RFC 222: Declarative Services Updates

Draft

97 Pages

Abstract

Updates to Declarative Services for Release 7.

0 Document Information

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0.3 Feedback

This document can be downloaded from the OSGi Alliance design repository at https://github.com/osgi/design The public can provide feedback about this document by opening a bug at https://www.osgi.org/bugzilla/.

0.4 Table of Contents

0.5 Terminology and Document Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY" and "OPTIONAL" in this document are to be interpreted as described in 10.1.

```
Source code is shown in this typeface.
```

0.6 Revision History

The last named individual in this history is currently responsible for this document.

Revision	Date	Comments
Initial	04/13/2016	Initial draft BJ Hargrave, IBM
2nd draft	04/14/2016	Add design for component reclamation and field injection of component activation objects. BJ Hargrave IBM
3rd draft	04/19/2016	After review at CPEG meeting. Updated design for component reclamation and field injection of component activation objects. Added use case for constructor injections. Added Logger support from RFC 219. BJ Hargrave, IBM

Revision	Date	Comments
4th draft	06/27/2016	Add design for Mapped Field Injection based on RFP-178. Carlos Sierra, Liferay Raymond Augé, Liferay
5th draft	5 Sep 2016	Added initial proposal for constructor injection design. Replaced the design for partitioned maps. BJ Hargrave, IBM
6th draft	19 Sep 2016	Comments from CPEG f2f meeting in San Jose. Added section for ConfigurationPlugin support changes, Converter package usage. Removed section on partitioned maps. Added updated to DTOs and Javadoc. BJ Hargrave, IBM

1 Introduction

This RFC collects a numbers of requested enhancements to Declarative Services that were suggested after Release 6 design work was completed.

2 Application Domain

Declarative Services (DS) was first released in 2005 as part of Release 4. From the Version 1.0 spec:

> The service component model uses a declarative model for publishing, finding and binding to OSGi services. This model simplifies the task of authoring OSGi services by performing the work of registering the service and handling service dependencies. This minimizes the amount of code a program- mer has to write; it also allows service components to be loaded only when they are needed. As a result, bundles need not provide a BundleActivator class to collaborate with others through the service registry.

DS has proven a popular and useful way of developing for OSGi. There have been 3 updates to the spec resulting in the current Version 1.3 in Release 6.

3 Problem Description

3.1 Component Factory Properties (Bug 2800)

Currently factory components can only have 2 service properties, component.name and component.factory. See 112.2.4 Factory Component.

It would be useful to allow a ComponentFactory service to have additional service properties. For example, a discussion of possible Device Access changes resulted in an alternate proposal using ComponentFactory. But this proposal utilized some service properties on the ComponentFactory service. Currently this could only be done through the value of the factory attribute which results in the component.factory service property.

3.2 Component Reclamation (Bug 2801)

With the current DS spec, a service can either be lazy or immediate. Neglecting configuration policy and satisfying of references, an immediate service is activate as soon as possible and deactivated when the bundle is stopped. A lazy component is only activated if someone else is using it, and deactivated once it's not used anymore. For the examples below I used Event Admin, as everyone is familiar with it; but it's applicable for other scenarios, usually whiteboard related.

There are at least two consequences of the lazy behavior:

1. A lazy component might create a burden on the system. For example, if an EventHandler is lazy and the handler is activated and deactivated for each event it's receiving, a lot of activation/deactivation of that service might happen, even concurrently. Of course, an event admin implementation can keep the service once it's send the first event. Making the EventHandler immediate reduces the burden in any case.
2. If a service wants to store information in between usages, for example if an EventHandler wants to count how often it was invoked, immediate is the only option. Of course, if the service becomes unsatisfied or the bundle is restarted the state is lost. However, in many cases keeping state in this way is sufficient.

For use case like the above mentioned, immediate works but comes with the penalty that the service is activated as soon as possible, even if it is not used. For example, if there is no EventAdmin the EventHandler is activated nevertheless.

Therefore it would be nice to have an option in between immediate and lazy: the service is activated like it is lazy but deactivated like it is immediate.

3.3 Constructor Injection (Bug 2790, Public Bug 179)

Method injection was the original dependency injection technique supported in DS. In Version 1.3, field injection support was added. Both of these techniques require the use of non-final field since the fields must be updatable after object construction. There is interest in also supporting constructor injection to allow the injected component instances to be stored in final fields.

Also, a component implementation super type constructor may require objects such as component activation objects or bound services or information obtainable from them. Supporting constructor injection of component activation objects and bound services will support this.

3.4 Mapped Field Injection (~~RFP 178~~Bug 2940)

When having multiple instances of the same service interface, often a key property is used to identify and differentiate these instances. When using these service instances from a DS component, it makes sense to collect these services and map them by their key property.

For example using the good old method injection:

```
Map<String, SomeService> services = new ConcurrentHashMap<>();

@Reference(
 cardinality=ReferenceCardinality.MULTIPLE,
 policy=ReferencePolicy.DYNAMIC)
void addService(SomeService s, Map<String, Object> properties){
    String key = (String)properties.get("keyProperty");
    services.put(key, s);
}

void removeService(SomeService s, Map<String, Object> properties){
    String key = (String)properties.get("keyProperty");
    services.remove(key);
}
```

~~However, this is currently not possible using field injection.~~

~~This approach also does not take into account the arrival and leaving time of the services and the ordering based on service ranking. In the event that two services with the same key arrive and one of them leaves, complex logic is required.~~Field injection using a custom list or collection of Map.Entry can be used, but the Reference annotation does not allow specifying the field-collection-type meaning xml authoring of the component description is needed.

3.5 Field injection of component activation objects (Bug 2902)

In many cases the activate method is only implemented to receive the ComponentContext, BundleContext or configuration and store it in a field. Similarly the deactivate method might be implemented to null out these fields - this allows service methods to check whether a component is active or not.

To reduce this boilerplate code, we could support annotating fields with @Activate. The type of a field can be one of the types supported by the activate method and are set before any component method is called.

3.6 Logger Support

RFC 219 Log Service Update adds support for named loggers. Since logging is both important and needed early in code execution, DS must add special support for injecting Logger and FormatterLogger objects even though they themselves are not services.

4 Requirements

DS-0010 – Provide a means to define configurable services properties for ComponentFactory services. These are separate from the service properties of the component instances constructed by the ComponentFactory service.

DS-0030 – Provide a means to support injecting bound services to a component constructor.

DS-0031 – Provide a means to support injecting component activation objects to a component constructor.

DS-0040 – Provide a means to ~~inject~~support a map of keyed services. ~~The means must allow the key name to be specified and also whether the multiple values for the key are supported.~~

~~DS-0041 – The type of the key and the type of the value, for DS-0040, must be specifiable or inferred from the generics types of annotated Map field.~~

DS-0050 – Provide a means to inject component activation objects into fields.

DS-0060 – Provide a means to inject Logger objects into a service component where the Logger objects are obtained from the LoggerFactory by SCR.

DS-1000 – All solutions must provide a way to utilize them via Annotations as well as via the component description xml.

5 Technical Solution

5.1 ~~Schema namespace update~~Version Increases

The XML schema namespace is updated to `http://www.osgi.org/xmlns/scr/v1.4.0` for the new features being added below. The package versions are updated to 1.4 also.

5.2 Component Factory Properties

TBD

5.3 Component Reclamation

Prototype scope service component instances must be reclaimed when released since they cannot be used again. Singleton scope service component instances may be reused by any bundle after being released and bundle scope service component instances may be reused by the same bundle again after being released.

Section 112.5.4 Delayed Component is updated to replace:

> If the service registered by a component configuration becomes unused because there are no more bundles using it, then SCR should deactivate that component configuration. This allows SCR implementations to eagerly reclaim activated component configurations.

with

> If the service has the `scope` attribute set to `prototype`, SCR must deactivate a component configuration when it stops being used as a service object since the component configuration must not be reused as a service object. If the service has the `scope` attribute set to `singleton` or `bundle`, SCR must deactivate a component configuration when it stops being used as a service object after a delay since the component configuration may be reused as a service object in the near future. This allows SCR implementations to reclaim component configurations not in use while attempting to avoid deactivating a component configuration only to have to quickly activate a new component configuration for a new service request. The delay amount is implementation specific and may be zero.

5.4 Constructor Injection

The spec is updated to allow a constructor as an activate method. By specifying the activate method name as "~~<init>~~-init-", SCR must use a constructor declared on the implementation class as the activate method.

The spec is further updated to allow activate method parameters to be referenced services. Thus referenced services can be injected into the activate method, and since the activate method can now be a constructor, referenced services can be injected into a constructor. <reference> elements will use the new "parameter" attribute to denote the reference is to an activate method parameter. The value of the attribute is the zero-based position of the parameter in the method declaration. Activate method parameters which do not have a corresponding <reference> element are normal activate method arguments. The rules for locating the activate method will be amended to include <reference> elements using the parameter attribute.

<reference> elements with the parameter attribute must have policy=STATIC since the activate method is only called once per component instance activation.

During component activation, the following steps are taken:

1. Load the component implementation class.
2. Create the component context.
3. If there is no activate method or the activate method is not a constructor, call the default constructor to create the component instance. Otherwise, if there is an activate method and the activate method is a constructor, bind the target services referenced by the activate constructor and call the activate constructor to create the component instance.
4. Bind the target services not reference by the activate constructor, if any.
5. If there is an activate method and the activate method is not a constructor, call the activate method.

For constructor parameters with optional and unary references, if there is no bound service, then null will be passed as the parameter value.

See the following example code which uses annotations to declare a constructor as the activate method with references services as arguments.

```
@Component
public class ConstructorInjection {
	@interface Config {
		int port() default 80;
	}

	private final LogService		log;
	private final Config			config;
	private final ComponentContext	cc;
	private final List<EventListener>	listeners;

	// Update @Activate so it can be applied to a CONSTRUCTOR
	// Only one method or constructor can be marked @Activate
	// Allow activation methods to have @Reference annotated parameters
too
	/*
	 * <scr:component xmlns:scr="http://www.osgi.org/xmlns/scr/v1.4.0"
```

```
	 * name="testConstructorInjection" activate="-init-<init>"
	 * deactivate="deactivate">
	 */
	@Activate
	public ConstructorInjection( //
			// Update @Reference so it can be applied to a PARAMETER;
			// policy=STATIC
			/*
			 * <reference name="log"
			 * interface="org.osgi.service.log.LogService"
			 * parameter=0/>
			 */
			@Reference LogService log, //

			// Non-@Reference annotated parameters are activate method
args
			Config config, //
			ComponentContext cc, //

			/*
			 * <reference name="listeners" cardinality="0..n"
			 * interface="java.util.EventListener" parameter=3
			 * field-collection-type="service"/>
			 */
			@Reference List<EventListener> listeners //
	) {
		this.log = log;
		this.config = config;
		this.cc = cc;
		this.listeners = listeners;
		System.out.println("Hello World!");
	}

	/**
	 */
	@Deactivate
	private void deactivate() {
		System.out.println("Goodbye World!");
	}
}
```

5.5 ~~Partitioned Map Field Type~~Reference annotation support for specifying field-collection-type

Using a custom implementation of list or collection of Map.Entry with field-option=update can be used to support partitioning multiple services based upon any criteria. The add and remove methods of the custom implementation will be called with the service properties and the service object for each service added or removed from the custom implementation. The implementation can then partition the services in any desired way such as by the value of a specific service property.

