

APS External Protocol Extender

User Guide

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1 APSExternalProtocolExtender

This is an OSGi bundle that makes use of the OSGi extender pattern. It listens to services being registered and unregistered and if the services bundles *MANIFEST.MF* contains `APS-Externalizable: true` the service is made externally available. If the *MANIFEST.MF* contains `APS-Externalizable: false` however making the service externally available is forbidden. A specific service can also be registered containing an *aps-externalizable* property with value *true* to be externalizable. This overrides any other specification.

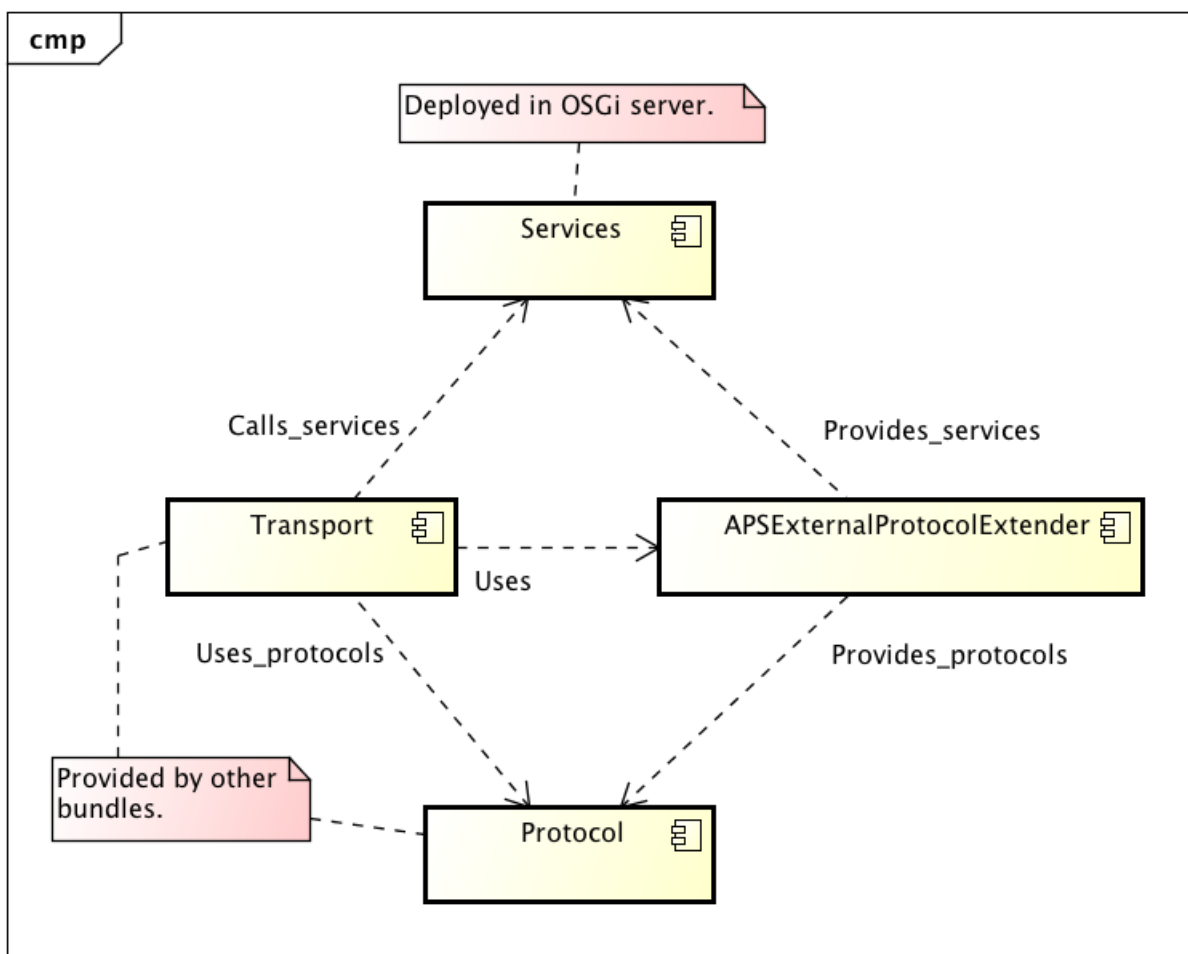
The external protocol extender also provides a configuration where services can be specified with their fully qualified name to be made externally available. If a bundle however have specifically specified false for the above manifest entry then the config entry will be ignored.

