The High Level SBW Libraries

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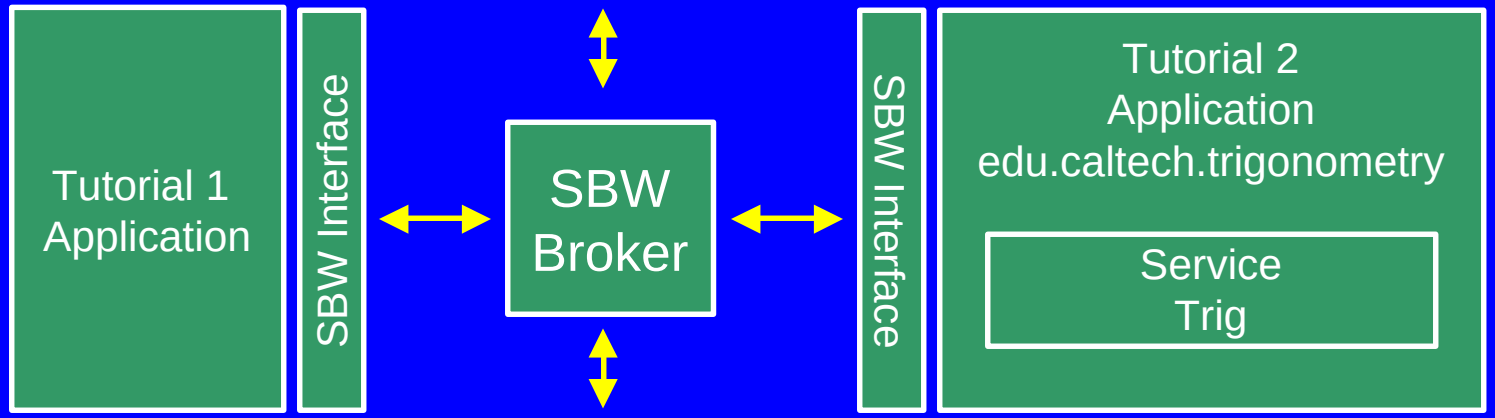
Systems Biology Workbench Project

Overview



- 3 Tutorials in Java and C++:
  - Calling a known service
  - Implementing a service
  - Finding services in a known category
- Assumes some understanding of Java or C++

Tutorial 1: Calling a known Service

- Assume we know there is
  - a module “edu.caltech.trigonometry”
  - with a service “Trig”
  - Which has the methods
    - **`double sin(double)`**
    - **`double cos(double)`**
- We will call the **`sin`** method

Tutorial 1: Accessing a service in C++ and Java

- In Java:

```
Module module =
  SBW.getModuleInstance("edu.caltech.trigonometry");
Service service = module.findServiceByName("Trig");
```

- In C++:

```
Module module =
  SBW::getModuleInstance("edu.caltech.trigonometry");
Service service = module.findServiceByName("Trig");
```

Tutorial 1: Calling a method in Java

- Create interface for service:

```
Interface Trigonometry
{
    double sin(double x) throws SBWException;
    double cos(double x) throws
    SBWException;
}
```

- Create proxy with this interface and call it:

```
Trigonometry trig =
    (Trigonometry)service.getServiceObject(
            Trigonometry.class);
Double result = trig.sin(x);
```

Tutorial 1: Calling a method in C++

- Access Method object:

```
Method method = service.getMethod("sin");
```

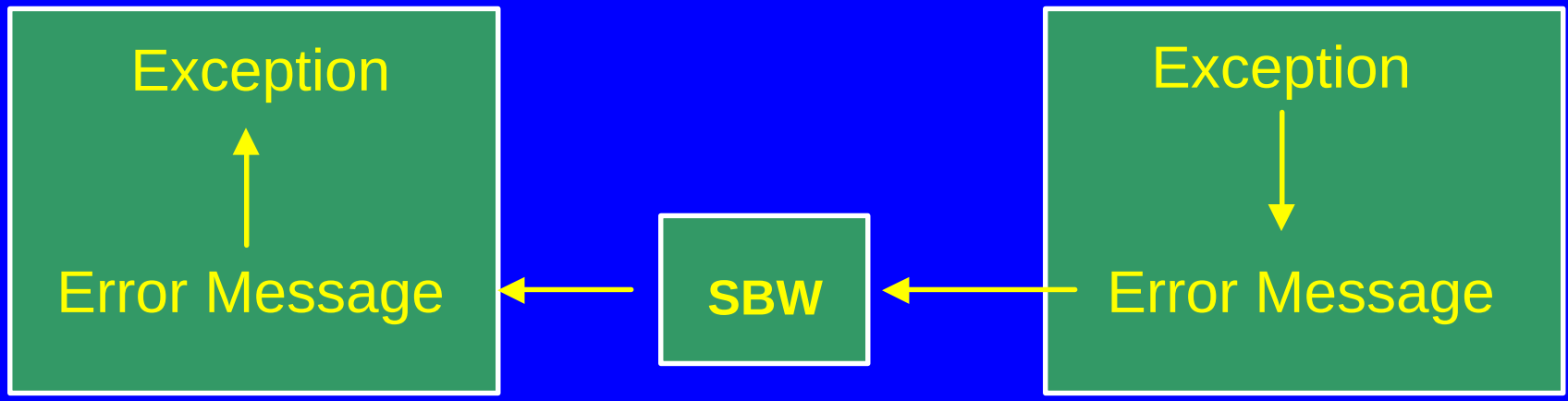
- Invoke method, marshalling arguments and result:

```
DataBlockReader resultData =
    method.call(DataBlockWriter() << x);

SBWDouble result ;

resultData >> result ;
```

