IIP-Ecosphere

Next Level Ecosphere for Intelligent Industrial Production

Service Integration: How to build a Python AI Service

Gefördert durch:

Bundesministerium für Wirtschaft und Klimaschutz

IIP-Ecosphere Platform

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Prerequisites

- Required:
  - Installed the platform and its dependencies or the development container
  - Installed the IDE for IIP-Ecosphere Platform (provided Eclipse Version)
  - How to configure datatypes
  - How to configure services
  - How to configure an application
  - How to build an application
  - How to test the application
- Optional:
  - Introduction to code generation

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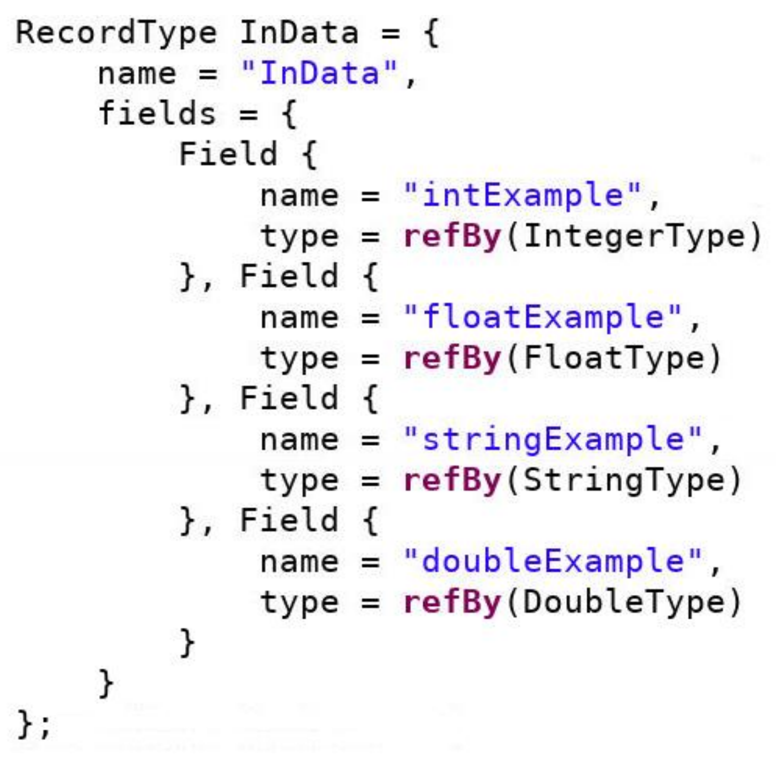
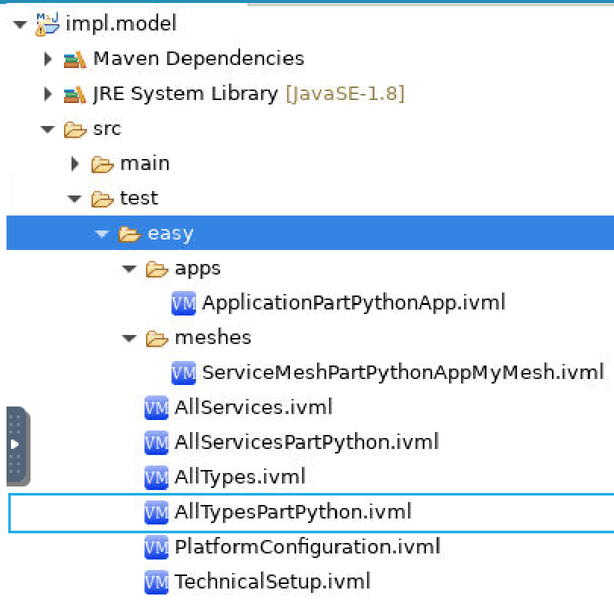
Configuring the Datatypes

- The configuration of datatypes is the same as for every other service
- Add your needed datatypes to the “*AllTypesPart….ivml*”