A change to the Reference annotation is needed to allow the programmer to specify the field-collection-type rather than it being only inferred by the tool processing the annotation. A new fieldCollectionType element is added to the Reference annotation to allow the field-collection-type to be specified. ~~A new field type is introduced called a partitioned map. The type of this field must be one of~~

- ~~Map<K,V>~~
- ~~A subtype of Map<K,V>~~

~~V can be S or List<S> where S is one of the types supported by the field-collection-type attribute. The former is a single-valued map while the latter is a multi-valued map or multimap. If a subtype of Map is used, a subtype of List can also be used for a multimap and the policy must be dynamic and the field-option must be update.~~

~~Partitioned maps must use multiple cardinality like Collection and List field types. @Reference defaults are the same as Collection and List.~~

~~When using a partitioned map, the partition-key attribute (@Reference.partitionKey) must be specified. The value of this attribute is the name of the service property which will be used to partition the bound services into the map. If a target service does not specify a service property with the partition-key name or if the value of that service property cannot be coerced to the type K, then the target service will not be bound to this reference.~~

~~For a single-valued map, for each unique value of the service property, the highest ranked target service is bound and put in the map under the key of the service property value coerced to type K. For a multimap, for each unique value of the service property, all the target services are bound and put into the map as a List, sorted using the same ordering as ServiceReference.compareTo based upon service ranking and service id, under the key of the service property value coerced to type K.~~

~~If the service property has multiple values, that is, the value is an array or collection, then, for each unique value, the service must be placed into the partitions for which a value can be coerced to type K.~~

~~If field-option=update is used with a multimap, then SCR does not manage the List in the multimap and will not provide any sorting for the list.~~

5.6 Field injection of component activation objects

A new `activation-fields` attribute is defined for the `<component>` element which names the instance fields in the component implementation class which are to be injected with component activation objects. This attribute must contain a whitespace separated list of field names.

An activation field must be one of the following types:

- `ComponentContext` - The field will be set to the Component Context for the component configuration.
- `BundleContext` - The field will be set the Bundle Context of the component's bundle.
- `Map` - The field will be set with an unmodifiable Map containing the component properties.

- A component property type - The field will be set with an instance of the component property type which allows type safe access to component properties defined by the component property type.

Only non-final instance fields of the field types above are supported. If an activation field is declared with the `static` modifier, the `final` modifier, or has a type other than one of the above, SCR must log an error message with the Log Service, if present, and the field must not be modified.

When using activation fields, SCR must set the activation fields in the component instance at component activation. The fields must be set after the component instance constructor completes and before any other method, such as the activate method, is called. That is, there is a *happens-before* relationship between the fields being set and any method being called on the fully constructed component instance.

A modified method must be specified if the component requires notification of component property modification. A deactivate method must be specified if the component requires notification of deactivation.

Fields can be declared private in the component class but are only looked up in the inheritance chain when they are protected, public, or have default access.

The `Activate` annotation is modified to allow it to be applied to fields. Applying the `Activate` annotation to a field will add that field to the `activation-field` attribute of the `<component>` element. Multiple fields can be annotated with `Activate` as well as an activate method.

5.7 Logger Support

DS must add special support for injecting `Logger` and `FormatterLogger` objects even though they themselves are not services. When a component references the `Logger` or `FormatterLogger` types, SCR must get first get the `LoggerFactory` service matching the reference and then call the `getLogger(String, Class)` method passing the component implementation class name as the first argument and the `Logger` type as the second argument. The returned `Logger` object is then injected for the reference, rather than the `LoggerFactory` service used to create the Logger.

A DS example using Logger:

```
@Component
public class MyComponent {
  @Reference
  private Logger logger;
  @Activate
  void activate(ComponentContext context) {
    logger.trace("activating component id {}",
      context.getProperties().get("component.id"));
  }
}
```

5.8 Improved ConfigurationPlugin Supporting

RFC 227 include several enhancements to Configuration Admin. Of particular note for DS is the improvements to ConfigurationPlugin support which will allow SCR to get Configurations after ConfigurationPlugins have been able to mutate the configuration data.

The DS spec will be updated to require SCR to obtain the configuration data from the new Configuration.getModifiedProperties method. SCR must already use the component's BundleContext to obtain the configuration. The use the new getModifiedProperties method, SCR must supply a ServiceReference for a ManagedService or ManagedServiceFactory. So SCR must register the ManagedService or ManageServiceFactory service using the component's BundleContext so the ServiceReference for that service can be used as the argument for the getModifiedProperties method. SCR should register these services without a service.pid service property if the SCR implementation will obtain the Configuration object through other means such as a method on the ConfigurationAdmin service so that the service is not called by ConfigurationAdmin.

5.9 Converter

The DS specification is to be updated to replace the rules for component property mapping and coercing property values to use the new Converter package from RFC 215 instead. Care must be taken to ensure backward compatibility is preserved with DS 1.3 spec.

6 Data Transfer Objects

The ReferenceDTO is updated to add 2 new fields: parameter and collectionType for the new parameter attribute and the existing field-collection-type attribute which can now be explicitly set via the Reference annotation.

~~RFC 185 defines Data Transfer Objects as a generic means for management solutions to interact with runtime entities in an OSGi Framework. DTOs provides a common, easily serializable representation of the technology.~~

~~For all new functionality added to the OSGi Framework the question should be asked: would this feature benefit from a DTO? The expectation is that in most cases it would.~~

~~The DTOs for the design in this RFC should be described here and if there are no DTOs being defined an explanation should be given explaining why this is not applicable in this case.~~

~~This section is optional and could also be provided in a separate RFC.~~

7 Javadoc

OSGi Javadoc

9/19/16 6:47 PM

Package Summary		Page
org.osgi.service.component	Service Component Package Version 1.4.	15
org.osgi.service.component.annotations	Service Component Annotations Package Version 1.4.	29
org.osgi.service.component.runtime	Service Component Runtime Package Version 1.4.	62
org.osgi.service.component.runtime.dto	Service Component Runtime Data Transfer Objects Package Version 1.4.	66

Package org.osgi.service.component

```
@org.osgi.annotation.versioning.Version(value="1.4")
```

Service Component Package Version 1.4.

See:
Description

Interface Summary		Page
ComponentConstants	Defines standard names for Service Component constants.	16
ComponentContext	A Component Context object is used by a component instance to interact with its execution context including locating services by reference name.	19
ComponentFactory	When a component is declared with the `factory` attribute on its `component` element, Service Component Runtime will register a Component Factory service to allow new component configurations to be created and activated rather than automatically creating and activating component configuration as necessary.	25
ComponentInstance	A ComponentInstance encapsulates a component instance of an activated component configuration.	26
ComponentServiceObjects	Allows multiple service objects for a service to be obtained.	27

Exception Summary		Page
ComponentException	Unchecked exception which may be thrown by Service Component Runtime.	23

Package org.osgi.service.component Description

Service Component Package Version 1.4.

Bundles wishing to use this package must list the package in the Import-Package header of the bundle's manifest. This package has two types of users: the consumers that use the API in this package and the providers that implement the API in this package.

Example import for consumers using the API in this package:

```
Import-Package: org.osgi.service.component; version="[1.4,2.0)"
```

Example import for providers implementing the API in this package:

```
Import-Package: org.osgi.service.component; version="[1.4,1.5)"
```

Interface ComponentConstants

org.osgi.service.component

@org.osgi.annotation.versioning.ProviderType
public interface **ComponentConstants**

Defines standard names for Service Component constants.

Field Summary		Page
String	**COMPONENT_CAPABILITY_NAME** Capability name for Service Component Runtime.	18
String	**COMPONENT_FACTORY** A service registration property for a Component Factory that contains the value of the `factory` attribute.	17
String	**COMPONENT_ID** A component property that contains the generated id for a component configuration.	17
String	**COMPONENT_NAME** A component property for a component configuration that contains the name of the component as specified in the `name` attribute of the `component` element.	17
int	**DEACTIVATION_REASON_BUNDLE_STOPPED** The component configuration was deactivated because the bundle was stopped.	18
int	**DEACTIVATION_REASON_CONFIGURATION_DELETED** The component configuration was deactivated because its configuration was deleted.	18
int	**DEACTIVATION_REASON_CONFIGURATION_MODIFIED** The component configuration was deactivated because its configuration was changed.	18
int	**DEACTIVATION_REASON_DISABLED** The component configuration was deactivated because the component was disabled.	17
int	**DEACTIVATION_REASON_DISPOSED** The component configuration was deactivated because the component was disposed.	18
int	**DEACTIVATION_REASON_REFERENCE** The component configuration was deactivated because a reference became unsatisfied.	17
int	**DEACTIVATION_REASON_UNSPECIFIED** The reason the component configuration was deactivated is unspecified.	17
String	**REFERENCE_TARGET_SUFFIX** The suffix for reference target properties.	17
String	**SERVICE_COMPONENT** Manifest header specifying the XML documents within a bundle that contain the bundle's Service Component descriptions.	16

Field Detail

SERVICE_COMPONENT

public static final String **SERVICE_COMPONENT** = "Service-Component"

Manifest header specifying the XML documents within a bundle that contain the bundle's Service Component descriptions.

The attribute value may be retrieved from the `Dictionary` object returned by the `Bundle.getHeaders` method.

~~COMPONENT_NAME~~

```
public static final String COMPONENT_NAME = "component.name"
```

A component property for a component configuration that contains the name of the component as specified in the `name` attribute of the `component` element. The value of this property must be of type `String`.

~~COMPONENT_ID~~

```
public static final String COMPONENT_ID = "component.id"
```

A component property that contains the generated id for a component configuration. The value of this property must be of type `Long`.

The value of this property is assigned by Service Component Runtime when a component configuration is created. Service Component Runtime assigns a unique value that is larger than all previously assigned values since Service Component Runtime was started. These values are NOT persistent across restarts of Service Component Runtime.

~~COMPONENT_FACTORY~~

```
public static final String COMPONENT_FACTORY = "component.factory"
```

A service registration property for a Component Factory that contains the value of the `factory` attribute. The value of this property must be of type `String`.

~~REFERENCE_TARGET_SUFFIX~~

```
public static final String REFERENCE_TARGET_SUFFIX = ".target"
```

The suffix for reference target properties. These properties contain the filter to select the target services for a reference. The value of this property must be of type `String`.

~~DEACTIVATION_REASON_UNSPECIFIED~~

```
public static final int DEACTIVATION_REASON_UNSPECIFIED = 0
```

The reason the component configuration was deactivated is unspecified.

Since:
1.1

DEACTIVATION_REASON_DISABLED

```
public static final int DEACTIVATION_REASON_DISABLED = 1
```

The component configuration was deactivated because the component was disabled.

Since:
1.1

DEACTIVATION_REASON_REFERENCE

```
public static final int DEACTIVATION_REASON_REFERENCE = 2
```

The component configuration was deactivated because a reference became unsatisfied.

Since:
1.1

DEACTIVATION_REASON_CONFIGURATION_MODIFIED

```
public static final int DEACTIVATION_REASON_CONFIGURATION_MODIFIED = 3
```

The component configuration was deactivated because its configuration was changed.

Since:
1.1

DEACTIVATION_REASON_CONFIGURATION_DELETED

```
public static final int DEACTIVATION_REASON_CONFIGURATION_DELETED = 4
```

The component configuration was deactivated because its configuration was deleted.

Since:
1.1

DEACTIVATION_REASON_DISPOSED

```
public static final int DEACTIVATION_REASON_DISPOSED = 5
```

The component configuration was deactivated because the component was disposed.

Since:
1.1

DEACTIVATION_REASON_BUNDLE_STOPPED

```
public static final int DEACTIVATION_REASON_BUNDLE_STOPPED = 6
```

The component configuration was deactivated because the bundle was stopped.

Since:
1.1

COMPONENT_CAPABILITY_NAME

```
public static final String COMPONENT_CAPABILITY_NAME = "osgi.component"
```

Capability name for Service Component Runtime.

Used in `Provide-Capability` and `Require-Capability` manifest headers with the `osgi.extender` namespace. For example:

```
 Require-Capability: osgi.extender;
  filter:="(&(osgi.extender=osgi.component)(version>=1.3)(!(version>=2.0)))"
```

Since:
1.3

Interface ComponentContext

org.osgi.service.component

@org.osgi.annotation.versioning.ProviderType
public interface **ComponentContext**

A Component Context object is used by a component instance to interact with its execution context including locating services by reference name. Each component instance has a unique Component Context.

A component instance may obtain its Component Context object through its activate, modified, and deactivate methods.

