in the United States.

4.13.8 LanguageSetType

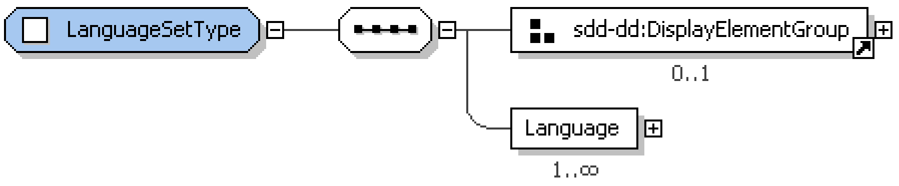


Figure 105: LanguageSetType structure.

LanguageSetType provides the type definition for the *OptionalLanguages* elements of *CompositeInstallable* and *Feature*. It defines a set of languages that can be selected together.

4.13.8.1 LanguageSetType Property Summary

Name	Type	*	Description
DisplayName	DisplayTextType	0..1	A name for the set of languages.
Description	DisplayTextType	0..1	A description of the set of languages.
ShortDescription	DisplayTextType	0..1	A short description of the set of languages.
Language	LanguageType	1..*	A set of one or more language codes.

4.13.8.2 LanguageSetType Property Usage Notes

- **DisplayName**: This element MAY be used to provide human-understandable information. If used, it MUST provide a label for the set of languages.

  For example, “Eastern European Languages” or “French, English and German”.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].

- **Description, ShortDescription**: These elements MAY be used to provide human-understandable information. If used, they MUST provide a description of the set of languages.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayElementGroup* section for structure and additional usage details [4.14.2].
- **Language**: The languages defined in this element MUST be selected together.

  See the *LanguageType* section for structure and additional usage details [4.13.7].

4.14 Display Information

There are many places throughout the SDD where translatable information intended for display to humans MAY be defined. All display information definitions can include a *translationKey* that can be used as an index into a file containing translations.

4.14.1 DescriptionGroup

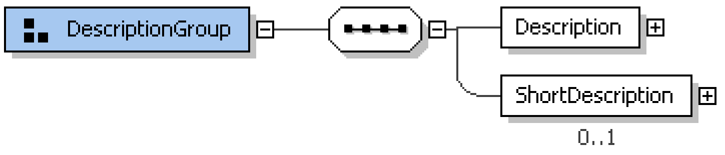


Figure 106: DescriptionGroup structure.

The *DescriptionGroup* type is used throughout the SDD to provide human-readable, translatable, descriptive-text elements.

4.14.1.1 DescriptionGroup Property Usage Notes

- **Description**: This is a description of the defining element unless usage notes for that element state otherwise. It can be as long as necessary to provide a useful description.

  The *Description* element MUST be defined if the *ShortDescription* element is defined.

  See the *DisplayTextType* section for details about associating this text with translated text [4.14.3].
- **ShortDescription**: This is a short description of the defining element unless usage notes for that element state that it refers to something else. It SHOULD provide a limited description that can be used by tools where limited text is allowed, for example, fly-over help.

  See the *DisplayTextType* section for details about associating this text with translated text [4.14.3].

4.14.2 DisplayElementGroup

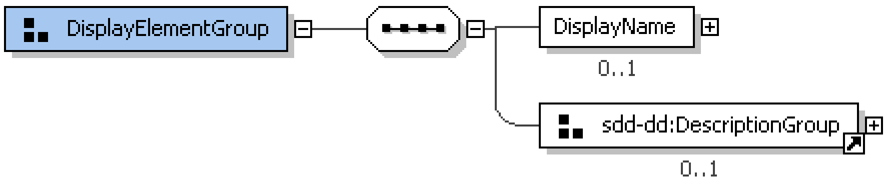


Figure 107: DisplayElementGroup structure.

The *DisplayElementGroup* is used throughout the package descriptor and deployment descriptor to provide human-readable, translatable names, descriptions and/or short descriptions for a variety of elements.

4.14.2.1 DisplayElementGroup Property Usage Notes

- **DisplayName**: This is a label for the defining element unless usage notes for that element state otherwise.

  See the *DisplayTextType* section for details about associating this text with translated text [4.14.3].

4.14.3 DisplayTextType

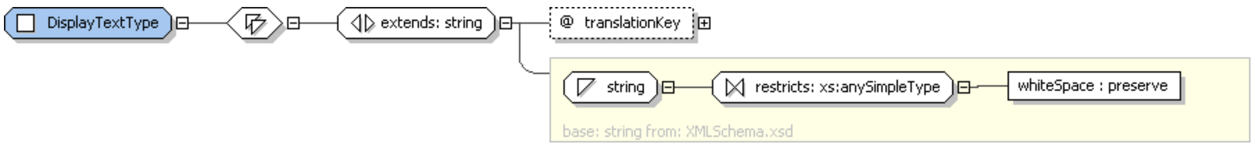


Figure 108: DisplayTextType Structure.

