



RFC 203 – Remote Service Admin 1.1

Draft

13 Pages

Abstract

The Remote Service Admin specification is lacking a mechanism to notify consumers of changes to an endpoint. The EndpointListener interface defines endpointAdded and endpointRemoved callbacks, but no mechanism to convey that an endpoint has been modified, for example because the service properties of the backing service have changed. This RFC addresses this issue.

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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/>.

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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	August, 2013	David Bosschaert, initial version of separate RFC. Previous design has been taking place in RFC 183.
0.1	September, 2013	Post September F2F discussion - add the new "update" methods to the ExportRegistration and ImportRegistration
0.2	September, 2013	Clarify the uniqueness requirements for endpoint ids, include community feedback
0.3	October, 2013	Update based on comments from 23/10 EEG call. Restructure sections to place background information in section 3. No changes to content.

1 Introduction

The OSGi Remote Services and Remote Service Admin specifications describe how OSGi services can be remoted and how to consume these remote services using the OSGi Services programming model.

The Remote Service Admin specification version 1.0 defines how listeners are notified of endpoints being added and removed. However the associated API does not support notifying listeners of changes to endpoints such as service property changes of the associated service. This RFC addresses this issue by proposing an extension to the Remote Service Admin specification.

2 Application Domain

This RFC relates to the domain of remote OSGi Services, specifically the Remote Service Admin specification.

3 Problem Description

In Remote Service Admin 1.0 it was possible for Topology Managers to dynamically register and unregister remote services, however there was no way to update a service without unregistering it. This causes significant disruption when remote clients are dependent upon the availability of the remote service for their operation.

It has also been found that part of the Remote Service Admin 1.0 specification wording relating to Endpoint Id uniqueness is insufficiently clear, in that it does not specify the scope of the uniqueness. This needs to be clarified so that different Topology Managers, Discovery Providers and Distribution Providers can reliably interoperate.

3.1 Notifying the Discovery Provider of updates

The EndpointListener interface is used to implement a distributed discovery mechanism and it allows the registration of a listener for distributed endpoints to appear and disappear via the endpointAdded() and endpointRemoved() callback methods. However, an endpoint can also change. This is in particular the case when the service registration properties of the endpoint are modified. Such modifications are not supported by the EndpointListener today, it sends a sequence of endpointRemoved() and endpointAdded() callbacks in such a case which can cause unnecessary volatility in the system.

3.2 Notifying the Distribution Provider of updates

In the Remote Service Admin specification the Topology Manager is responsible for interacting with RSA distribution providers. In RSA 1.0 this was broadly limited to creating and closing ImportRegistration and ExportRegistration objects using the Distribution Provider. To support updates RSA 1.1 will need additional interaction mechanisms to indicate that an ImportRegistration or ExportRegistration should be updated. It is necessary for the Topology Manager to initiate these updates, because either:

- It is then responsible for notifying Discovery services of any changes to an exported endpoint

or

- The topology manager is the component that is notified of changes to a remote endpoint via Discovery announcements.

3.3 Clarifying Endpoint Id Uniqueness

The following is an extract from the OSGi R5 compendium:

122.4.3 Endpoint Id

An Endpoint Id is an opaque unique identifier for an Endpoint. There is no syntax defined for this string except that white space at the beginning and ending must be ignored. The actual syntax for this Endpoint Id must be defined by the actual configuration type.

Two Endpoint Descriptions are deemed identical when their Endpoint Id is equal. The Endpoint Ids must be compared as string compares with leading and trailing spaces removed. The Endpoint Description class must use the String class' hash Code from the Endpoint Id as its own hashCode.

Furthermore the OSGi R5 compendium states that:

Two Endpoint Descriptions are deemed equal when their Endpoint Id is equal. The Endpoint Id is a mandatory property of an Endpoint Description, it is further described at *Endpoint Id* on page 709. The hash code is therefore also based on the Endpoint Id.

122.4.1 Validity

A valid Endpoint Description must at least satisfy the following assertions:

- It must have a non-null Id that uniquely identifies the Endpoint

The extracts above are sufficient to require that:

1. The Endpoint Id is opaque, and has no declared format or syntax
2. The Endpoint Id defines the identity of an EndpointDescription, regardless of its other properties
3. The Endpoint Id is expected to be “unique”, although the scope of this uniqueness is not expressly defined.

3.3.1 Required Scope of Endpoint Id Uniqueness

The Remote Service Admin specification states that there may be multiple Topology Managers, Distribution Providers and Discovery Providers active concurrently within a single framework. It is clear that if these implementations are to coexist then Endpoint Id uniqueness must hold within the OSGi framework. This applies regardless of the number of installed Distribution Providers, more than one of which may be exporting a given service.