ThreadSafe

Method Summary		Page
void	**disableComponent**(String name) Disables the specified component name.	22
void	**enableComponent**(String name) Enables the specified component name.	21
org.osgi.framework.BundleContext	**getBundleContext**() Returns the BundleContext of the bundle which contains this component.	21
ComponentInstance	**getComponentInstance**() Returns the Component Instance object for the component instance associated with this Component Context.	21
Dictionary<String,Object>	**getProperties**() Returns the component properties for this Component Context.	19
org.osgi.framework.ServiceReference<?>	**getServiceReference**() If the component instance is registered as a service using the service element, then this method returns the service reference of the service provided by this component instance.	22
org.osgi.framework.Bundle	**getUsingBundle**() If the component instance is registered as a service using the servicescope="bundle" or servicescope="prototype" attribute, then this method returns the bundle using the service provided by the component instance.	21
Object	**locateService**(String name) Returns the service object for the specified reference name.	20
S	**locateService**(String name, org.osgi.framework.ServiceReference<S> reference) Returns the service object for the specified reference name and ServiceReference.	20
Object[]	**locateServices**(String name) Returns the service objects for the specified reference name.	20

Method Detail

getProperties

Dictionary<String,Object> **getProperties**()

Returns the component properties for this Component Context.

Returns:
The properties for this Component Context. The Dictionary is read only and cannot be modified.

locateService

`Object` **`locateService`**`(String name)`

Returns the service object for the specified reference name.

If the cardinality of the reference is `0..n` or `1..n` and multiple services are bound to the reference, the service with the highest ranking (as specified in its `Constants.SERVICE_RANKING` property) is returned. If there is a tie in ranking, the service with the lowest service id (as specified in its `Constants.SERVICE_ID` property); that is, the service that was registered first is returned.

Parameters:

`name` - The name of a reference as specified in a `reference` element in this component's description.

Returns:

A service object for the referenced service or `null` if the reference cardinality is `0..1` or `0..n` and no bound service is available.

Throws:

`ComponentException` - If Service Component Runtime catches an exception while activating the bound service.

locateService

`S` **`locateService`**`(String name,`
`org.osgi.framework.ServiceReference<S> reference)`

Returns the service object for the specified reference name and `ServiceReference`.

Type Parameters:

`S` - Type of Service.

Parameters:

`name` - The name of a reference as specified in a `reference` element in this component's description.

`reference` - The `ServiceReference` to a bound service. This must be a `ServiceReference` provided to the component via the bind or unbind method for the specified reference name.

Returns:

A service object for the referenced service or `null` if the specified `ServiceReference` is not a bound service for the specified reference name.

Throws:

`ComponentException` - If Service Component Runtime catches an exception while activating the bound service.

locateServices

`Object[]` **`locateServices`**`(String name)`

Returns the service objects for the specified reference name.

Parameters:

`name` - The name of a reference as specified in a `reference` element in this component's description.

Returns:

An array of service objects for the referenced service or `null` if the reference cardinality is `0..1` or `0..n` and no bound service is available. If the reference cardinality is `0..1` or `1..1` and a bound service is available, the array will have exactly one element.

Throws:

`ComponentException` - If Service Component Runtime catches an exception while activating a bound service.

getBundleContext

`org.osgi.framework.BundleContext getBundleContext()`

Returns the `BundleContext` of the bundle which contains this component.

Returns:
The `BundleContext` of the bundle containing this component.

getUsingBundle

`org.osgi.framework.Bundle getUsingBundle()`

If the component instance is registered as a service using the `servicescope="bundle"` or `servicescope="prototype"` attribute, then this method returns the bundle using the service provided by the component instance.

This method will return `null` if:

- The component instance is not a service, then no bundle can be using it as a service.
- The component instance is a service but did not specify the `servicescope="bundle"` or `servicescope="prototype"` attribute, then all bundles using the service provided by the component instance will share the same component instance.
- The service provided by the component instance is not currently being used by any bundle.

Returns:
The bundle using the component instance as a service or `null`.

getComponentInstance

`ComponentInstance getComponentInstance()`

Returns the Component Instance object for the component instance associated with this Component Context.

Returns:
The Component Instance object for the component instance.

enableComponent

`void enableComponent(String name)`

Enables the specified component name. The specified component name must be in the same bundle as this component.

This method must return after changing the enabled state of the specified component name. Any actions that result from this, such as activating or deactivating a component configuration, must occur asynchronously to this method call.

Parameters:
`name` - The name of a component or `null` to indicate all components in the bundle.

disableComponent

`void disableComponent(String name)`

Disables the specified component name. The specified component name must be in the same bundle as this component.

This method must return after changing the enabled state of the specified component name. Any actions that result from this, such as activating or deactivating a component configuration, must occur asynchronously to this method call.

Parameters:

`name` - The name of a component.

getServiceReference

`org.osgi.framework.ServiceReference<?> getServiceReference()`

If the component instance is registered as a service using the `service` element, then this method returns the service reference of the service provided by this component instance.

This method will return `null` if the component instance is not registered as a service.

Returns:

The `ServiceReference` object for the component instance or `null` if the component instance is not registered as a service.

Class ComponentException

org.osgi.service.component

java.lang.Object
  └ java.lang.Throwable
      └ java.lang.Exception
          └ java.lang.RuntimeException
              └ **org.osgi.service.component.ComponentException**

All Implemented Interfaces:
Serializable

---

public class **ComponentException**
extends RuntimeException

Unchecked exception which may be thrown by Service Component Runtime.

Constructor Summary	Page
ComponentException(String message) Construct a new ComponentException with the specified message.	23
ComponentException(String message, Throwable cause) Construct a new ComponentException with the specified message and cause.	23
ComponentException(Throwable cause) Construct a new ComponentException with the specified cause.	24

Method Summary		Page
Throwable	**getCause**() Returns the cause of this exception or `null` if no cause was set.	24
Throwable	**initCause**(Throwable cause) Initializes the cause of this exception to the specified value.	24

Constructor Detail

ComponentException

public **ComponentException**(String message,
                              Throwable cause)

Construct a new ComponentException with the specified message and cause.

Parameters:
`message` - The message for the exception.
`cause` - The cause of the exception. May be `null`.

ComponentException

public **ComponentException**(String message)

Construct a new ComponentException with the specified message.

Parameters:
`message` - The message for the exception.

ComponentException

`public ComponentException(Throwable cause)`

Construct a new ComponentException with the specified cause.

Parameters:
`cause` - The cause of the exception. May be `null`.

Method Detail

getCause

`public Throwable getCause()`

Returns the cause of this exception or `null` if no cause was set.

Overrides:
`getCause` in class `Throwable`
Returns:
The cause of this exception or `null` if no cause was set.

---

initCause

`public Throwable initCause(Throwable cause)`

Initializes the cause of this exception to the specified value.

Overrides:
`initCause` in class `Throwable`
Parameters:
`cause` - The cause of this exception.
Returns:
This exception.
Throws:
`IllegalArgumentException` - If the specified cause is this exception.
`IllegalStateException` - If the cause of this exception has already been set.

Interface ComponentFactory

org.osgi.service.component

`@org.osgi.annotation.versioning.ProviderType`
`public interface` **ComponentFactory**

When a component is declared with the `factory` attribute on its `component` element, Service Component Runtime will register a Component Factory service to allow new component configurations to be created and activated rather than automatically creating and activating component configuration as necessary.

ThreadSafe

Method Summary		Page
ComponentInstance	**newInstance**(Dictionary<String,?> properties) Create and activate a new component configuration.	25

Method Detail

newInstance

ComponentInstance **newInstance**(Dictionary<String,?> properties)

Create and activate a new component configuration. Additional properties may be provided for the component configuration.

Parameters:

`properties` - Additional properties for the component configuration or `null` if there are no additional properties.

Returns:

A `ComponentInstance` object encapsulating the component instance of the component configuration. The component configuration has been activated and, if the component specifies a `service` element, the component instance has been registered as a service.

Throws:

`ComponentException` - If Service Component Runtime is unable to activate the component configuration.

Interface ComponentInstance

org.osgi.service.component

```
@org.osgi.annotation.versioning.ProviderType
public interface ComponentInstance
```

A ComponentInstance encapsulates a component instance of an activated component configuration. ComponentInstances are created whenever a component configuration is activated.

ComponentInstances are never reused. A new ComponentInstance object will be created when the component configuration is activated again.

ThreadSafe

Method Summary		Page
void	**dispose**() Dispose of the component configuration for this component instance.	26
Object	**getInstance**() Returns the component instance of the activated component configuration.	26

Method Detail

dispose

```
void dispose()
```

Dispose of the component configuration for this component instance. The component configuration will be deactivated. If the component configuration has already been deactivated, this method does nothing.

getInstance

```
Object getInstance()
```

Returns the component instance of the activated component configuration.

Returns:

The component instance or `null` if the component configuration has been deactivated.

Interface ComponentServiceObjects

org.osgi.service.component

Type Parameters:

S - Type of Service

@org.osgi.annotation.versioning.ProviderType
public interface **ComponentServiceObjects**

Allows multiple service objects for a service to be obtained.

A component instance can receive a `ComponentServiceObjects` object via a reference that is typed `ComponentServiceObjects`.

For services with `prototype` scope, multiple service objects for the service can be obtained. For services with `singleton` or `bundle` scope, only one, use-counted service object is available.

Any unreleased service objects obtained from this `ComponentServiceObjects` object are automatically released by Service Component Runtime when the service becomes unbound.

Since:

1.3

See Also:

`org.osgi.framework.ServiceObjects`

ThreadSafe

Method Summary		Page
S	**getService**() Returns a service object for the `associated` service.	27
org.osgi.framework.ServiceReference<S>	**getServiceReference**() Returns the `org.osgi.framework.ServiceReference` for the service associated with this `ComponentServiceObjects` object.	28
void	**ungetService**(S service) Releases a service object for the `associated` service.	28

Method Detail

getService

S **getService**()

Returns a service object for the `associated` service.

This method will always return `null` when the associated service has been become unbound.

Returns:

A service object for the associated service or `null` if the service is unbound, the customized service object returned by a `ServiceFactory` does not implement the classes under which it was registered or the `ServiceFactory` threw an exception.

Throws:

`IllegalStateException` - If the component instance that received this `ComponentServiceObjects` object has been deactivated.

See Also:

`ungetService(Object)`

ungetService

`void` **`ungetService`**`(S service)`

Releases a service object for the `associated` service.

The specified service object must no longer be used and all references to it should be destroyed after calling this method.

Parameters:

`service` - A service object previously provided by this `ComponentServiceObjects` object.

Throws:

`IllegalStateException` - If the component instance that received this `ComponentServiceObjects` object has been deactivated.

`IllegalArgumentException` - If the specified service object was not provided by this `ComponentServiceObjects` object.

See Also:

`getService()`

getServiceReference

`org.osgi.framework.ServiceReference<S>` **`getServiceReference`**`()`

Returns the `org.osgi.framework.ServiceReference` for the service associated with this `ComponentServiceObjects` object.

Returns:

The `org.osgi.framework.ServiceReference` for the service associated with this `ComponentServiceObjects` object.

Package org.osgi.service.component.annotations

`@org.osgi.annotation.versioning.Version(value="1.4")`

Service Component Annotations Package Version 1.4.

See:
Description

Enum Summary		Page
CollectionType	Collection types for the `Reference` annotation.	31
ConfigurationPolicy	Configuration Policy for the `Component` annotation.	39
FieldOption	Field options for the `Reference` annotation.	42
ReferenceCardinality	Cardinality for the `Reference` annotation.	52
ReferencePolicy	Policy for the `Reference` annotation.	54
ReferencePolicyOption	Policy option for the `Reference` annotation.	56
ReferenceScope	Reference scope for the `Reference` annotation.	58
ServiceScope	Service scope for the `Component` annotation.	60

Annotation Types Summary		Page
Activate	Identify the annotated method as the `activate` method of a Service Component.	30
Component	Identify the annotated class as a Service Component.	33
Deactivate	Identify the annotated method as the `deactivate` method of a Service Component.	41
Modified	Identify the annotated method as the `modified` method of a Service Component.	44
Reference	Identify the annotated member as a reference of a Service Component.	45

Package org.osgi.service.component.annotations Description

Service Component Annotations Package Version 1.4.