So, what is meant by *made externally available* ? Well what this bundle does is to analyze with reflection all services that are in one way or the other specified as being externalizable (manifest or config) and for all callable methods of the service an *APSExternallyCallable* object will be created and saved locally with the service name.

APSExternallyCallable extends *java.util.concurrent.Callable*, and adds the possibility to add parameters to calls and also provides meta data for the service method, and the bundle it belongs to. There is also an *APSRESTCallable* that extends *APSExternallyCallable* and also takes an http method and maps that to a appropriate service method.

1.1 The overall structure

The complete picture for making services externally callable looks like this:



This bundle provides the glue between the services and the protocols. Transports and protocols have to be provided by other bundles.

The flow is like this:

1. Transport gets some request and an `InputStream`.
2. Transport gets some user selected protocol (The `APSExtProtocolHTTPTransportProvider` allows specification of both protocol, protocol version, and service to call in the URL).
3. Transport calls `APSExternalProtocolService` to get requested protocol.
4. Transport calls protocol to parse `InputStream` and it returns an `RPCRequest`.
5. Transport uses the information in the `RPCRequest` to call a service using `APSExternalProtocolService`.
6. Transport takes the result from the call and passes to the protocol along with an `OutputStream` to write response on.

1.2 APSExternalProtocolService

This bundle registers an `APSExternalProtocolService` that will provide all `APSExternallyCallable` instances (or rather copies of them since you can modify the one you get back by providing arguments). This service also provides getters for available remote protocols and you can register with it to receive information about changes for services and protocols.

1.2.1 Protocols

There is a base API for protocols: `RPCProtocol`. APIs for different types of protocols should extend this. The protocol type APIs are service APIs and services implementing them must be provided by other bundles. This bundle looks for and keeps track of all such service providers.

The `StreamedRPCProtocol` extends `RPCProtocol` and provides a method for parsing a request from an `InputStream` returning an `RPCRequest` object. This request object contains the name of the service, the method, and the parameters. This is enough for using `APSExternalProtocolService` to do a call to the service. The request object is also used to write the call response on an `OutputStream`. There is also a method to write an error response.

It is the responsibility of the transport provider to use a protocol to read and write requests and responses and to use the request information to call a service method. An exception is the case of http transports supporting REST that must take the responsibility for returning an http status.

1.2.2 Getting information about services and protocols.

A transport provider can register themselves with the `APSExternalProtocolService` by implementing the `APSExternalProtocolListener` interface. They will then be notified when a new externalizable service becomes available or is leaving and when a protocol becomes available or is leaving.

1.3 WARNING - Non backwards compatible changes!

This version have non backwards compatible changes! `StreamedRPCProtocol` have changed in parameters for `parseRequest(...)` and `isRest()` is gone. `RPCProtocol` have changes in parameters for `createRPCError(...)`. The error code is now gone. These changes was a necessity! The old was really bad and tried to solve REST support in a very stupid way. It is now handled very much more elegantly without any special support for it with `isMethods()`

The `APSExtProtocolHTTPTransportProvider` now checks if an `RPCError` (returned by `createRPCError(...)`) object actually is an `HTTPError` subclass providing an HTTP error code to return.

`parseRequest(...)` parameters now also contain the class of the service and a new `RequestIntention` enum. The service class is only for inspecting methods for annotations or other possible meta data. The JSONREST protocol for example uses this to find annotations indicating GET, PUT, DELETE, etc methods, which is far more flexible than the old solution of requiring a `get()`, `put()`, etc method. The `RequestIntention` enum provides the following values: CREATE, READ, UPDATE, DELETE, UNKNOWN. That is CRUD + UNKNOWN. It will be UNKNOWN if the transport cannot determine such information. These are basically to support REST protocols without being too HTTP specific. Other transports can possibly also make use of them.