In the Remote Service Admin Specification EndpointDescriptions are created by distribution providers, but are passed on to Topology Managers. Depending upon the Topology Manager's implementation these EndpointDescription objects may then be passed to other actors, such as Discovery Providers, via EndpointListener or EndpointEventListener services. Discovery providers then advertise EndpointDescription objects over the network. These advertisements result in the EndpointDescription being serialized and reconstituted on a remote machine.

The above scenario adds some constraints on the uniqueness of EndpointDescription Ids.

1. Portable Discovery Providers can only use the EndpointDescription Id to determine which endpoint is being announced, updated or revoked. This applies both when being notified of local and remote events.
2. Portable Topology Managers can only use the EndpointDescription Id to determine which EndpointDescription they are receiving an event for.

As EndpointDescription objects are made available remotely, and therefore shared between frameworks, the required scope of Id uniqueness required is larger than a single framework.

If three frameworks are connected by a Discovery provider, and two produce an EndpointDescription with the same Id, then two “identical” notification events will arrive at the third framework. If one of the two frameworks then destroys the endpoint, and advertises the service removal to the third framework, then the third framework will reach the incorrect conclusion that there are now zero endpoints available.

We can therefore state that the minimum scope of Endpoint Id uniqueness is that no two distinct endpoints should have the same Id within a connected group. Distribution Providers must ensure that they do not produce Endpoint Id clashes within a connected group.

3.3.2 Ensuring Endpoint Ids are sufficiently Unique

It should be noted that Discovery Providers can be added to a framework at any time, increasing the size of a connected group. New Distribution Providers that can support additional configuration types can also be added dynamically, as can Topology Managers with the ability to source EndpointDescriptions from XML, representing external services. This means that although an Endpoint Id must only be unique with a single connected group, the group can expand in size or number of EndpointDescription objects representing a given service at any time.

4 Requirements

RSA01 – The Solution **MUST** define a mechanism to provide Endpoint Listeners with a notification when an endpoint was modified.

RSA02 – The Solution **SHOULD** allow a Topology Manager to update the service properties an Exported or Imported Service without unregistering it. This may not be possible if the configuration type or access intent of the service changes.

5 Technical Solution

5.1 Discovering Remote Service Updates

To receive modification events a new `EndpointEventListener` interface can be implemented by the listener. The `EndpointEventListener` follows a similar pattern as the `ServiceListener` in the core framework. The event holds a type attribute describing the type of event.

5.1.1 Backward compatibility

The existing `EndpointListener` interface sends a `endpointRemoved()` callback followed by an `endpointAdded()` callback in case an endpoint registration has changed (e.g. properties added or removed). The `EndpointListener` interface will continue to behave this way.

5.1.2 `EndpointEventListener`

The new `EndpointEventListener` will not send a sequence of `REMOVED` and `ADDED` events in such a case, but rather send a single `MODIFIED` or `MODIFIED_ENDMATCH` event, whichever is appropriate.

The `EndpointEventListener` is defined as follows:

```
public interface EndpointEventListener {  
    void endpointChanged(EndpointEvent event, String matchedFilter);  
}
```

```
public class EndpointEvent {  
    public static final int ADDED = 0x00000001;  
    public static final int REMOVED = 0x00000002;  
    public static final int MODIFIED = 0x00000004;  
    public static final int MODIFIED_ENDMATCH = 0x00000008;  
  
    private final EndpointDescription endpoint;  
    private final int type;  
  
    public EndpointEvent(int type, EndpointDescription endpoint) {  
        super(endpoint);  
        this.endpoint = endpoint;  
        this.type = type;  
    }  
  
    public EndpointDescription getEndpoint() {  
        return endpoint;  
    }  
  
    public int getType() {  
        return type;  
    }  
}
```



```
}
}
```

5.2 Updating Exported and Imported Services

To support requirement RSA02 cases it is necessary to add update methods to both `ImportRegistration` and `ExportRegistration`. As these are “provider types” that should only be implemented by RSA Distribution providers, this represents a minor change to the RSA API.

