

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.

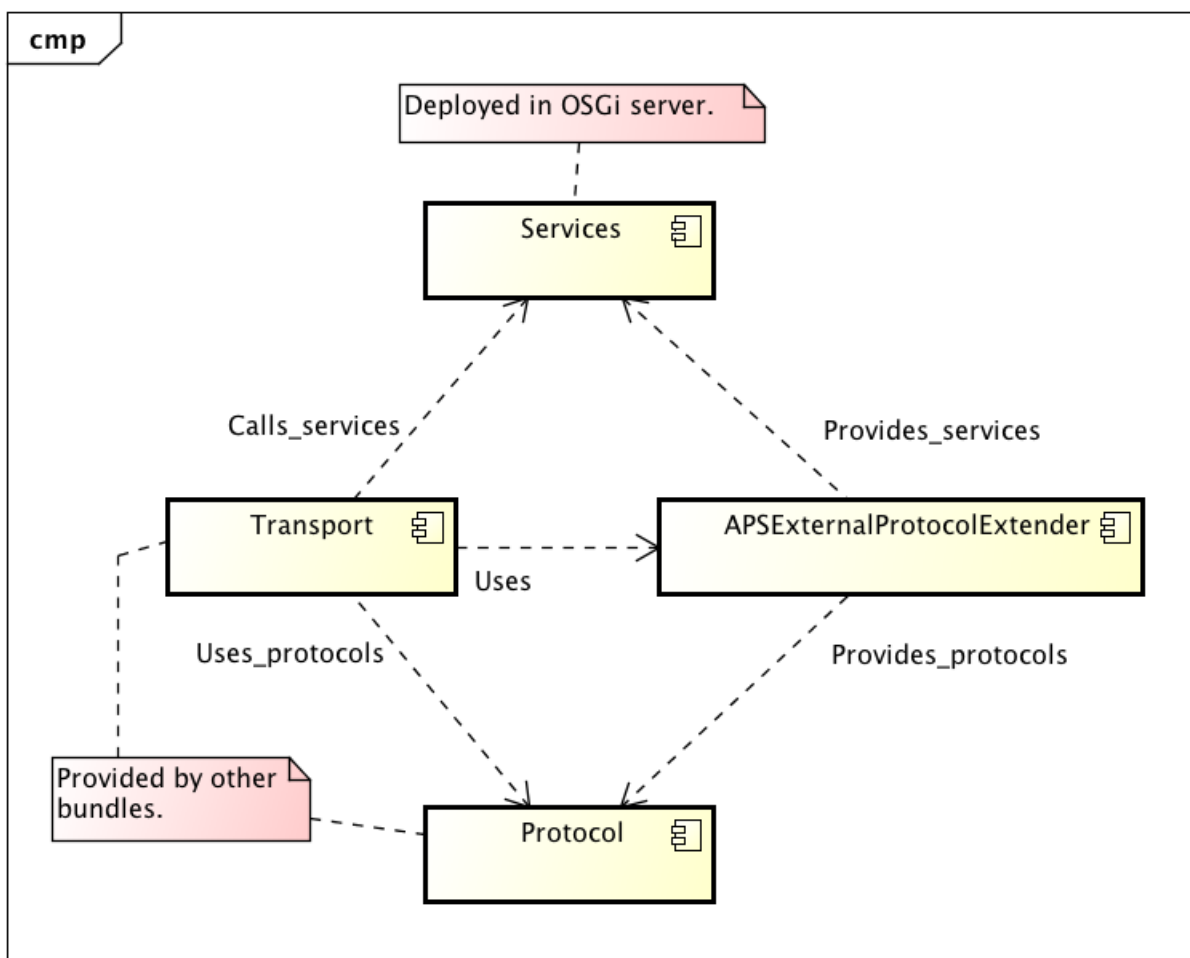
The external protocol extender also provides a configuration where services can be specified with their fully qualified name to be made externally available. If a bundle however have specifically specified false for the above manifest entry then the config entry will be ignored.

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.

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 `APSEExternalProtocolService` 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 `APSEExternalProtocolService`.
6. Transport takes the result from the call and passes to the protocol along with an `OutputStream` to write response on.

1.2 APSEExternalProtocolService

This bundle registers an *APSEExternalProtocolService* that will provide all *APSEExternallyCallable* 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. There is currently only one type of protocol available: *StreamedRPCProtocol*. 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* 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 *APSEExternalProtocolService* 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.

1.2.2 Getting information about services and protocols.

A transport provider can register themselves with the *APSEExternalProtocolService* by implementing the *APSEExternalProtocolListener* 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 See also

APSExtProtocolHTTPTransportProvider - Provides a HTTP transport.

APSSStreamedJSONRPCProtocolProvider - Provides version 1.0 and 2.0 of JSONRPC.

1.4 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 APSNoServiceAvailableException 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) throws RuntimeException

Returns all APSEexternallyCallable for the named service object.

Parameters

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

Throws

RuntimeException - If the service is not available.

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 APSEexternallyCallable 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(APSEExternalProtocolListener 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 void setArguments(Object... value)

Provides parameters to the callable using a varargs list of parameter values.

Parameters

value - A parameter value.

ReturnType call() throws Exception

Calls the service method represented by this APSExternallyCallable.

Returns

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

Throws

Exception - Any exception the called service method threw.

}

public interface APSExternalProtocolListener [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 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 APSExternalProtocolExtender + APSRPCHTTPTransportProvider. 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 message.

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 add SERVICE_NOT_FOUND since it is fully possible to try to call a service that does not exist.

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.

```
}
```

```
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 message. 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 `APSEException` instance.

Parameters

message - The exception message.

public `RequestedParamNotAvailableException(String message, Throwable cause)`

Creates a new `APSEException` instance.

*Parameters**message* - The exception message.*cause* - The cause of this exception.

}

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

*This contains a parsed JSONRPC request.***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 interface RPCRequest [se.natusoft.osgi.aps.api.net.rpc.model] {

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.

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()

REST protocol where it will be part of the URL.

Returns

The method to call. This can return null if the method is provided by other means, for example a

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()

Returns

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 errorCode, 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.

errorCode - An error code representing the error.

message - An error message.

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

cause - The cause of the error.

}

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

This is a marker interface indicating that the protocol is really assuming a HTTP transport and is expecting to be able to return http status codes. This also means it will be returning an HTTPError (which extends RPCError) from _createError(...)_ . It might be difficult for non HTTP transports to support this kind of protocol, and such should probably ignore these protocols. For example a REST implementation of this protocol will not be writing any error response back, but rather expect the transport to deliver the http status code it provides. A non HTTP transport will not be able to know how to communicate back errors in this case since it will not know anything about the protocol itself.

}

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, String method, InputStream requestStream) 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.

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

requestStream - The stream to parse request from.

Throws

IOException - on IO failure.

RPCRequest parseRequest(String serviceQName, String method, Map<String, String> parameters) throws IOException

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

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.

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

parameters - parameters passed as a

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.

}