1.4 See also

APSExtProtocolHTTPTransportProvider - Provides a HTTP transport.

APSSStreamedJSONRPCProtocolProvider - Provides version 1.0 and 2.0 of JSONRPC, JSONHTTP and JSONREST.

1.5 APIs

```
public interface APSEExternalProtocolService [se.natusoft.osgi.aps.api.external.extprotocolsvc] {
```

This service makes the currently available externalizable services available for calling. It should be used by a bundle providing an externally available way of calling a service (JSON over http for example) to translate and forward calls to the local service. The locally called service is not required to be aware that it is called externally.

Never cache any result of this service! Always make a new call to get the current state. Also note that it is possible that the service represented by an `APSEExternallyCallable` have gone away after it was returned, but before you do `call()` on it! In that case an `APSNServiceAvailableException` will be thrown. Note that you can register as an `APSEExternalProtocolListener` to receive notifications about externalizable services coming and going, and also protocols coming and going to keep up to date with the current state of things.

```
public Set<String> getAvailableServices()
```

Returns all currently available services.

```
public List<APSEExternallyCallable> getCallables(String serviceName)
```

Returns all `APSEExternallyCallable` for the named service object.

Parameters

serviceName - The name of the service to get callables for.

```
public Set<String> getAvailableServiceFunctionNames(String serviceName)
```

Returns the names of all available functions of the specified service.

Parameters

serviceName - The service to get functions for.

```
public APSEExternallyCallable getCallable(String serviceName, String serviceFunctionName)
```

Gets an `APSEExternallyCallable` for a specified service name and service function name.

Returns

An APSExternallyCallable instance or null if the combination of service and serviceFunction is not available.

Parameters

serviceName - The name of the service object to get callable for.

serviceFunctionName - The name of the service function of the service object to get callable for.

public List<RPCProtocol> getAllProtocols()

Returns

All currently deployed providers of RPCProtocol.

public RPCProtocol getProtocolByNameAndVersion(String name, String version)

Returns an RPCProtocol provider by protocol name and version.

Returns

Any matching protocol or null if nothing matches.

Parameters

name - The name of the protocol to get.

version - The version of the protocol to get.

public List<StreamedRPCProtocol> getAllStreamedProtocols()

Returns

All currently deployed providers of StreamedRPCProtocol.

public StreamedRPCProtocol getStreamedProtocolByNameAndVersion(String name, String version)

Returns a StreamedRPCProtocol provider by protocol name and version.

Returns

Any matching protocol or null if nothing matches.

Parameters

name - The name of the streamed protocol to get.

version - The version of the streamed protocol to get.

public void addExternalProtocolListener(APSExternalProtocolListener externalServiceListener)

Add a listener for externally available services.

Parameters

externalServiceListener - The listener to add.

public void removeExternalProtocolListener(APSEExternalProtocolListener externalServiceListener)

Removes a listener for externally available services.

Parameters

externalServiceListener - The listener to remove.

}

public interface APSEexternallyCallable<ReturnType> extends Callable<ReturnType>
[se.natusoft.osgi.aps.api.external.extprotocolsvc.model] {

This API represents one callable service method.

public String getServiceName()

Returns

The name of the service this callable is part of.

public String getServiceFunctionName()

Returns

The name of the service function this callable represents.

public DataTypeDescription getReturnDataDescription()

Returns

A description of the return type.

public List<ParameterDataTypeDescription> getParameterDataDescriptions()

Returns

A description of each parameter type.

public Bundle getServiceBundle()

Returns

The bundle the service belongs to.

public Class getServiceClass()

Returns the class of the service implementation.

ReturnType call(Object... arguments) throws Exception

Calls the service method represented by this `APSEexternallyCallable`.

Returns

The return value of the method call if any or null otherwise.

Parameters

arguments - Possible arguments to the call.

Throws

Exception - Any exception the called service method threw.