This package is not used at runtime. Annotated classes are processed by tools to generate Component Descriptions which are used at runtime.

Annotation Type Activate

org.osgi.service.component.annotations

```
@Retention(value=RetentionPolicy.CLASS)
@Target(value={
  ElementType.METHOD,
  ElementType.CONSTRUCTOR
})
public @interface Activate
```

Identify the annotated method as the `activate` method of a Service Component.

The annotated method is the activate method of the Component. A constructor can also be used as the activate method of the Component.

This annotation is not processed at runtime by Service Component Runtime. It must be processed by tools and used to add a Component Description to the bundle.

Since:

1.1

See Also:

"The activate attribute of the component element of a Component Description."

Enum CollectionType

org.osgi.service.component.annotations

java.lang.Object
  └ java.lang.Enum<CollectionType>
    └ **org.osgi.service.component.annotations.CollectionType**

All Implemented Interfaces:

Comparable<CollectionType>, Serializable

---

public enum **CollectionType**
extends Enum<CollectionType>

Collection types for the `Reference` annotation.

Since:

1.4

Enum Constant Summary	Page
PROPERTIES The properties collection type is used to indicate the collection holds unmodifiable Maps containing the service properties of the bound services.	32
REFERENCE The reference collection type is used to indicate the collection holds Service References for the bound services.	32
SERVICE The service collection type is used to indicate the collection holds the bound service objects.	31
SERVICEOBJECTS The serviceobjects collection type is used to indicate the collection holds Component Service Objects for the bound services.	32
TUPLE The tuple collection type is used to indicate the collection holds unmodifiable Map.Entries whose key is an unmodifiable Map containing the service properties of the bound service, as specified in `PROPERTIES`, and whose value is the bound service object.	32

Method Summary		Page
String	**toString**()	32
static CollectionType	**valueOf**(String name)	32
static CollectionType[]	**values**()	32

Enum Constant Detail

SERVICE

public static final CollectionType **SERVICE**

The service collection type is used to indicate the collection holds the bound service objects.

This is the default collection type.

REFERENCE

```
public static final CollectionType REFERENCE
```

The reference collection type is used to indicate the collection holds Service References for the bound services.

SERVICEOBJECTS

```
public static final CollectionType SERVICEOBJECTS
```

The serviceobjects collection type is used to indicate the collection holds Component Service Objects for the bound services.

PROPERTIES

```
public static final CollectionType PROPERTIES
```

The properties collection type is used to indicate the collection holds unmodifiable Maps containing the service properties of the bound services.

The Maps must implement `Comparable` with the `compareTo` method comparing service property maps using the same ordering as `ServiceReference.compareTo` based upon service ranking and service id.

TUPLE

```
public static final CollectionType TUPLE
```

The tuple collection type is used to indicate the collection holds unmodifiable Map.Entries whose key is an unmodifiable Map containing the service properties of the bound service, as specified in `PROPERTIES`, and whose value is the bound service object.

The Map.Entries must implement `Comparable` with the `compareTo` method comparing service property maps using the same ordering as `ServiceReference.compareTo` based upon service ranking and service id.

Method Detail

values

```
public static CollectionType[] values()
```

valueOf

```
public static CollectionType valueOf(String name)
```

toString

```
public String toString()
```

Overrides:

`toString` in class `Enum`

Annotation Type Component

org.osgi.service.component.annotations

```
@Retention(value=RetentionPolicy.CLASS)
@Target(value=ElementType.TYPE)
public @interface Component
```

Identify the annotated class as a Service Component.

The annotated class is the implementation class of the Component.

This annotation is not processed at runtime by Service Component Runtime. It must be processed by tools and used to add a Component Description to the bundle.

See Also:

"The component element of a Component Description."

Field Summary		Page
String	**NAME** Special string representing the name of this Component.	34

Required Element Summary		Page
String[]	**configurationPid** The configuration PIDs for the configuration of this Component.	37
ConfigurationPolicy	**configurationPolicy** The configuration policy of this Component.	37
boolean	**enabled** Declares whether this Component is enabled when the bundle containing it is started.	35
String	**factory** The factory identifier of this Component.	34
boolean	**immediate** Declares whether this Component must be immediately activated upon becoming satisfied or whether activation should be delayed.	35
String	**name** The name of this Component.	34
String[]	**properties** Property entries for this Component.	36
String[]	**property** Properties for this Component.	36
Reference[]	**reference** The lookup strategy references of this Component.	38
ServiceScope	**scope** The service scope for the service of this Component.	37
Class<?>[]	**service** The types under which to register this Component as a service.	34
boolean	**servicefactory** **Deprecated.** Since 1.3.	35
String	**xmlns** The XML name space of the Component Description for this Component.	36

Field Detail

NAME

```
public static final String NAME = "$"
```

Special string representing the name of this Component.

This string can be used in `configurationPid()` to specify the name of the component as a configuration PID. For example:

```
 @Component(configurationPid={"com.acme.system", Component.NAME})
```

Tools creating a Component Description from this annotation must replace the special string with the actual name of this Component.

Since:
1.3

Element Detail

name

```
public abstract String name
```

The name of this Component.

If not specified, the name of this Component is the fully qualified type name of the class being annotated.

Default:
""

See Also:
"The name attribute of the component element of a Component Description."

---

service

```
public abstract Class<?>[] service
```

The types under which to register this Component as a service.

If no service should be registered, the empty value `{}` must be specified.

If not specified, the service types for this Component are all the *directly* implemented interfaces of the class being annotated.

Default:
{}

See Also:
"The service element of a Component Description."

---

factory

```
public abstract String factory
```

The factory identifier of this Component. Specifying a factory identifier makes this Component a Factory Component.

If not specified, the default is that this Component is not a Factory Component.

Default:
""
See Also:
"The factory attribute of the component element of a Component Description."

---

servicefactory

`public abstract boolean` **`servicefactory`**

Deprecated. *Declares whether this Component uses the OSGi ServiceFactory concept and each bundle using this Component's service will receive a different component instance.*

This element is ignored when the `scope()` element does not have the default value. If `true`, this Component uses `bundle` service scope. If `false` or not specified, this Component uses `singleton` service scope. If the `factory()` element is specified or the `immediate()` element is specified with `true`, this element can only be specified with `false`.

Declares whether this Component uses the OSGi ServiceFactory concept and each bundle using this Component's service will receive a different component instance.

This element is ignored when the `scope()` element does not have the default value. If `true`, this Component uses `bundle` service scope. If `false` or not specified, this Component uses `singleton` service scope. If the `factory()` element is specified or the `immediate()` element is specified with `true`, this element can only be specified with `false`.

Default:
false
See Also:
"The scope attribute of the service element of a Component Description."

---

enabled

`public abstract boolean` **`enabled`**

Declares whether this Component is enabled when the bundle containing it is started.

If `true` or not specified, this Component is enabled. If `false`, this Component is disabled.

Default:
true
See Also:
"The enabled attribute of the component element of a Component Description."

---

immediate

`public abstract boolean` **`immediate`**

Declares whether this Component must be immediately activated upon becoming satisfied or whether activation should be delayed.

If `true`, this Component must be immediately activated upon becoming satisfied. If `false`, activation of this Component is delayed. If this property is specified, its value must be `false` if the `factory()` property is also specified or must be `true` if the `service()` property is specified with an empty value.

If not specified, the default is `false` if the `factory()` property is specified or the `service()` property is not specified or specified with a non-empty value and `true` otherwise.

Default:
false
See Also:
"The immediate attribute of the component element of a Component Description."

---

property

`public abstract String[] property`

Properties for this Component.

Each property string is specified as `"name=value"`. The type of the property value can be specified in the name as `name:type=value`. The type must be one of the property types supported by the type attribute of the property element of a Component Description.

To specify a property with multiple values, use multiple name, value pairs. For example, `"foo=bar", "foo=baz"`.

Default:
{}
See Also:
"The property element of a Component Description."

---

properties

`public abstract String[] properties`

Property entries for this Component.

Specifies the name of an entry in the bundle whose contents conform to a standard Java Properties File. The entry is read and processed to obtain the properties and their values.

Default:
{}
See Also:
"The properties element of a Component Description."

---

xmlns

`public abstract String xmlns`

The XML name space of the Component Description for this Component.

If not specified, the XML name space of the Component Description for this Component should be the lowest Declarative Services XML name space which supports all the specification features used by this Component.

Default:
""
See Also:
"The XML name space specified for a Component Description."

---

configurationPolicy

`public abstract ConfigurationPolicy configurationPolicy`

The configuration policy of this Component.

Controls whether component configurations must be satisfied depending on the presence of a corresponding Configuration object in the OSGi Configuration Admin service. A corresponding configuration is a Configuration object where the PID equals the name of the component.

If not specified, the configuration policy is based upon whether the component is also annotated with the Meta Type `Designate` annotation.

- Not annotated with `Designate` - The configuration policy is `OPTIONAL`.
- Annotated with `Designate(factory=false)` - The configuration policy is `OPTIONAL`.
- Annotated with `Designate(factory=true)` - The configuration policy is `REQUIRE`.

Default:
ConfigurationPolicy.OPTIONAL
Since:
1.1
See Also:
"The configuration-policy attribute of the component element of a Component Description."

---

configurationPid

`public abstract String[] configurationPid`

The configuration PIDs for the configuration of this Component.

Each value specifies a configuration PID for this Component.

If no value is specified, the name of this Component is used as the configuration PID of this Component.

A special string (`"$"`) can be used to specify the name of the component as a configuration PID. The `NAME` constant holds this special string. For example:

```
@Component(configurationPid={"com.acme.system", Component.NAME})
```

Tools creating a Component Description from this annotation must replace the special string with the actual name of this Component.

Default:
{ "$" }
Since:
1.2
See Also:
"The configuration-pid attribute of the component element of a Component Description."

---

scope

`public abstract ServiceScope scope`

The service scope for the service of this Component.

If not specified (and the deprecated `servicefactory()` element is not specified), the `singleton` service scope is used. If the `factory()` element is specified or the `immediate()` element is specified with `true`, this element can only be specified with the `singleton` service scope.

Default:
ServiceScope.DEFAULT
Since:
1.3
See Also:
"The scope attribute of the service element of a Component Description."

---

reference

```
public abstract Reference[] reference
```

The lookup strategy references of this Component.

To access references using the lookup strategy, `Reference` annotations are specified naming the reference and declaring the type of the referenced service. The referenced service can be accessed using one of the `locateService` methods of `ComponentContext`.

To access references using the event strategy, bind methods are annotated with `Reference`. To access references using the field strategy, fields are annotated with `Reference`.

Default:
{}
Since:
1.3
See Also:
"The reference element of a Component Description."

Enum ConfigurationPolicy

org.osgi.service.component.annotations

java.lang.Object
  └ java.lang.Enum<ConfigurationPolicy>
    └ **org.osgi.service.component.annotations.ConfigurationPolicy**

All Implemented Interfaces:

Comparable<ConfigurationPolicy>, Serializable

---

public enum **ConfigurationPolicy**
extends Enum<ConfigurationPolicy>

Configuration Policy for the `Component` annotation.

Controls whether component configurations must be satisfied depending on the presence of a corresponding Configuration object in the OSGi Configuration Admin service. A corresponding configuration is a Configuration object where the PID is the name of the component.

Since:

1.1

Enum Constant Summary	Page
IGNORE Always allow the component configuration to be satisfied and do not use the corresponding Configuration object even if it is present.	40
OPTIONAL Use the corresponding Configuration object if present but allow the component to be satisfied even if the corresponding Configuration object is not present.	39
REQUIRE There must be a corresponding Configuration object for the component configuration to become satisfied.	39

Method Summary		Page
String	**toString**()	40
static ConfigurationPolicy	**valueOf**(String name)	40
static ConfigurationPolicy[]	**values**()	40

Enum Constant Detail

OPTIONAL

public static final ConfigurationPolicy **OPTIONAL**

Use the corresponding Configuration object if present but allow the component to be satisfied even if the corresponding Configuration object is not present.

