

# Querying Using Procedures

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# Module Objectives

In this module, you will cover:

- Using Procedures for querying Reactor
  - Creating a Procedure
  - Implementing responses
  - Handling errors
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# Querying Reactor

**Procedures** let you query the Reactor, its DataSets and retrieve results

Procedures:

- Allow synchronous calls into the Reactor from an external system
- Perform server-side processing on-demand
- Are similar to a stored procedure in a traditional database

Procedures are typically used to post-process data at query time:

- Filtering
  - Aggregating
  - Joins over multiple DataSets
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# Procedure Operations

A Procedure can perform all the same operations as a Flowlet

- With the same consistency and durability guarantees
- Deployed into the same pool of application containers as Flows
- Can run multiple instances to increase the throughput of requests

A Procedure implements and exposes a very simple API:

- A method name (String) and
- Arguments (map of Strings)

This implementation is then bound to a REST endpoint and can be called from any external system

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# Creating and Implementing a Procedure

To create a Procedure:

- Implement the `Procedure` interface, or
- More conveniently, extend the `AbstractProcedure` class

Configuration and Initialization

- Similar to a Flowlet
- Instead of a process method you'll define a handler method

Response

- Upon external call, the handler method receives the request and sends a response
  - The most generic way to send a response is to obtain a `Writer` and stream out the response as bytes
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## Example Procedure

```
import static com.continuity.api.procedure.ProcedureResponse.Code.SUCCESS;
...
class HelloWorld extends AbstractProcedure {

    @Handle("hello")
    public void wave(ProcedureRequest request,
                    ProcedureResponder responder) throws IOException {
        String hello = "Hello " + request.getArgument("who");
        ProcedureResponse.Writer writer =
            responder.stream(new ProcedureResponse(SUCCESS));
        writer.write(ByteBuffer.wrap(hello.getBytes())).close();
    }
}
```

- This uses the most generic way to create the response, which allows you to send arbitrary byte content as the response body
  - Make sure to close the `Writer` when you are done
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## Responding with JSON

In many cases, you will actually respond with JSON

Reactor `ProcedureResponder` has convenience methods for returning JSON maps:

```
// Return a JSON map
Map<String, Object> results = new TreeMap<String, Object>();
results.put("totalWords", totalWords);
results.put("uniqueWords", uniqueWords);
results.put("averageLength", averageLength);
responder.sendJson(results);
```

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## Responding to Errors

Convenience method to respond with an error message:

```
@Handle("getCount")
public void getCount(ProcedureRequest request, ProcedureResponder responder)
    throws IOException, InterruptedException{
    String word = request.getArgument("word");
    if (word == null) {
        responder.error(Code.CLIENT_ERROR,
            "Method 'getCount' requires argument 'word'");
        return;
    }
}
```

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## Module Summary

You should now be able to:

- Using Procedures for querying Reactor
  - Create a Procedure
  - Implement a response
  - Handle errors
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## Module Completed