}

```
public interface APSEExternalProtocolListener [se.natusoft.osgi.aps.api.external.extprotocolsvc.model] {
```

A listener for externally available services. Please note that this means that the service is available for potential external protocol exposure! For it to be truly available there also has to be a protocol and transport available. It is probably only transports that are interested in this information!

public void externalServiceAvailable(String service, String version)

This gets called when a new externally available service becomes available.

Parameters

service - The fully qualified name of the newly available service.

version - The version of the service.

public void externalServiceLeaving(String service, String version)

This gets called when an externally available service no longer is available.

Parameters

service - The fully qualified name of the service leaving.

version - The version of the service.

public void protocolAvailable(String protocolName, String protocolVersion)

This gets called when a new protocol becomes available.

Parameters

protocolName - The name of the protocol.

protocolVersion - The version of the protocol.

public void protocolLeaving(String protocolName, String protocolVersion)

This gets called when a new protocol is leaving.

Parameters

protocolName - The name of the protocol.

protocolVersion - The version of the protocol.

}

public interface **APSRESTCallable** extends APSEexternallyCallable
[se.natusoft.osgi.aps.api.external.extprotocolsvc.model] {

This is a special variant of APSEexternallyCallable that supports a HTTP REST call.

This is only available when a service have zero or one method whose name starts with put, zero or one method whose name starts with post, and so on. There has to be at least one method of put, post, get or delete.

APSEExternalProtocolService can provide an instance of this is a service matches the criteria.

This is only of use for HTTP transports! aps-ext-protocol-http-transport-provider does make use of this for protocols that indicate they support REST.

public boolean supportsPut()*Returns*

true if the service supports the PUT method.

public boolean supportsPost()*Returns*

true if the service supports the POST method.

public boolean supportsGet()*Returns*

true if the service supports the GET method.

public boolean supportsDelete()*Returns*

true if the service supports the DELETE method.

public void selectMethod(HttpMethod method)

This selects the method to call with this callable.

Parameters

method - The selected method to call.

```
public static enum HttpMethod [se.natusoft.osgi.aps.api.external.extprotocolsvc.model] {
```

This defines the valid choices for selectMethod(...).

```
}
```

```
}
```

```
public class APSRESTException extends APSRuntimeException [se.natusoft.osgi.aps.api.net.rpc.errors] {
```

This is a special exception that services can throw if they are intended to be available as REST services through the aps-external-protocol-extender + aps-ext-protocol-http-transport-provider. This allows for better control over status codes returned by the service call.

```
public APSRESTException(int httpStatusCode)
```

Creates a new *APSRESTException*.

Parameters

httpStatusCode - The http status code to return.

```
public APSRESTException(int httpStatusCode, String message)
```

Creates a new *APSRESTException*.

Parameters

httpStatusCode - The http status code to return.

message - An error messaging.

```
public int getHttpStatusCode()
```

Returns the http status code.

```
}
```

```
public enum ErrorType [se.natusoft.osgi.aps.api.net.rpc.errors] {
```

This defines what I think is a rather well thought through set of error types applicable for an RPC call. No they are not mine, they come from Matt Morley in his JSONRPC 2.0 specification at <http://jsonrpc.org/spec.html>.

I did however add the following:

- **SERVICE_NOT_FOUND** - Simply because this can happen in this case!
- **AUTHORIZATION_REQUIRED** - This is also a clear possibility.
- **BAD_AUTHORIZATION**

PARSE_ERROR

Invalid input was received by the server. An error occurred on the server while parsing request data.

INVALID_REQUEST

The request data sent is not a valid.

METHOD_NOT_FOUND

The called method does not exist / is not available.

SERVICE_NOT_FOUND

The called service does not exist / is not available.

INVALID_PARAMS

The parameters to the method are invalid.

INTERNAL_ERROR

Internal protocol error.

SERVER_ERROR

Server related error.

AUTHORIZATION_REQUIRED

Authorization is required, but none was supplied.

BAD_AUTHORIZATION

Bad authorization was supplied.