REQUIRE

public static final ConfigurationPolicy **REQUIRE**

There must be a corresponding Configuration object for the component configuration to become satisfied.

IGNORE

```
public static final ConfigurationPolicy IGNORE
```

Always allow the component configuration to be satisfied and do not use the corresponding Configuration object even if it is present.

Method Detail

values

```
public static ConfigurationPolicy[] values()
```

valueOf

```
public static ConfigurationPolicy valueOf(String name)
```

toString

```
public String toString()
```

Overrides:

`toString` in class `Enum`

Annotation Type Deactivate

org.osgi.service.component.annotations

```
@Retention(value=RetentionPolicy.CLASS)
@Target(value=ElementType.METHOD)
public @interface Deactivate
```

Identify the annotated method as the `deactivate` method of a Service Component.

The annotated method is the deactivate method of the Component.

This annotation is not processed at runtime by Service Component Runtime. It must be processed by tools and used to add a Component Description to the bundle.

Since:

1.1

See Also:

"The deactivate attribute of the component element of a Component Description."

Enum FieldOption

org.osgi.service.component.annotations

```
java.lang.Object
  └ java.lang.Enum<FieldOption>
      └ org.osgi.service.component.annotations.FieldOption
```

All Implemented Interfaces:

Comparable<FieldOption>, Serializable

```
public enum FieldOption
extends Enum<FieldOption>
```

Field options for the `Reference` annotation.

Since:

1.3

Enum Constant Summary	Page
REPLACE The replace field option is used to replace the field value with a new value when there are changes to the bound services.	42
UPDATE The update field option is used to update the collection referenced by the field when there are changes to the bound services.	42

Method Summary		Page
String	**toString**()	43
static FieldOption	**valueOf**(String name)	43
static FieldOption[]	**values**()	43

Enum Constant Detail

UPDATE

```
public static final FieldOption UPDATE
```

The update field option is used to update the collection referenced by the field when there are changes to the bound services.

This field option can only be used when the field reference has dynamic policy and multiple cardinality.

REPLACE

```
public static final FieldOption REPLACE
```

The replace field option is used to replace the field value with a new value when there are changes to the bound services.

Method Detail

values

```
public static FieldOption[] values()
```

valueOf

```
public static FieldOption valueOf(String name)
```

toString

```
public String toString()
```

Overrides:

`toString` in class `Enum`

Annotation Type Modified

org.osgi.service.component.annotations

```
@Retention(value=RetentionPolicy.CLASS)
@Target(value=ElementType.METHOD)
public @interface Modified
```

Identify the annotated method as the `modified` method of a Service Component.

The annotated method is the modified method of the Component.

This annotation is not processed at runtime by Service Component Runtime. It must be processed by tools and used to add a Component Description to the bundle.

Since:

1.1

See Also:

"The modified attribute of the component element of a Component Description."

Annotation Type Reference

org.osgi.service.component.annotations

```
@Retention(value=RetentionPolicy.CLASS)
@Target(value={
  ElementType.METHOD,
  ElementType.FIELD,
  ElementType.PARAMETER
})
public @interface Reference
```

Identify the annotated member as a reference of a Service Component.

When the annotation is applied to a method, the method is the bind method of the reference.

When the annotation is applied to a field, the field will contain the bound service(s) of the reference.

When the annotation is applied to a parameter of a constructor that is annotated with `Activate`, the parameter will contain the bound service(s) of the reference.

This annotation is not processed at runtime by Service Component Runtime. It must be processed by tools and used to add a Component Description to the bundle.

In the generated Component Description for a component, the references must be ordered in ascending lexicographical order (using `String.compareTo`) of the reference `name`s.

See Also:
"The reference element of a Component Description."

Required Element Summary		Page
String	**bind** The name of the bind method for this reference.	48
ReferenceCardinality	**cardinality** The cardinality of this reference.	47
CollectionType	**collectionType** The collection type for this reference.	51
String	**field** The name of the field for this reference.	49
FieldOption	**fieldOption** The field option for this reference.	50
String	**name** The name of this reference.	46
int	**parameter** The zero-based parameter number of the constructor parameter for this reference.	50
ReferencePolicy	**policy** The policy for this reference.	47
ReferencePolicyOption	**policyOption** The policy option for this reference.	48
ReferenceScope	**scope** The reference scope for this reference.	48
Class<?>	**service** The type of the service for this reference.	46

String	**target** The target property for this reference.	47
String	**unbind** The name of the unbind method for this reference.	49
String	**updated** The name of the updated method for this reference.	49

Element Detail

name

`public abstract String` **`name`**

The name of this reference.

The name of this reference must be specified when using this annotation in the `Component.reference()` element since there is no annotated member from which the name can be determined. If not specified, the name of this reference is based upon how this annotation is used:

- Annotated method - If the method name begins with `bind`, `set` or `add`, that prefix is removed to create the name of the reference. Otherwise, the name of the reference is the method name.
- Annotated field - The name of the reference is the field name.
- Annotated constructor parameter - The name of the reference is the parameter name.

Default:
""

See Also:
"The name attribute of the reference element of a Component Description."

---

service

`public abstract Class<?>` **`service`**

The type of the service for this reference.

The type of the service for this reference must be specified when using this annotation in the `Component.reference()` element since there is no annotated member from which the type of the service can be determined.

If not specified, the type of the service for this reference is based upon how this annotation is used:

- Annotated method - The type of the service is the type of the first argument of the method.
- Annotated field - The type of the service is based upon the type of the field being annotated and the cardinality of the reference. If the cardinality is either `0..n`, or `1..n`, the type of the field must be one of `java.util.Collection`, `java.util.List`, or a subtype of `java.util.Collection` so the type of the service is the generic type of the collection. Otherwise, the type of the service is the type of the field.
- Annotated constructor parameter - The type of the service is based upon the type of the parameter being annotated and the cardinality of the reference. If the cardinality is either `0..n`, or `1..n`, the type of the parameter must be one of `java.util.Collection`, `java.util.List`, or a subtype of `java.util.Collection` so the type of the service is the generic type of the collection. Otherwise, the type of the service is the type of the parameter.

Default:
Object.class

See Also:
"The interface attribute of the reference element of a Component Description."

---

cardinality

`public abstract ReferenceCardinality` **`cardinality`**

The cardinality of this reference.

If not specified, the cardinality of this reference is based upon how this annotation is used:

- Annotated method - The cardinality is `1..1`.
- Annotated field - The cardinality is based on the type of the field. If the type is either `java.util.Collection`, `java.util.List`, or a subtype of `java.util.Collection`, the cardinality is `0..n`. Otherwise the cardinality is `1..1`.
- `Component.reference()` element - The cardinality is `1..1`.
- Annotated constructor parameter - The cardinality is based on the type of the parameter. If the type is either `java.util.Collection`, `java.util.List`, or a subtype of `java.util.Collection`, the cardinality is `0..n`. Otherwise the cardinality is `1..1`.
- `Component.reference()` element - The cardinality is `1..1`.

Default:
ReferenceCardinality.MANDATORY
See Also:
"The cardinality attribute of the reference element of a Component Description."

---

policy

`public abstract ReferencePolicy` **`policy`**

The policy for this reference.

If not specified, the policy of this reference is based upon how this annotation is used:

- Annotated method - The policy is `STATIC`.
- Annotated field - The policy is based on the modifiers of the field. If the field is declared `volatile`, the policy is `ReferencePolicy.DYNAMIC`. Otherwise the policy is `STATIC`.
- Annotated constructor parameter - The policy is `STATIC`. Constructor parameters must use `STATIC` policy.
- `Component.reference()` element - The policy is `STATIC`.

Default:
ReferencePolicy.STATIC
See Also:
"The policy attribute of the reference element of a Component Description."

---

target

`public abstract String` **`target`**

The target property for this reference.

If not specified, no target property is set.

Default:
""

See Also:
"The target attribute of the reference element of a Component Description."

---

policyOption

```
public abstract ReferencePolicyOption policyOption
```

The policy option for this reference.

If not specified, the `RELUCTANT` reference policy option is used.

Default:
ReferencePolicyOption.RELUCTANT
Since:
1.2
See Also:
"The policy-option attribute of the reference element of a Component Description."

---

scope

```
public abstract ReferenceScope scope
```

The reference scope for this reference.

If not specified, the `bundle` reference scope is used.

Default:
ReferenceScope.BUNDLE
Since:
1.3
See Also:
"The scope attribute of the reference element of a Component Description."

---

bind

```
public abstract String bind
```

The name of the bind method for this reference.

If specified and this reference annotates a method, the specified name must match the name of the annotated method.

If not specified, the name of the bind method is based upon how this annotation is used:

- Annotated method - The name of the annotated method is the name of the bind method.
- Annotated field - There is no bind method name.
- Annotated constructor parameter - There is no bind method name.
- `Component.reference()` element - There is no bind method name.

If there is a bind method name, the component must contain a method with that name.

Default:
""
Since:
1.3
See Also:
"The bind attribute of the reference element of a Component Description."

---

updated

`public abstract String` **`updated`**

The name of the updated method for this reference.

If not specified, the name of the updated method is based upon how this annotation is used:

- Annotated method - The name of the updated method is created from the name of the annotated method. If the name of the annotated method begins with `bind`, `set` or `add`, that prefix is replaced with `updated` to create the name candidate for the updated method. Otherwise, `updated` is prefixed to the name of the annotated method to create the name candidate for the updated method. If the component type contains a method with the candidate name, the candidate name is used as the name of the updated method. To declare no updated method when the component type contains a method with the candidate name, the value `"-"` must be used.
- Annotated field - There is no updated method name.
- Annotated constructor parameter - There is no updated method name.
- `Component.reference()` element - There is no updated method name.

If there is an updated method name, the component must contain a method with that name.

Default:
""
Since:
1.2
See Also:
"The updated attribute of the reference element of a Component Description."

---

unbind

`public abstract String` **`unbind`**

The name of the unbind method for this reference.

If not specified, the name of the unbind method is based upon how this annotation is used:

- Annotated method - The name of the unbind method is created from the name of the annotated method. If the name of the annotated method begins with `bind`, `set` or `add`, that prefix is replaced with `unbind`, `unset` or `remove`, respectively, to create the name candidate for the unbind method. Otherwise, `un` is prefixed to the name of the annotated method to create the name candidate for the unbind method. If the component type contains a method with the candidate name, the candidate name is used as the name of the unbind method. To declare no unbind method when the component type contains a method with the candidate name, the value `"-"` must be used.
- Annotated field - There is no unbind method name.
- Annotated constructor parameter - There is no unbind method name.
- `Component.reference()` element - There is no unbind method name.

If there is an unbind method name, the component must contain a method with that name.

Default:
""
See Also:
"The unbind attribute of the reference element of a Component Description."

---

field

`public abstract String` **`field`**

The name of the field for this reference.

If specified and this reference annotates a field, the specified name must match the name of the annotated field.

If not specified, the name of the field is based upon how this annotation is used:

- Annotated method - There is no field name.
- Annotated field - The name of the annotated field is the name of the field.
- Annotated constructor parameter - There is no field name.
- `Component.reference()` element - There is no field name.

If there is a field name, the component must contain a field with that name.

Default:
""
Since:
1.3
See Also:
"The field attribute of the reference element of a Component Description."

---

fieldOption

```
public abstract FieldOption fieldOption
```

The field option for this reference.

If not specified, the field option is based upon how this annotation is used:

- Annotated method - There is no field option.
- Annotated field - The field option is based upon the policy and cardinality of the reference and the modifiers of the field. If the policy is `ReferencePolicy.DYNAMIC`, the cardinality is `0..n` or `1..n`, and the field is declared `final`, the field option is `FieldOption.UPDATE`. Otherwise, the field option is `FieldOption.REPLACE`.
- Annotated constructor parameter - There is no field option.
- `Component.reference()` element - There is no field option.

Default:
FieldOption.REPLACE
Since:
1.3
See Also:
"The field-option attribute of the reference element of a Component Description."