5.2.1 ExportRegistration

The `ExportRegistration` represents an OSGi service that has been exported by a Distribution Provider. It is the Topology Manager's role to track and manage which services are exported, therefore an update method should be added to this interface. The Topology Manager should also have an opportunity to change the set of properties that were passed when originally creating the `ExportRegistration`

```
/**
 * Update the endpoint represented by this {@link ExportRegistration} and
 * return an updated {@link EndpointDescription}. If this method returns an
 * updated {@link EndpointDescription}, then the object returned via
 * {@link #getExportReference()} must also have been updated to return this
 * new object. If this method does not return an updated
 * {@link EndpointDescription} then the object returned via
 * {@link #getExportReference()} should remain unchanged.
 *
 * When creating the updated {@link EndpointDescription} the
 * {@link ServiceReference} originally passed to
 * {@link RemoteServiceAdmin#exportService(ServiceReference, Map)} must be
 * queried to pick up any changes to its service properties.
 *
 * If this argument is null then the original properties passed when
 * creating this ExportRegistration should be used when constructing the
 * updated {@link EndpointDescription}. Otherwise the new properties should
 * be used, and replace the original properties for subsequent calls to the
 * update method.
 *
 * @param properties properties to be merged with the current service
 *        properties for the {@link ServiceReference} represented by this
 *        {@link ExportRegistration}. If null is passed then the original
 *        properties passed to
 *        {@link RemoteServiceAdmin#exportService(ServiceReference, Map)}
 *        will be used.
 * @return The updated {@link EndpointDescription} for this registration.
 * @throws IllegalStateException When this registration was not properly
 *        initialized. See {@link #getException()}.
 */
EndpointDescription update(Map<String, ?> properties);
```

5.2.2 ImportRegistration

The ExportRegistration represents an OSGi service that has been imported into the framework by a Distribution Provider. It is the Topology Manager's role to track and manage which services are imported, but not to actually register the imported service, therefore an update method should be added to this interface. The Topology Manager must be able to pass the new EndpointDescription for this imported service.

```
_____/**
_____ * Update the local service represented by this {@link ImportRegistration}.
_____ * After this method returns the {@link EndpointDescription} returned via
_____ * {@link #getImportReference()} must have been updated.
_____ *
_____ * @param endpoint The updated endpoint
_____ *
_____ * @throws IllegalStateException When this registration was not properly
_____ *       initialized. See {@link #getException()}.
_____ * @throws IllegalArgumentException When the supplied
_____ *       {@link EndpointDescription} does not represent the same endpoint
_____ *       as this {@link ImportRegistration}.
_____ *
_____ */
_____ void update(EndpointDescription endpoint);
```

5.3 Clarify the uniqueness of EndpointDescription Id Strings

The RSA 1.1 specification should clarify the uniqueness of EndpointDescription Id Strings to state that they are required to be unique within the connected set of frameworks. This means that no two distribution providers connected by a discovery service should produce the same Id String unless the EndpointDescription is for the same endpoint.

5.3.1 Producing a suitably Unique identifier

The simplest way to ensure that a growth in the number of EndpointDescriptions and/or the size of the connected group does not violate the required uniqueness of Endpoint Ids is for implementations to make their Endpoint Ids globally unique. This protects against clashes regardless of changes to the connected group.

Whilst globally unique identifiers are a simple solution to the Endpoint Id uniqueness problem, they are not easy to implement in all environments. In some systems they can be prohibitively expensive to create, or of insufficient entropy to be genuinely unique. Some distribution providers may therefore choose not to use random globally unique ids.

In the case where no globally unique value is used the following actions are recommended (although not required).

1. Distribution Providers protect against intra-framework clashes using some known value unique to the service, for example the service id.
2. Distribution Providers protect against inter-provider collisions within a single framework by using some unique value, such as the distribution provider's bundle id. The distribution provider bundle's symbolic name is insufficient, as there may be multiple versions of the same distribution provider installed within a single framework.

3. Distribution Providers protect against inter-framework collisions using some value unique to the framework, such as the framework UUID.

These suggestions may be included in the specification, but are not intended to be normative, and no implementation should rely on certain values being contained within the id. Distribution Providers are free to generate Endpoint Id in any way, as long as it meets the required level of uniqueness.

6 Data Transfer Objects

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

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

For posterity, record the design alternatives that were considered but rejected along with the reason for rejection. This is especially important for external/earlier solutions that were deemed not applicable.

9 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

*Add references simply by adding new items. You can then cross-refer to them by choosing <Insert><Cross Reference><Numbered Item> and then selecting the paragraph. **STATIC REFERENCES (I.E. BODGED) ARE NOT ACCEPTABLE, SOMEONE WILL HAVE TO UPDATE THEM LATER, SO DO IT PROPERLY NOW.***

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10.3 Acronyms and Abbreviations

10.4 End of Document