}

```
public interface HTTPErrors extends RPCError [se.natusoft.osgi.aps.api.net.rpc.errors] {
```

Extends *RPCError* with an HTTP status code. HTTP transports can make use of this information.

```
public int getHttpStatusCode()
```

Returns

Returns an http status code.

}

```
public interface RPCError [se.natusoft.osgi.aps.api.net.rpc.errors] {
```

This represents an error in servicing an RPC request.

```
public ErrorType getErrorType()
```

The type of the error.

```
public String getErrorCode()
```

A potential error code.

```
public String getMessage()
```

Returns an error messaging. This is also optional.

```
public boolean hasOptionalData()
```

True if there is optional data available. An example of optional data would be a stack trace for example.

```
public String getOptionalData()
```

The optional data.

```
}
```

```
public class RequestedParamNotAvailableException extends APSEException  
[se.natusoft.osgi.aps.api.net.rpc.exceptions] {
```

This exception is thrown when a parameter request cannot be fulfilled.

```
public RequestedParamNotAvailableException(String message)
```

Creates a new *RequestedParamNotAvailableException* instance.

Parameters

message - The exception messaging.

```
public RequestedParamNotAvailableException(String message, Throwable cause)
```

Creates a new *RequestedParamNotAvailableException* instance.

Parameters

message - The exception messaging.

cause - The cause of this exception.

```
}
```

```
public abstract class AbstractRPCRequest implements RPCRequest [se.natusoft.osgi.aps.api.net.rpc.model] {
```

This provides a partial implementation of RPCRequest.

public AbstractRPCRequest(String method)

Creates a new AbstractRPCRequest.

Parameters

method - The method to call.

public AbstractRPCRequest(RPCError error)

Creates a new AbstractRPCRequest.

Parameters

error - An RPCError indicating a request problem, most probably of *ErrorType.PARSE_ERROR* type.

public AbstractRPCRequest(String method, Object callId)

Creates a new AbstractRPCRequest.

Parameters

method - The method to call.

callId - The callId of the call.

protected Map<String, Object> getNamedParameters()

Returns

The named parameters.

protected List<Object> getParameters()

Returns

The sequential parameters.

public void setServiceQName(String serviceQName)

Sets the fully qualified name of the service to call. This is optional since not all protocol delivers a service name this way.

Parameters

serviceQName - The service name to set.

public void addParameter(Object parameter)

Adds a parameter. This is mutually exclusive with addParameter(name, parameter)!

Parameters

parameter - The parameter to add.

```
}
```

public enum RequestIntention [se.natusoft.osgi.aps.api.net.rpc.model] {

The intention of a request.

```
}
```

public interface RPCExceptionConverter [se.natusoft.osgi.aps.api.net.rpc.model] {

An instance of this can be passed to RPCRequest to convert the caught exception to an RPCError.

RPCError convertException(Exception e)

This should be called on any service exception to convert the exception to an RPCError.

Parameters

e - The exception to convert.

```
}
```

public interface RPCRequest [se.natusoft.osgi.aps.api.net.rpc.model] {

This represents a request returned by protocol implementations.

boolean isValid()

Returns true if this request is valid. If this returns false all information except *getError()* is **invalid**, and *getError()* should return a valid *RPCError* object.

RPCError getError()

Returns an *RPCError* object if *isValid()* == false, *null* otherwise.

RPCExceptionConverter getExceptionConverter()

If an exception occurred during the request call, and this returns non null, then the returned converter should be called

with the occurred exception to provide an `RPCError`.

This allows for a specific protocol implementation to handle its own exceptions and provide an appropriate `RPCError`.

String getServiceQName()

Returns a fully qualified name of service to call. This will be null for protocols where service name is not provided this way. So this cannot be taken for given!

String getMethod()

Returns the method to call. This can return *null* if the method is provided by other means, for example a REST protocol where it will be part of the URL.

boolean hasCallId()

Returns true if there is a call id available in the request.

A call id is something that is received with a request and passed back with the response to the request. Some RPC implementations will require this and some wont.

Object getCallId()

Returns the method call call Id.