---

parameter

```
public abstract int parameter
```

The zero-based parameter number of the constructor parameter for this reference.

If specified and this reference annotates a constructor parameter, the specified value must match the zero-based parameter number of the annotated constructor parameter.

If not specified, the parameter number is based upon how this annotation is used:

- Annotated method - There is no parameter number.
- Annotated field - There is no parameter number.
- Annotated constructor parameter - The zero-based parameter number of the parameter.
- `Component.reference()` element - There is no parameter number.

If there is a parameter number, the component must contain a constructor annotated with `Activate` that has a parameter having the zero-based parameter number.

Default:
0
Since:
1.4
See Also:
"The parameter attribute of the reference element of a Component Description."

---

collectionType

```
public abstract CollectionType collectionType
```

The collection type for this reference.

If not specified, the collection type is based upon how this annotation is used:

- Annotated method - There is no collection type.
- Annotated field - The collection type is based upon the cardinality of the reference and the generic type of the field. If the the cardinality is `0..n` or `1..n`, the collection type is inferred from the generic type of the list or collection. Otherwise, there is no collection type
- Annotated constructor parameter - The collection type is based upon the cardinality of the reference and the generic type of the parameter. If the the cardinality is `0..n` or `1..n`, the collection type is inferred from the generic type of the list or collection. Otherwise, there is no collection type
- `Component.reference()` element - There is no collection type.

Default:
CollectionType.SERVICE
Since:
1.4
See Also:
"The field-collection-type attribute of the reference element of a Component Description."

Enum ReferenceCardinality

org.osgi.service.component.annotations

java.lang.Object
  └ java.lang.Enum<ReferenceCardinality>
    └ **org.osgi.service.component.annotations.ReferenceCardinality**

All Implemented Interfaces:

Comparable<ReferenceCardinality>, Serializable

---

public enum **ReferenceCardinality**
extends Enum<ReferenceCardinality>

Cardinality for the `Reference` annotation.

Specifies if the reference is optional and if the component implementation support a single bound service or multiple bound services.

Enum Constant Summary	Page
AT_LEAST_ONE The reference is mandatory and multiple.	53
MANDATORY The reference is mandatory and unary.	52
MULTIPLE The reference is optional and multiple.	52
OPTIONAL The reference is optional and unary.	52

Method Summary		Page
String	**toString**()	53
static ReferenceCardinality	**valueOf**(String name)	53
static ReferenceCardinality[]	**values**()	53

Enum Constant Detail

OPTIONAL

public static final ReferenceCardinality **OPTIONAL**

The reference is optional and unary. That is, the reference has a cardinality of `0..1`.

MANDATORY

public static final ReferenceCardinality **MANDATORY**

The reference is mandatory and unary. That is, the reference has a cardinality of `1..1`.

MULTIPLE

public static final ReferenceCardinality **MULTIPLE**

The reference is optional and multiple. That is, the reference has a cardinality of `0..n`.

AT_LEAST_ONE

```
public static final ReferenceCardinality AT_LEAST_ONE
```

The reference is mandatory and multiple. That is, the reference has a cardinality of `1..n`.

Method Detail

values

```
public static ReferenceCardinality[] values()
```

valueOf

```
public static ReferenceCardinality valueOf(String name)
```

toString

```
public String toString()
```

Overrides:

`toString` in class `Enum`

Enum ReferencePolicy

org.osgi.service.component.annotations

java.lang.Object
  └ java.lang.Enum<ReferencePolicy>
    └ **org.osgi.service.component.annotations.ReferencePolicy**

All Implemented Interfaces:

Comparable<ReferencePolicy>, Serializable

---

public enum **ReferencePolicy**
extends Enum<ReferencePolicy>

Policy for the `Reference` annotation.

Enum Constant Summary	Page
DYNAMIC The dynamic policy is slightly more complex since the component implementation must properly handle changes in the set of bound services.	54
STATIC The static policy is the most simple policy and is the default policy.	54

Method Summary		Page
String	**toString**()	55
static ReferencePolicy	**valueOf**(String name)	55
static ReferencePolicy[]	**values**()	55

Enum Constant Detail

STATIC

public static final ReferencePolicy **STATIC**

The static policy is the most simple policy and is the default policy. A component instance never sees any of the dynamics. Component configurations are deactivated before any bound service for a reference having a static policy becomes unavailable. If a target service is available to replace the bound service which became unavailable, the component configuration must be reactivated and bound to the replacement service.

DYNAMIC

public static final ReferencePolicy **DYNAMIC**

The dynamic policy is slightly more complex since the component implementation must properly handle changes in the set of bound services. With the dynamic policy, SCR can change the set of bound services without deactivating a component configuration. If the component uses the event strategy to access services, then the component instance will be notified of changes in the set of bound services by calls to the bind and unbind methods.

Method Detail

values

`public static ReferencePolicy[] values()`

valueOf

`public static ReferencePolicy valueOf(String name)`

toString

`public String toString()`

Overrides:

`toString` in class `Enum`

Enum ReferencePolicyOption

org.osgi.service.component.annotations

java.lang.Object
  └ java.lang.Enum<ReferencePolicyOption>
    └ **org.osgi.service.component.annotations.ReferencePolicyOption**

All Implemented Interfaces:
Comparable<ReferencePolicyOption>, Serializable

---

public enum **ReferencePolicyOption**
extends Enum<ReferencePolicyOption>

Policy option for the `Reference` annotation.

Since:
1.2

Enum Constant Summary	Page
GREEDY The greedy policy option is a valid policy option for both `static` and `dynamic` reference policies.	56
RELUCTANT The reluctant policy option is the default policy option for both `static` and `dynamic` reference policies.	56

Method Summary		Page
String	**toString**()	57
static ReferencePolicyOption	**valueOf**(String name)	57
static ReferencePolicyOption[]	**values**()	57

Enum Constant Detail

RELUCTANT

public static final ReferencePolicyOption **RELUCTANT**

The reluctant policy option is the default policy option for both `static` and `dynamic` reference policies. When a new target service for a reference becomes available, references having the reluctant policy option for the static policy or the dynamic policy with a unary cardinality will ignore the new target service. References having the dynamic policy with a multiple cardinality will bind the new target service.

GREEDY

public static final ReferencePolicyOption **GREEDY**

The greedy policy option is a valid policy option for both `static` and `dynamic` reference policies. When a new target service for a reference becomes available, references having the greedy policy option will bind the new target service.

Method Detail

values

```
public static ReferencePolicyOption[] values()
```

valueOf

```
public static ReferencePolicyOption valueOf(String name)
```

toString

```
public String toString()
```

Overrides:

`toString` in class `Enum`

Enum ReferenceScope

org.osgi.service.component.annotations

java.lang.Object
  └ java.lang.Enum<ReferenceScope>
    └ **org.osgi.service.component.annotations.ReferenceScope**

All Implemented Interfaces:
Comparable<ReferenceScope>, Serializable

---

public enum **ReferenceScope**
extends Enum<ReferenceScope>

Reference scope for the `Reference` annotation.

Since:
1.3

Enum Constant Summary	Page
BUNDLE A single service object is used for all references to the service in this bundle.	58
PROTOTYPE If the bound service has prototype service scope, then each instance of the component with this reference can receive a unique instance of the service.	58
PROTOTYPE_REQUIRED Bound services must have prototype service scope.	59

Method Summary		Page
String	**toString**()	59
static ReferenceScope	**valueOf**(String name)	59
static ReferenceScope[]	**values**()	59

Enum Constant Detail

BUNDLE

public static final ReferenceScope **BUNDLE**

A single service object is used for all references to the service in this bundle.

PROTOTYPE

public static final ReferenceScope **PROTOTYPE**

If the bound service has prototype service scope, then each instance of the component with this reference can receive a unique instance of the service. If the bound service does not have prototype service scope, then this reference scope behaves the same as `BUNDLE`.

PROTOTYPE_REQUIRED

```
public static final ReferenceScope PROTOTYPE_REQUIRED
```

Bound services must have prototype service scope. Each instance of the component with this reference can receive a unique instance of the service.

Method Detail

values

```
public static ReferenceScope[] values()
```

valueOf

```
public static ReferenceScope valueOf(String name)
```

toString

```
public String toString()
```

Overrides:

`toString` in class `Enum`

Enum ServiceScope

org.osgi.service.component.annotations

java.lang.Object
  └ java.lang.Enum<ServiceScope>
    └ **org.osgi.service.component.annotations.ServiceScope**

All Implemented Interfaces:

Comparable<ServiceScope>, Serializable

---

public enum **ServiceScope**
extends Enum<ServiceScope>

Service scope for the `Component` annotation.

Since:

1.3

Enum Constant Summary	Page
BUNDLE When the component is registered as a service, it must be registered as a bundle scope service and an instance of the component must be created for each bundle using the service.	60
DEFAULT Default element value for annotation.	61
PROTOTYPE When the component is registered as a service, it must be registered as a prototype scope service and an instance of the component must be created for each distinct request for the service.	61
SINGLETON When the component is registered as a service, it must be registered as a bundle scope service but only a single instance of the component must be used for all bundles using the service.	60

Method Summary		Page
String	**toString**()	61
static ServiceScope	**valueOf**(String name)	61
static ServiceScope[]	**values**()	61

Enum Constant Detail

SINGLETON

public static final ServiceScope **SINGLETON**

When the component is registered as a service, it must be registered as a bundle scope service but only a single instance of the component must be used for all bundles using the service.

~~BUNDLE~~

public static final ServiceScope **BUNDLE**

When the component is registered as a service, it must be registered as a bundle scope service and an instance of the component must be created for each bundle using the service.

PROTOTYPE

```
public static final ServiceScope PROTOTYPE
```

When the component is registered as a service, it must be registered as a prototype scope service and an instance of the component must be created for each distinct request for the service.

DEFAULT

```
public static final ServiceScope DEFAULT
```

Default element value for annotation. This is used to distinguish the default value for an element and should not otherwise be used.

Method Detail

values

```
public static ServiceScope[] values()
```

valueOf

```
public static ServiceScope valueOf(String name)
```

toString

```
public String toString()
```

Overrides:

`toString` in class `Enum`

Package org.osgi.service.component.runtime

`@org.osgi.annotation.versioning.Version(value="1.4")`

Service Component Runtime Package Version 1.4.

See:
Description

Interface Summary		Page
ServiceComponentRuntime	The `ServiceComponentRuntime` service represents the Declarative Services actor, known as Service Component Runtime (SCR), that manages the service components and their life cycle.	63

Package org.osgi.service.component.runtime Description

Service Component Runtime Package Version 1.4.

Bundles wishing to use this package must list the package in the Import-Package header of the bundle's manifest. This package has two types of users: the consumers that use the API in this package and the providers that implement the API in this package.

Example import for consumers using the API in this package:

```
Import-Package: org.osgi.service.component.runtime; version="[1.4,2.0)"
```

Example import for providers implementing the API in this package:

```
Import-Package: org.osgi.service.component.runtime; version="[1.4,1.5)"
```

Interface ServiceComponentRuntime

org.osgi.service.component.runtime

@org.osgi.annotation.versioning.ProviderType
public interface **ServiceComponentRuntime**

The ServiceComponentRuntime service represents the Declarative Services actor, known as Service Component Runtime (SCR), that manages the service components and their life cycle. The ServiceComponentRuntime service allows introspection of the components managed by Service Component Runtime.

This service differentiates between a ComponentDescriptionDTO and a ComponentConfigurationDTO. A ComponentDescriptionDTO is a representation of a declared component description. A ComponentConfigurationDTO is a representation of an actual instance of a declared component description parameterized by component properties.

Access to this service requires the ServicePermission[ServiceComponentRuntime, GET] permission. It is intended that only administrative bundles should be granted this permission to limit access to the potentially intrusive methods provided by this service.