Elements of *DisplayTextType* define translatable strings and an optional key to translated text in language bundle files. *DisplayTextType* extends the `xsd:string` type with an optional *translationKey* attribute.

4.14.3.1 DisplayTextType Property Usage Notes

- **translationKey**: The *translationKey* attribute is a value that can be used as an index into a file containing translations of *DisplayTextType* elements in the *DeploymentDescriptor* and/or *PackageDescriptor*. The value of the *translationKey* MUST match an entry in the message bundle referenced by the *descriptorLanguageBundle* attribute in the package descriptor.

5 Conformance

5.1 General Conformance Statements

An implementation MAY claim conformance to the entirety of the SDD specification (including all conformance levels) or one or more particular conformance levels, and/or one or more particular profiles (SDD conformance levels and profiles are detailed next).

5.2 Conformance Levels

An SDD conformance level (CL) is defined, consistent with **[CONFORM]**, as a subset of the schema intended to enable a certain set of capabilities to be achieved, based on SDDs that restrict their content to the particular CL. The purpose of conformance levels is to allow subsets of the full set of capabilities that can be expressed using an SDD to be implemented. The proper subsets are expected to be easier to implement, but still offer features, value and interoperability that make it worthwhile to implement a particular CL in certain circumstances.

SDD conformance levels are designated as CL1 and CL2. CL1 is a proper subset of the schema; CL2 represents the full schema. CL1 is the minimal set or core of the specification that shall be implemented by all products. CL2 includes all of CL1 and consists of the entire specification.

The following sections describe the defined CLs for SDD.

5.2.1 CL Capabilities

Table 1 expresses the capabilities for each defined CL.

	Conformance Level 1	**Conformance Level 2**
Description	Single target, simple package.	Multi-target, aggregated packages; full deployment capabilities with all functions enabled by the SDD schema.
Objective	Serve as the “on-ramp” for SDD adoption. Deploy pre-prepared content that needs limited customization (basic parameters). Descriptors serve as contract between assembly and operations. Exemplary use case is “wrappering” existing packages in SDD.	Serve as the expected level for newly-authored non-legacy SDDs. Deploy newly-prepared content that has related components in a solution, with various topologies. Most robust specification (and corresponding run-time implementations) of SDD. Exemplary use case is non-trivial, non-legacy solution deployment.
Included Schema Functions	• Solution package with single component (singleton IU, CU, or LU; no composite) and single target topology • Solution package dependency checking for given environment • base installations and maintenance • Simple uninstall (based on information in single descriptor) • Ability to deploy existing artifact formats appropriate for the target	All functions, including: • Aggregation (composites) • Features • Selectable features • Conditional content • Variable-target topology • Robust localization

	environment • Some localization possible (localization of the units that are supplied)	
Excluded Functions	• Features • Selectable content • Requisites • Aggregation • Multi-target topology • Robust localization • Replacements and modifications that change base resource/solution composition (including obsolescence) • Backwards compatibility, range enforcement • Verification of installation and configuration	None

Table 1: SDD conformance level capabilities summary.

5.2.2 Conformance Level Differences

CL1 SDDs can be used to describe the inputs, requirements and results of processing a single deployment artifact. This artifact could be one that deploys, updates, configures or localizes software resources. This is useful for simple deployments that require only a single artifact. CL2 SDDs add support for aggregation of multiple artifacts and SDDs into solutions; definition of features that optionally select content; and requisite software that can be deployed if needed to satisfy requirements. CL1 SDDs can be aggregated by CL2 SDDs.

For example, CL2 SDDs can describe a solution that consists of a Web server, an application server, a database and one or more applications, in which each of these components is described by its own individual SDD and an aggregating CL2 SDD aggregates them into the composite solution.

The differences between CL1 and CL2 that are summarized in Table 1 are detailed next. These make use of the information that is in the SDD schema; see **[**Error! Reference source not found.**]** for the CL1 schema files, and **[**Error! Reference source not found.**]** for the CL2 schema files. The differences between the CL1 and CL2 schema files are isolated to the “sdd-dd” namespace. The “sdd-common” and “sdd-pd” namespaces contain identical schema files for each namespace with respect to CL1 and CL2.

5.2.2.1 Type Definitions Modified in CL2

A few SDD types used in CL1 have additional elements added in CL2. The types listed in the left column of **Error! Reference source not found.** exist in both CL1 and CL2 with different definitions. The elements in the right column are the sub-elements added to the type definitions in CL2.