A call id is something that is received with a request and passed back with the response to the request. Some RPC implementations will require this and some wont.

int getNumberOfParameters()

Return the number of parameters available.

<T> T getIndexedParameter(int index, Class<T> paramClass) throws RequestedParamNotAvailableException

Returns the parameter at the specified index.

Returns

The parameter object or null if indexed parameters cannot be delivered.

Parameters

index - *The index of the parameter to get.*

paramClass - *The expected class of the parameter.*

Throws

RequestedParamNotAvailableException - *if requested parameter is not available.*

}

```
public interface RPCProtocol [se.natusoft.osgi.aps.api.net.rpc.service] {
```

This represents an RPC protocol provider. This API is not enough in itself, it is a common base for different protocols.

String getServiceProtocolName()

Returns

The name of the provided protocol.

String getServiceProtocolVersion()

Returns

The version of the implemented protocol.

String getRequestContentType()

Returns

The expected content type of a request. This should be verified by the transport if it has content type availability.

String getResponseContentType()

Returns

The content type of the response for when such can be provided.

String getRPCProtocolDescription()

Returns

A short description of the provided service. This should be in plain text.

RPCError createRPCError(ErrorType errorType, String message, String optionalData, Throwable cause)

Factory method to create an error object.

Returns

An RPCError implementation or null if not handled by the protocol implementation.

Parameters

errorType - The type of the error.

message - An error messaging.

optionalData - Whatever optional data you want to pass along or null.

cause - The cause of the error.

}

```
public interface StreamedRPCProtocol extends RPCProtocol [se.natusoft.osgi.aps.api.net.rpc.service] {
```

This represents an RPC protocol provider that provide client/service calls with requests read from an InputStream or having parameters passes as strings and responses written to an OutputStream.

HTTP transports can support both *parseRequests(...)* and *parseRequest(...)* while other transports probably can handle only *parseRequests(...)*. **A protocol provider can return null for either of these!** Most protocol providers will support *parseRequests(...)* and some also *parseRequest(...)*.

List<RPCRequest> parseRequests(String serviceQName, Class serviceClass, String method, InputStream requestStream, RequestIntention requestIntention) throws IOException

Parses a request from the provided InputStream and returns 1 or more RPCRequest objects.

Returns

The parsed requests.

Parameters

serviceQName - A fully qualified name to the service to call. This can be null if service name is provided on the stream.

serviceClass - The class of the service to call. Intended for looking for method annotations! Don't try to be "smart" here!

method - The method to call. This can be null if method name is provided on the stream.

requestStream - The stream to parse request from.

requestIntention - The intention of the request (CRUD + UNKNOWN).

Throws

IOException - on IO failure.

RPCRequest parseRequest(String serviceQName, Class serviceClass, String method, Map<String, String> parameters, RequestIntention requestIntention) throws IOException

Provides an RPCRequest based on in-parameters. This variant supports HTTP transports.

Return null for this if the protocol does not support this!

Returns

The parsed requests.

Parameters

serviceQName - A fully qualified name to the service to call. This can be null if service name is provided on the stream.

serviceClass - The class of the service to call. Intended for looking for method annotations! Don't try to be "smart"

here!

method - The method to call. This can be null if method name is provided on the stream.

parameters - parameters passed as a

requestIntention - The intention of the request (CRUD + UNKNOWN).

Throws

IOException - on IO failure.

void writeResponse(Object result, RPCRequest request, OutputStream responseStream) throws IOException

Writes a successful response to the specified OutputStream.

Parameters

result - The resulting object of the RPC call or null if void return. If is possible a non void method also returns null!

request - The request this is a response to.

responseStream - The OutputStream to write the response to.

Throws

IOException - on IO failure.

boolean writeErrorResponse(RPCError error, RPCRequest request, OutputStream responseStream) throws IOException

Writes an error response.

Returns

true if this call was handled and an error response was written. It returns false otherwise.

Parameters

error - The error to pass back.

request - The request that this is a response to.

responseStream - The OutputStream to write the response to.

Throws

IOException - on IO failure.

}