Since:
1.3
ThreadSafe

Method Summary		Page
org.osgi.util.promise.Promise<Void>	**disableComponent**(ComponentDescriptionDTO description) Disables the specified component description.	65
org.osgi.util.promise.Promise<Void>	**enableComponent**(ComponentDescriptionDTO description) Enables the specified component description.	65
Collection<ComponentConfigurationDTO>	**getComponentConfigurationDTOs**(ComponentDescriptionDTO description) Returns the component configurations for the specified component description.	64
ComponentDescriptionDTO	**getComponentDescriptionDTO**(org.osgi.framework.Bundle bundle, String name) Returns the ComponentDescriptionDTO declared with the specified name by the specified bundle.	64
Collection<ComponentDescriptionDTO>	**getComponentDescriptionDTOs**(org.osgi.framework.Bundle... bundles) Returns the component descriptions declared by the specified active bundles.	63
boolean	**isComponentEnabled**(ComponentDescriptionDTO description) Returns whether the specified component description is currently enabled.	64

Method Detail

getComponentDescriptionDTOs

Collection<ComponentDescriptionDTO> **getComponentDescriptionDTOs**(org.osgi.framework.Bundle... bundles)

Returns the component descriptions declared by the specified active bundles.

Only component descriptions from active bundles are returned. If the specified bundles have no declared components or are not active, an empty collection is returned.

Parameters:

`bundles` - The bundles whose declared component descriptions are to be returned. Specifying no bundles, or the equivalent of an empty `Bundle` array, will return the declared component descriptions from all active bundles.

Returns:

The declared component descriptions of the specified active `bundles`. An empty collection is returned if there are no component descriptions for the specified active bundles.

---

getComponentDescriptionDTO

```
ComponentDescriptionDTO getComponentDescriptionDTO(org.osgi.framework.Bundle bundle,
                                                   String name)
```

Returns the `ComponentDescriptionDTO` declared with the specified name by the specified bundle.

Only component descriptions from active bundles are returned. `null` if no such component is declared by the given `bundle` or the bundle is not active.

Parameters:

`bundle` - The bundle declaring the component description. Must not be `null`.
`name` - The name of the component description. Must not be `null`.

Returns:

The declared component description or `null` if the specified bundle is not active or does not declare a component description with the specified name.

---

getComponentConfigurationDTOs

```
Collection<ComponentConfigurationDTO> getComponentConfigurationDTOs(ComponentDescriptionDTO description)
```

Returns the component configurations for the specified component description.

Parameters:

`description` - The component description. Must not be `null`.

Returns:

A collection containing a snapshot of the current component configurations for the specified component description. An empty collection is returned if there are none or if the provided component description does not belong to an active bundle.

---

isComponentEnabled

```
boolean isComponentEnabled(ComponentDescriptionDTO description)
```

Returns whether the specified component description is currently enabled.

The enabled state of a component description is initially set by the `enabled` attribute of the component description.

Parameters:

`description` - The component description. Must not be `null`.

Returns:

`true` if the specified component description is currently enabled. Otherwise, `false`.

See Also:

`enableComponent(ComponentDescriptionDTO)`,
`disableComponent(ComponentDescriptionDTO)`,
`ComponentContext.disableComponent(String)`,
`ComponentContext.enableComponent(String)`

enableComponent

`org.osgi.util.promise.Promise<Void> enableComponent(ComponentDescriptionDTO description)`

Enables the specified component description.

If the specified component description is currently enabled, this method has no effect.

This method must return after changing the enabled state of the specified component description. Any actions that result from this, such as activating or deactivating a component configuration, must occur asynchronously to this method call.

Parameters:

`description` - The component description to enable. Must not be `null`.

Returns:

A promise that will be resolved when the actions that result from changing the enabled state of the specified component have completed. If the provided description does not belong to an active bundle, a failed promise is returned.

See Also:

`isComponentEnabled(ComponentDescriptionDTO)`

disableComponent

`org.osgi.util.promise.Promise<Void> disableComponent(ComponentDescriptionDTO description)`

Disables the specified component description.

If the specified component description is currently disabled, this method has no effect.

This method must return after changing the enabled state of the specified component description. Any actions that result from this, such as activating or deactivating a component configuration, must occur asynchronously to this method call.

Parameters:

`description` - The component description to disable. Must not be `null`.

Returns:

A promise that will be resolved when the actions that result from changing the enabled state of the specified component have completed. If the provided description does not belong to an active bundle, a failed promise is returned.

See Also:

`isComponentEnabled(ComponentDescriptionDTO)`

Package org.osgi.service.component.runtime.dto

@org.osgi.annotation.versioning.Version(value="1.4")

Service Component Runtime Data Transfer Objects Package Version 1.4.

See:
Description

Class Summary		Page
ComponentConfigurationDTO	A representation of an actual instance of a declared component description parameterized by component properties.	67
ComponentDescriptionDTO	A representation of a declared component description.	70
ReferenceDTO	A representation of a declared reference to a service.	87
SatisfiedReferenceDTO	A representation of a satisfied reference.	92
UnsatisfiedReferenceDTO	A representation of an unsatisfied reference.	94

Package org.osgi.service.component.runtime.dto Description

Service Component Runtime Data Transfer Objects Package Version 1.4.

Bundles wishing to use this package must list the package in the Import-Package header of the bundle's manifest. This package has two types of users: the consumers that use the API in this package and the providers that implement the API in this package.

Example import for consumers using the API in this package:

```
Import-Package: org.osgi.service.component.runtime.dto; version="[1.4,2.0)"
```

Example import for providers implementing the API in this package:

```
Import-Package: org.osgi.service.component.runtime.dto; version="[1.4,1.5)"
```

Class ComponentConfigurationDTO

org.osgi.service.component.runtime.dto

```
java.lang.Object
  └ org.osgi.dto.DTO
      └ org.osgi.service.component.runtime.dto.ComponentConfigurationDTO
```

```
public class ComponentConfigurationDTO
extends org.osgi.dto.DTO
```

A representation of an actual instance of a declared component description parameterized by component properties.

Since:
1.3

NotThreadSafe

Field Summary		Page
static int	**ACTIVE** The component configuration is active.	68
ComponentDescriptionDTO	**description** The representation of the component configuration's component description.	68
long	**id** The id of the component configuration.	68
Map<String, Object>	**properties** The component properties for the component configuration.	68
static int	**SATISFIED** The component configuration is satisfied.	68
SatisfiedReferenceDTO[]	**satisfiedReferences** The satisfied references.	69
int	**state** The current state of the component configuration.	68
static int	**UNSATISFIED_CONFIGURATION** The component configuration is unsatisfied due to a missing required configuration.	68
static int	**UNSATISFIED_REFERENCE** The component configuration is unsatisfied due to an unsatisfied reference.	68
UnsatisfiedReferenceDTO[]	**unsatisfiedReferences** The unsatisfied references.	69

Constructor Summary	Page
ComponentConfigurationDTO()	69

Methods inherited from class org.osgi.dto.DTO
toString

Field Detail

UNSATISFIED_CONFIGURATION

```
public static final int UNSATISFIED_CONFIGURATION = 1
```

The component configuration is unsatisfied due to a missing required configuration.

~~UNSATISFIED_REFERENCE~~

```
public static final int UNSATISFIED_REFERENCE = 2
```

The component configuration is unsatisfied due to an unsatisfied reference.

~~SATISFIED~~

```
public static final int SATISFIED = 4
```

The component configuration is satisfied.

Any `services` declared by the component description are registered.

~~ACTIVE~~

```
public static final int ACTIVE = 8
```

The component configuration is active.

This is the normal operational state of a component configuration.

~~description~~

```
public ComponentDescriptionDTO description
```

The representation of the component configuration's component description.

~~state~~

```
public int state
```

The current state of the component configuration.

This is one of `UNSATISFIED_CONFIGURATION`, `UNSATISFIED_REFERENCE`, `SATISFIED` or `ACTIVE`.

~~id~~

```
public long id
```

The id of the component configuration.

The id is a non-persistent, unique value assigned at runtime. The id is also available as the `component.id` component property. The value of this field is unspecified if the state of this component configuration is unsatisfied.

~~properties~~

```
public Map<String,Object> properties
```

The component properties for the component configuration.

See Also:

`ComponentContext.getProperties()`

satisfiedReferences

public SatisfiedReferenceDTO[] **satisfiedReferences**

The satisfied references.

Each `SatisfiedReferenceDTO` in the array represents a satisfied reference of the component configuration. The array must be empty if the component configuration has no satisfied references.

unsatisfiedReferences

public UnsatisfiedReferenceDTO[] **unsatisfiedReferences**

The unsatisfied references.

Each `UnsatisfiedReferenceDTO` in the array represents an unsatisfied reference of the component configuration. The array must be empty if the component configuration has no unsatisfied references.

Constructor Detail

ComponentConfigurationDTO

public **ComponentConfigurationDTO**()

Class ComponentDescriptionDTO

org.osgi.service.component.runtime.dto

```
java.lang.Object
  └ org.osgi.dto.DTO
      └ org.osgi.service.component.runtime.dto.ComponentDescriptionDTO
```

```
public class ComponentDescriptionDTO
extends org.osgi.dto.DTO
```

A representation of a declared component description.

Since:
1.3

NotThreadSafe

Field Summary		Page
String	**activate** The name of the activate method.	72
org.osgi.framework.dto.BundleDTO	**bundle** The bundle declaring the component description.	71
String[]	**configurationPid** The configuration pids.	86
String	**configurationPolicy** The configuration policy.	86
String	**deactivate** The name of the deactivate method.	72
boolean	**defaultEnabled** The initial enabled state.	71
String	**factory** The component factory name.	71
boolean	**immediate** The immediate state.	72
String	**implementationClass** The fully qualified name of the implementation class.	71
String	**modified** The name of the modified method.	85
String	**name** The name of the component.	71
Map<String, Object>	**properties** The component properties.	72
ReferenceDTO[]	**references** The referenced services.	72
String	**scope** The service scope.	71
String[]	**serviceInterfaces** The fully qualified names of the service interfaces.	72

Constructor Summary	Page
ComponentDescriptionDTO()	86

Methods inherited from class org.osgi.dto.DTO
toString

Field Detail

name

public String **name**

The name of the component.

This is declared in the `name` attribute of the `component` element. This must be the default name if the component description does not declare a name.

bundle

public org.osgi.framework.dto.BundleDTO **bundle**

The bundle declaring the component description.

factory

public String **factory**

The component factory name.

This is declared in the `factory` attribute of the `component` element. This must be `null` if the component description is not declared as a component factory.

scope

public String **scope**

The service scope.

This is declared in the `scope` attribute of the `service` element. This must be `null` if the component description does not declare any service interfaces.

implementationClass

public String **implementationClass**

The fully qualified name of the implementation class.

This is declared in the `class` attribute of the `implementation` element.

defaultEnabled

public boolean **defaultEnabled**

The initial enabled state.

This is declared in the `enabled` attribute of the `component` element.

immediate

`public boolean immediate`

The immediate state.

This is declared in the `immediate` attribute of the `component` element.

serviceInterfaces

`public String[] serviceInterfaces`

The fully qualified names of the service interfaces.

These are declared in the `interface` attribute of the `provide` elements. The array must be empty if the component description does not declare any service interfaces.

properties

`public Map<String,Object> properties`

The component properties.

These are declared in the component description by the `property` and `properties` elements as well as the `target` attribute of the `reference` elements.

references

`public ReferenceDTO[] references`

The referenced services.

These are declared in the `reference` elements. The array must be empty if the component description does not declare references to any services.

activate

`public String activate`

The name of the activate method.

This is declared in the `activate` attribute of the `component` element. This must be `null` if the component description does not declare an activate method name.

deactivate

`public String deactivate`

The name of the deactivate method.

This is declared in the `deactivate` attribute of the `component` element. This must be `null` if the component description does not declare a deactivate method name.

modified

`public String modified`

The name of the modified method.

This is declared in the `modified` attribute of the `component` element. This must be `null` if the component description does not declare a modified method name.

configurationPolicy

`public String` **`configurationPolicy`**

The configuration policy.

This is declared in the `configuration-policy` attribute of the `component` element. This must be the default configuration policy if the component description does not declare a configuration policy.

configurationPid

`public String[]` **`configurationPid`**

The configuration pids.