Type Name	CL2 Sub-Element Names
DeploymentDescriptorType	Requisites CompositeInstallable
InstallationArtifactsType	RepairArtifact
ResultingResourceType	Relationship
ResultingChangeType	Relationship
ResourceConstraintGroup	UniquenessConstraint

Type Name	CL2 Sub-Element Names
	RelationshipConstraint
ConditionalResourceConstraintType	UniquenessConstraint RelationshipConstraint
RequirementType	Dependency
AlternativeRequirementType	Dependency

Table 2. Modified Types.

5.2.2.2 Type Structures Modified in CL2

Several SDD types have altered structure between CL1 and CL2. The types listed in the left column of Table 3 are valid for both CL1 and CL2; however, valid structure for these types differs between CL1 and CL2, as shown in the center and right columns.

Type	CL1 Structure	CL2 Structure
DeploymentDescriptorType	Choice of one of the following: *InstallableUnit*, *ConfigurationUnit*, or *LocalizationUnit*	Choice of one of the following: *InstallableUnit*, *ConfigurationUnit*, or *LocalizationUnit*; or one or more *CompositeInstallable* elements
RequirementType	Sequence of *ResourceConstraint* elements	Unbounded choice of *ResourceConstraint* elements and *Dependency* elements
AlternativeRequirementType	Sequence of *ResourceConstraint* elements	Unbounded choice of *ResourceConstraint* elements and *Dependency* elements

Table 3. Altered types in CL2.

5.2.2.3 SDD Types Introduced in CL2

As seen in Table 2, CL2 adds two new elements to *DeploymentDescriptor*. The *CompositeInstallable* element provides the definition of an aggregate deployment. *CompositeInstallable* is a complex element with many sub-elements. The second element added to *DeploymentDescriptor* is *Requisites*. *Requisites* is a list of references to SDDs that can be used, if needed, to satisfy deployment requirements defined in the *CompositeInstallable*.

Table 4 includes the CL2 types that are introduced in support *CompositeInstallable* and *Requisites*

BaseContentType	FeatureType	PackageFeatureReferenceType
CompositeInstallableType	GroupsType	ReferencedPackageType
CompositeLocalizationType	GroupType	RelationshipConstraintType
CompositeUnitType	InternalDependencyType	RelationshipType
ConstrainedResourceType	LanguageSelectionType	RequiredContentSelectionType
ContentElementReferenceType	LocalizationContentType	RequisitesType
ContentListGroup	MultiplicityConstraintType	ResourceMapType

ContentSelectionFeatureType	MultiplicityType	ResultingChangeMapType
DependencyType	MultiSelectType	ResultingResourceMapType
FeatureReferenceType	NestedFeatureType	SelectableContentType
FeaturesType	OptionalLanguagesType	UniquenessConstraintType

Table 4 SDD types introduced in CL2.

5.2.2.4 Extended Enumeration Value in CL2

One SDD type has an additional enumeration value that is valid only for CL2-based implementations. The type listed in the left column of Table 5 is valid for both CL1 and CL2; however, the value in the right column is valid only for CL2.

Type	CL2 Enumeration Value
OperationType	repair

Table 5 Extended enumeration value in CL2.

5.3 Profiles

Profiles are intended to specify detailed information that can be used in an SDD to promote interoperability. An SDD profile is defined consistent with **[CONFORM]**, to identify the functionality, parameters, options and/or implementation requirements necessary to satisfy the requirements of a particular community of users. SDD profiles are intended to enable a specific set of use cases, typically in a particular domain. Profiles are considered largely orthogonal to CLs; whereas a CL is a subset of the schema, a profile specifies the usage of the schema, including appropriate conventions and content values, to accomplish a particular set of use cases (typically in a particular domain).

A *starter profile* is initially defined with version 1.0 of this specification and is published separately. This starter profile defines terms and patterns that can be used to generate other specific profiles and addresses the content values that are required to support the SDD XML examples that also are published separately.

The starter profile is not intended to be a complete vocabulary for all SDDs, but rather to illustrate the format and provide example content so that additional profiles can be generated in the future. The starter profile leverages and extends the CIM standard **[CIM]** for many content values, but other profiles MAY use other content values.

Other profiles MAY be published by the TC in the future, and new profiles can be created as specified in 5.3.1.

An implementation MAY claim conformance to one or more particular profiles.

5.3.1 Profile Creation

The SDD TC has created a starter profile as described in 5.3. The SDD TC MAY create additional profiles in the future.

Others MAY create SDD profiles for use cases, domains, or user communities that are not addressed by the currently available profiles from the SDD TC. When creating new profiles, it is RECOMMENDED that profile creators follow the model of the starter profile and any existing profiles and reuse content from existing standards where possible. It is also RECOMMENDED that implementations publish the profile(s) that they support.