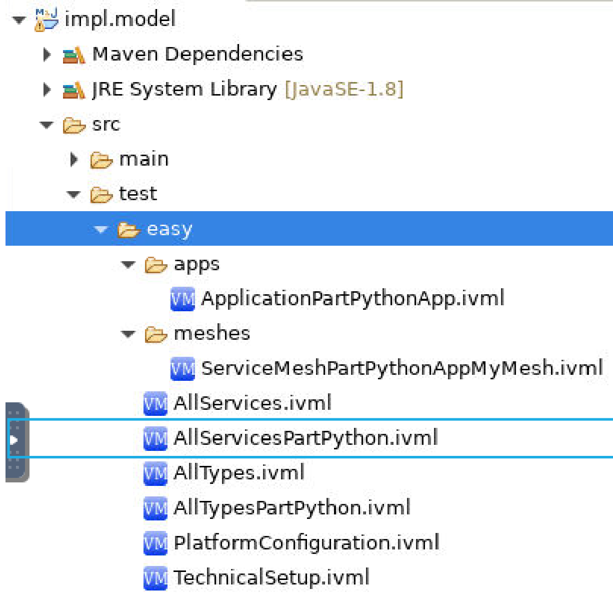
```
RecordType InData = {
    name = "InData",
    fields = {
        Field {
            name = "intExample",
            type = refBy(IntegerType)
        }, Field {
            name = "floatExample",
            type = refBy(FloatType)
        }, Field {
            name = "stringExample",
            type = refBy(StringType)
        }, Field {
            name = "doubleExample",
            type = refBy(DoubleType)
        }
    }
};
```



```
impl.model
  Maven Dependencies
  JRE System Library [JavaSE-1.8]
  src
    main
    test
      easy
        apps
          ApplicationPartPythonApp.ivml
        meshes
          ServiceMeshPartPythonAppMyMesh.ivml
        AllServices.ivml
        AllServicesPartPython.ivml
        AllTypes.ivml
        AllTypesPartPython.ivml
        PlatformConfiguration.ivml
        TechnicalSetup.ivml
```

Configure the Services (1)

- Define the services in the *`AllServicesPart….ivml`* file:
- Only highlight the changes to a java service



```
impl.model
  Maven Dependencies
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  src
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        AllServicesPartPython.ivml
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        AllTypesPartPython.ivml
        PlatformConfiguration.ivml
        TechnicalSetup.ivml
```
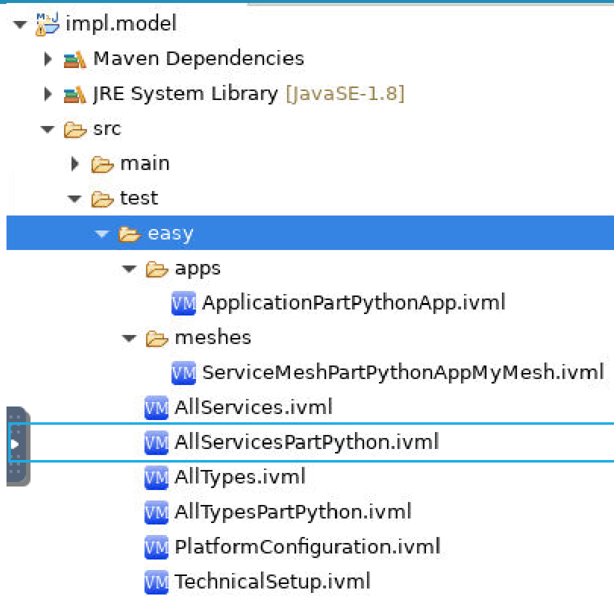

```
Service pyth = PythonService {
    id = "PyService",
    name = "PyService",
    description = "",
    ver = "0.1.0",
    deployable = true,
    traceRcv = TraceKind::SYSOUT,
    traceSent = TraceKind::SYSOUT,
    input = {{type=refBy(InData)}},
    output = {{type=refBy(OutData)}},
    artifact = "de.iip-ecosphere.platform.apps:TestTestAppServices:" + iipVer,
    kind = ServiceKind::TRANSFORMATION_SERVICE,
    dependencies = {refBy(PYTHON39)}
};
```

- **Servicetype:** `PythonService`
- **`class`:** left out as it is not needed for a python service
- **`kind`:** The type of service: Python can only be used as a TRANSFORMATION_SERVICE which is why this value can be left out
- **`dependencies`:** the python version needed for this service
- **`asynchronous`:** as this is no sink it will be true if not set otherwise

Configure the Services (2)