Tutorial 1: Exception Handling



- Most High Level API calls can potentially throw **`SBWException`**
- **`SBWException`** base class of hierarchy of exception types
- **`SBWApplicationException`** can be thrown by service implementations

Tutorial 1: Summary

- Start with information on a specific service
- Access module then service
- Call Method
  - In Java: use proxy object with defined interface
  - In C++: use **`call`** on **`Method`** object
- Exception Handling

Tutorial 2: Implementing a Service

- Implementation of the service called in Tutorial 1
- Service is an interface to a software resource inside a module (executable)
- Typically an executable operates in 3 modes:
  - Normal
  - Register
  - Module

Tutorial 2: Java Service Implementation

```
class Trig
{
   public double sin(double x)
       throws SBWApplicationException
   {
       return Math.sin(x);
   }

   public double cos(double x)
       throws SBWApplicationException
   {
       return Math.cos(x);
   }
}
```

Tutorial 2: Java **main** method

```
ModuleImpl moduleImp =
   new ModuleImpl(
       “edu.caltech.trigonometry”,
       “trig”, SBW.STATIC, this.getClass());

moduleImp.addService(
   “trig funcs”, “trigonometry”, Trig.class);

if (args[0].equals(“-sbwregister”))
   moduleImp.register();
else (args[0].equals(“-sbwmodule”))
   moduleImp.enableServices();
else
   // in normal mode – do something else
```

Tutorial 2: C++ Service Implementation

```
class Sin : public Handler
{
  DataBlockWriter receive(
      Module from, DataBlockReader args)
            throws SBWApplicationException
  {
      SBWDouble x;
      args >> x ;
      return DataBlockWriter() << sin(x);
  }
};

class Cos : public Handler …
```

Tutorial 2: C++ **main** function

```
ModuleImpl moduleImp(
   “edu.caltech.trigonometry”, “trig”, SBW::STATIC, argv[0]);
moduleImp.addService(“Trig”, “trig funcs”, “trigonometry”);

if (strcmp(argv[1], “-sbwregister”) == 0)
   moduleImp.register();
else if (strcmp(argv[1], “-sbwmodule”) == 0)
{
   moduleImp.setHandler(
        “trig”, new Sin(), “double sin(double)”);
   moduleImp.setHandler(
        “trig”, new Cos(), “double cos(double)”);
   moduleImp.enableServicesAndWait();
}
else
        // normal mode – do something else
```

Tutorial 2: Summary

- Create Service implementation
  - In Java: use normal class
  - In C++: one class per method
- Supply module information in **`ModuleImpl`** constructor
- Supply service implementation via **`addService`** method on **`ModuleImpl`**
- Use the **`register`** method in register mode
- Use the **`enableServices`** method in module mode

Tutorial 3: Finding and using services in a given category

- Dynamically locate services in a given category
- We will locate services in the "Analysis" category
  - This category is an important standard for SBW
  - Has one method:
    - **`void doAnalysis(string sbml)`**

Tutorial 3: Finding services in Java

- Get information on services in category:

```
ServiceDescriptor[] descriptors =
    SBW.findServices("Analysis");
```

- Access the humanly readable name of a service:

```
descriptors[0].getDisplayName();
```

- Get a real service:

```
Service service =
    descriptors[0].getServiceInModuleInstance();
```

Tutorial 3: Finding services in C++

- Get information on services in category:

```
std::vector<ServiceDescriptor> *descriptors =
    SBW::findServices("Analysis");
```

- Access the humanly readable name of a service:

```
(*descriptors)[0].getDisplayName();
```

- Get a real service:

```
Service service =
    (*descriptors)[0].getServiceInModuleInstance();
```

Tutorial 3: Summary

- Start with just a service category and its interface
- Use **`findServices`** to get static information on potential services
- Perhaps display list of potential services to user using **`getDisplayName`**
- Access actual service, perhaps via user selection, using **`getServiceInModuleInstance`**

Summary

- Refer to “Programmer’s Manual for the Systems Biology Workbench (SBW)” Finney et al for more detail
  - **`http://www.cds.caltech.edu/erato/sbw/docs/api`**
- Subject to change: implementation not complete
- Scripting language High Level APIs similar to those described in this presentation