5.3.2 Profile Publication

The SDD TC publishes the starter profile and MAY publish any other profiles created by the SDD TC.

Profiles created by the SDD TC SHALL be made available by the SDD TC.

Profiles created by others MAY be published and made available by those parties and/or submitted to the SDD TC for consideration for publication by the SDD TC, according to the OASIS policies and procedures, including intellectual property rights. The SDD TC MAY publish and make available the new profiles through majority vote of the TC.

5.3.3 Profile Applicability

Profiles are applicable to particular usage models, domains and/or user communities. An implementation MAY claim conformance to one or more particular profiles.

5.4 Compatibility Statements

Versions of the specification use the version value defined in the *schemaVersion* attribute described in section 3.2. New versions of the specification MAY update the conformance level contents.

Profiles also use the *schemaVersion* attribute described in section 3.2. New versions of profiles MAY update the profile contents.

Minor version updates of the schema, specification and profiles SHALL be backward-compatible with proceeding major versions (for example, all “1.x” versions are backward-compatible with version “1.0”).

Moreover, minor version updates of the schema, specification and profiles SHALL be backward-compatible with proceeding minor versions of the same major version (for example, version “1.4” is backward-compatible with versions “1.3”, “1.2”, “1.1” and “1.0”).

Major version updates of the schema, specification and profiles are NOT REQUIRED to be backward-compatible with previous versions and MAY NOT be backward-compatible with previous versions. For example, if non-backward-compatible changes occur in version “1.x”, the new version is “2.0”. Although new major versions MAY have substantial backward compatibility, backward compatibility is not guaranteed for all aspects of the schema across major versions.

5.5 Conformance Clause

5.5.1 Conformance for Users of This Specification

An SDD conforms to this specification if it conforms to the SDD schema and follows the syntax and semantics defined in the normative portions of this specification. An SDD MAY conform to conformance levels CL1 or CL2.

An implementation conforms to this specification if it conforms to, at minimum, conformance level CL1 of the SDD schema; supports at least one SDD profile; and follows the syntax and semantics defined in the normative portions of this specification. An implementation MAY support conformance levels CL1 or CL2 and MAY support additional SDD profiles.

5.5.2 Conformance for This Specification Itself

This section is the conformance claim for how this document conforms to **[CONFORM]**. The conformance issues in section 8 of **[CONFORM]** apply to this document as follows:

1. This document is applicable to SDDs as defined in this specification. To claim conformance to this document, all the requirements in section 5.5.1 SHALL be met.
2. This document MAY be implemented in its entirety or in defined conformance levels CL1 and CL2. This document does not define profiles, but the SDD TC MAY define profiles that MAY be implemented.
3. This document allows extensions. Each implementation SHALL fully support all required functionality of the specification exactly as specified. The use of extensions SHALL NOT contradict nor cause the non-conformance of functionality defined in the specification.
4. This document contains no discretionary items.

5. This document’s normative language is English. Translation into other languages is permitted.

A. Schema File List

The SDD schema is implemented by multiple schema files. Types defined in each file are identified by a specific namespace prefix, as indicated in the following list:

- cd04-sdd-common-1.0.xsd (prefix: sdd-common)

  Contains definitions of common types used in the SDD specification, including identity and fix-identity types, UUID and version types, and the display text type.

  http://docs.oasis-open.org/sdd/v1.0/cd04/CL1Schema/cd04-sdd-common-1.0.xsd

  http://docs.oasis-open.org/sdd/v1.0/cd04/FullSchema/cd04-sdd-common-1.0.xsd
- cd04-sdd-deploymentDescriptor-1.0.xsd (prefix: sdd-dd)

  Contains the deployment descriptor specification, including various content types.

  http://docs.oasis-open.org/sdd/v1.0cd04/CL1Schema/cd04-sdd-deploymentDescriptor-1.0.xsd

  http://docs.oasis-open.org/sdd/v1.0/cd04/FullSchema/cd04-sdd-deploymentDescriptor-1.0.xsd
- cd04-sdd-packageDescriptor-1.0.xsd (prefix: sdd-pd)

  Contains the package descriptor specification, including types related to packages and files.

  http://docs.oasis-open.org/sdd/v1.0/cd04/CL1Schema/cd04-sdd-packageDescriptor-1.0.xsd

  http://docs.oasis-open.org/sdd/v1.0/cd04/FullSchema/cd04-sdd-packageDescriptor-1.0.xsd

Example SDDs showing the use of the schema can be found at the following address.

http://docs.oasis-open.org/sdd/v1.0/sdd-examples-v1.0.zip

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