These are declared in the `configuration-pid` attribute of the `component` element. This must contain the default configuration pid if the component description does not declare a configuration pid.

Constructor Detail

ComponentDescriptionDTO

`public` **`ComponentDescriptionDTO`**`()`

Class ReferenceDTO

org.osgi.service.component.runtime.dto

```
java.lang.Object
  └ org.osgi.dto.DTO
      └ org.osgi.service.component.runtime.dto.ReferenceDTO
```

```
public class ReferenceDTO
extends org.osgi.dto.DTO
```

A representation of a declared reference to a service.

Since:
1.3

NotThreadSafe

Field Summary		Page
String	**bind** The name of the bind method of the reference.	89
String	**cardinality** The cardinality of the reference.	88
String	**collectionType** The collection type for the reference.	91
String	**field** The name of the field of the reference.	89
String	**fieldOption** The field option of the reference.	89
String	**interfaceName** The service interface of the reference.	88
String	**name** The name of the reference.	88
int	**parameter** The zero-based parameter number of the constructor parameter for the reference.	90
String	**policy** The policy of the reference.	88
String	**policyOption** The policy option of the reference.	88
String	**scope** The scope of the reference.	89
String	**target** The target of the reference.	88
String	**unbind** The name of the unbind method of the reference.	89
String	**updated** The name of the updated method of the reference.	89

Constructor Summary	Page

ReferenceDTO()	91

Methods inherited from class org.osgi.dto.DTO
toString

Field Detail

name

public String **name**

The name of the reference.

This is declared in the `name` attribute of the `reference` element. This must be the default name if the component description does not declare a name for the reference.

interfaceName

public String **interfaceName**

The service interface of the reference.

This is declared in the `interface` attribute of the `reference` element.

cardinality

public String **cardinality**

The cardinality of the reference.

This is declared in the `cardinality` attribute of the `reference` element. This must be the default cardinality if the component description does not declare a cardinality for the reference.

policy

public String **policy**

The policy of the reference.

This is declared in the `policy` attribute of the `reference` element. This must be the default policy if the component description does not declare a policy for the reference.

policyOption

public String **policyOption**

The policy option of the reference.

This is declared in the `policy-option` attribute of the `reference` element. This must be the default policy option if the component description does not declare a policy option for the reference.

target

public String **target**

The target of the reference.

This is declared in the `target` attribute of the `reference` element. This must be `null` if the component description does not declare a target for the reference.

bind

`public String bind`

The name of the bind method of the reference.

This is declared in the `bind` attribute of the `reference` element. This must be `null` if the component description does not declare a bind method for the reference.

unbind

`public String unbind`

The name of the unbind method of the reference.

This is declared in the `unbind` attribute of the `reference` element. This must be `null` if the component description does not declare an unbind method for the reference.

updated

`public String updated`

The name of the updated method of the reference.

This is declared in the `updated` attribute of the `reference` element. This must be `null` if the component description does not declare an updated method for the reference.

field

`public String field`

The name of the field of the reference.

This is declared in the `field` attribute of the `reference` element. This must be `null` if the component description does not declare a field for the reference.

fieldOption

`public String fieldOption`

The field option of the reference.

This is declared in the `field-option` attribute of the `reference` element. This must be `null` if the component description does not declare a field for the reference.

scope

`public String scope`

The scope of the reference.

This is declared in the `scope` attribute of the `reference` element. This must be the default scope if the component description does not declare a scope for the reference.

parameter

`public int parameter`

The zero-based parameter number of the constructor parameter for the reference.

This is declared in the `parameter` attribute of the `reference` element. This must be zero if the component description does not declare a parameter number for the reference.

Since:
1.4

---

collectionType

`public String` **`collectionType`**

The collection type for the reference.

This is declared in the `field-collection-type` attribute of the `reference` element. This must be `null` if the component description does not declare a collection type for the reference.

Since:
1.4

Constructor Detail

ReferenceDTO

`public` **`ReferenceDTO`**`()`

Class SatisfiedReferenceDTO

org.osgi.service.component.runtime.dto

java.lang.Object
  └ org.osgi.dto.DTO
      └ **org.osgi.service.component.runtime.dto.SatisfiedReferenceDTO**

---

public class **SatisfiedReferenceDTO**
extends org.osgi.dto.DTO

A representation of a satisfied reference.

Since:
1.3

NotThreadSafe

Field Summary		Page
org.osgi.framework.dto.ServiceReferenceDTO[]	**boundServices** The bound services.	93
String	**name** The name of the declared reference.	92
String	**target** The target property of the satisfied reference.	92

Constructor Summary	Page
SatisfiedReferenceDTO()	93

Methods inherited from class org.osgi.dto.DTO
toString

Field Detail

name

public String **name**

The name of the declared reference.

This is declared in the `name` attribute of the `reference` element of the component description.

See Also:
ReferenceDTO.name

---

target

public String **target**

The target property of the satisfied reference.

This is the value of the `component property` whose name is the concatenation of the `declared reference name` and ".target". This must be `null` if no target property is set for the reference.

boundServices

`public org.osgi.framework.dto.ServiceReferenceDTO[] boundServices`

The bound services.

Each `org.osgi.framework.dto.ServiceReferenceDTO` in the array represents a service bound to the satisfied reference. The array must be empty if there are no bound services.

Constructor Detail

SatisfiedReferenceDTO

`public SatisfiedReferenceDTO()`

Class UnsatisfiedReferenceDTO

org.osgi.service.component.runtime.dto

```
java.lang.Object
  └ org.osgi.dto.DTO
      └ org.osgi.service.component.runtime.dto.UnsatisfiedReferenceDTO
```

```
public class UnsatisfiedReferenceDTO
extends org.osgi.dto.DTO
```

A representation of an unsatisfied reference.

Since:
1.3

NotThreadSafe

Field Summary		Page
String	**name** The name of the declared reference.	94
String	**target** The target property of the unsatisfied reference.	94
org.osgi.framework.dto.ServiceReferenceDTO[]	**targetServices** The target services.	95

Constructor Summary	Page
UnsatisfiedReferenceDTO()	95

Methods inherited from class org.osgi.dto.DTO
toString

Field Detail

name

```
public String name
```

The name of the declared reference.

This is declared in the `name` attribute of the `reference` element of the component description.

See Also:
`ReferenceDTO.name`

---

target

```
public String target
```

The target property of the unsatisfied reference.

This is the value of the `component_property` whose name is the concatenation of the `declared_reference_name` and ".target". This must be `null` if no target property is set for the reference.

targetServices

`public org.osgi.framework.dto.ServiceReferenceDTO[] targetServices`

The target services.

Each `org.osgi.framework.dto.ServiceReferenceDTO` in the array represents a target service for the reference. The array must be empty if there are no target services. The upper bound on the number of target services in the array is the upper bound on the `cardinality` of the reference.

Constructor Detail

UnsatisfiedReferenceDTO

`public UnsatisfiedReferenceDTO()`

~~Please include Javadoc of any new APIs here, once the design has matured. Instructions on how to export Javadoc for inclusion in the RFC can be found here: https://www.osgi.org/members/RFC/Javadoc~~

8 Considered Alternatives

8.1 Field injection of component activation objects

Activation fields are only set at component activation. They cannot be modified after that for the modified or deactivate life cycle events because of atomicity issues. The following was deleted:

- modification - For fields of type `Map` and component property types which are declared with the `volatile` modifier, the field is set to the modified component properties before the modified method, if specified, is called. If the field is not declared with the `volatile` modifier, it is not modified. The field is only modified if declared with the `volatile` modifier so that field value changes made by SCR are visible to other threads. If the component does not specify a modified method or an activation field of type `Map` or a component property type which is declared `volatile`, then the component configuration will become unsatisfied if its component properties are modified since there is no way for SCR to provide the modified component properties to the component instance.
- deactivation - For fields which are declared with the `volatile` modifier, the field is set to `null` after the deactivate method, if specified, completes. If the field is not declared with the `volatile` modifier, it is not modified. The field is only modified if declared with the `volatile` modifier so that field value changes made by SCR are visible to other threads.

8.2 Component Reclamation

We agreed that the SCR implementation should provide some delay in reclaiming singleton and bundle scope services rather than create new markup for this. Also during CPEG discussion, we concluded that this could only apply to singleton and bundle scope services anyway since prototype services must be reclaimed when released. The following was deleted:

A new `activation-policy` attribute is defined for the `<component>` element. This attribute defines the policy for activating and deactivating the component.The `activation-policy` attribute replaces the `immediate` attribute which is removed from the schema.

The `activation-policy` attribute can have one of the following values:

- `immediate` – The component instance must be activated as soon as the component configuration is satisfied. The component instance must remain activated until the component configuration becomes unsatisfied when the component instance must be deactivated. This is the replacement for `immediate=true`.
- `ondemand` – The activation of a component instance must be delayed until there is an actual need for the component instance such as an actual request for the service object. The component instance must remain activate as long as the component instance is in use. If the service registered by a component configuration becomes unused because there are no more bundles using it, then SCR should deactivate the component instance. This allows SCR implementations to eagerly reclaim activated component configurations. This is the replacement for `immediate=false`.
- `delayed` – The activation of a component instance must be delayed until there is an actual need for the component instance such as an actual request for the service object. The component instance must remain activated until the component configuration becomes unsatisfied when the component instance must be deactivated. This is a new policy.

The default policy is `immediate` if the component is not a factory component and does not specify a service. Otherwise the default policy is `ondemand`.

Both the `ondemand` and `delayed` policies delay activation of component instances until they are actually needed but the `delayed` policy will keep the component instance activated until it becomes unsatisfied while the `ondemand` policy will allow SCR to deactivate component instances which are not in use as services.

The `Component` annotation is updated to add a new `activationPolicy` element of type `ActivationPolicy` which is an enum having the values: `IMMEDIATE`, `ONDEMAND`, and `DELAYED`. The `immediate` element of the `Component` annotation is deprecated. If the `activationPolicy` element is specified, then the `immediate` element is ignored.

8.3 Partitioned Map Field Type

Issues with concurrency and field-option updated led to the removal of this support. Using a custom list or collection of map.entry with field-option=update can be used to provide the desired behavior.

A new field type is introduced called a partitioned map. The type of this field must be one of

- Map<K,V>
- A subtype of Map<K,V>

V can be S or List<S> where S is one of the types supported by the field-collection-type attribute. The former is a single-valued map while the latter is a multi-valued map or multimap. If a subtype of Map is used, a subtype of List can also be used for a multimap and the policy must be dynamic and the field-option must be update.

Partitioned maps must use multiple cardinality like Collection and List field types. @Reference defaults are the same as Collection and List.

When using a partitioned map, the partition-key attribute (@Reference.partitionKey) must be specified. The value of this attribute is the name of the service property which will be used to partition the bound services into the map. If a target service does not specify a service property with the partition-key name or if the value of that service property cannot be coerced to the type K, then the target service will not be bound to this reference.

For a single-valued map, for each unique value of the service property, the highest ranked target service is bound and put in the map under the key of the service property value coerced to type K. For a multimap, for each unique value of the service property, all the target services are bound and put into the map as a List, sorted using the same ordering as ServiceReference.compareTo based upon service ranking and service id, under the key of the service property value coerced to type K.

If the service property has multiple values, that is, the value is an array or collection, then, for each unique value, the service must be placed into the partitions for which a value can be coerced to type K.

If field-option=update is used with a multimap, then SCR does not manage the List in the multimap and will not provide any sorting for the list.

9 Security Considerations

This design introduces no new security considerations.~~Description of all known vulnerabilities this may either introduce or address as well as scenarios of how the weaknesses could be circumvented.~~

10 Document Support

10.1 References

[1]. Bradner, S., Key words for use in RFCs to Indicate Requirement Levels, RFC2119, March 1997.

[2]. Software Requirements & Specifications. Michael Jackson. ISBN 0-201-87712-0

10.2 Author's Address

Name	BJ Hargrave
Company	IBM

10.3 Acronyms and Abbreviations

DS – Declarative Services

SCR – Service Component Runtime

10.4 End of Document