- Define the services in the *`AllServicesPart….ivml`* file:
- We also add further dependencies of the python service



```
impl.model
  Maven Dependencies
  JRE System Library [JavaSE-1.8]
  src
    main
    test
      easy
        apps
          ApplicationPartPythonApp.ivml
        meshes
          ServiceMeshPartPythonAppMyMesh.ivml
        AllServices.ivml
        AllServicesPartPython.ivml
        AllTypes.ivml
        AllTypesPartPython.ivml
        PlatformConfiguration.ivml
        TechnicalSetup.ivml
```

```
PythonDependency skLearn0232 = {
    name = "scikit-learn",
    version = "0.23.2"
};

PythonDependency numpy1201 = {
    name = "numpy",
    version = "1.20.1"
};

PythonDependency pickle40 = {
    name = "pickle",
    version = "4.0"
};

PythonDependency pyflakes250 = {
    name = "pyflakes",
    version = "2.5.0"
};
```

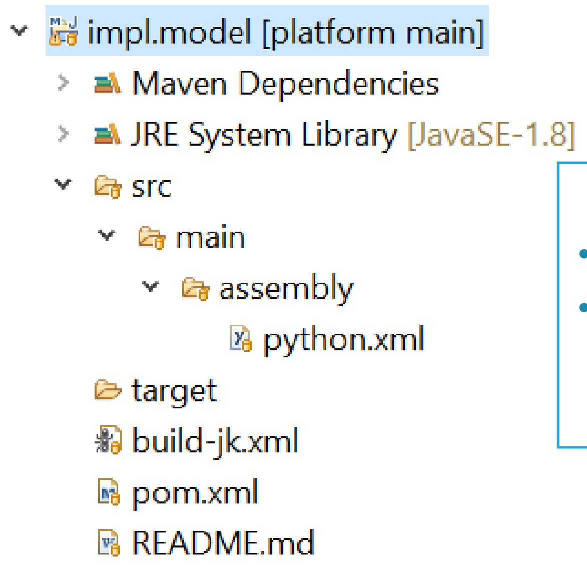
`PythonDependency`: `The defined type`

`name`: the name of the package as it is installed i.e. “pip install numpy==1.20.1”

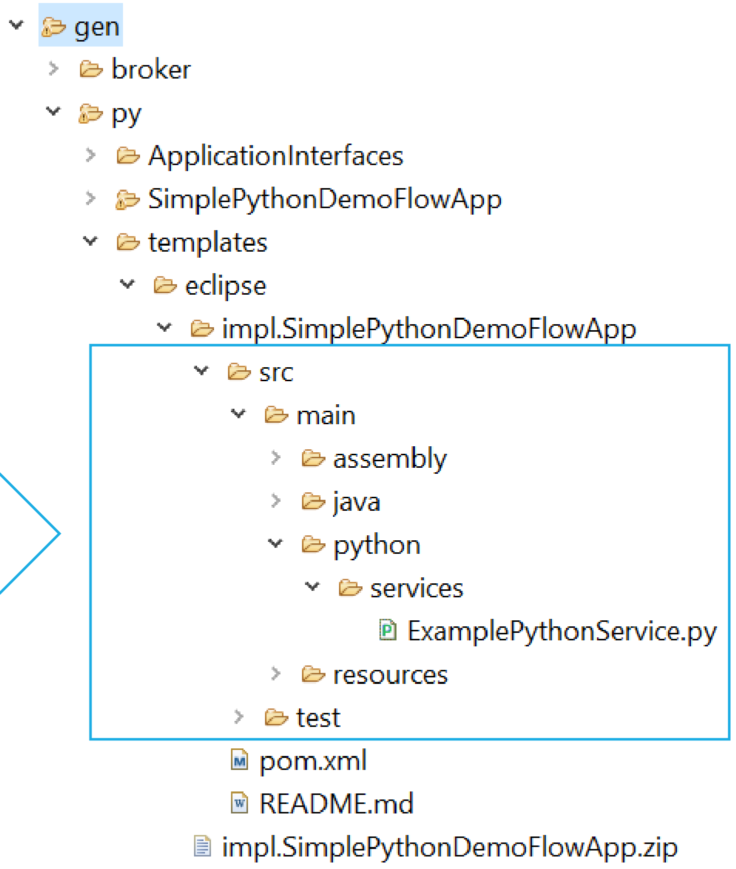
`version`: The specific version that is needed for the service

Build the Templates

- To add functionality to your python service you need to first generate the templates
- Run "*`mvn -U generate-sources`*"

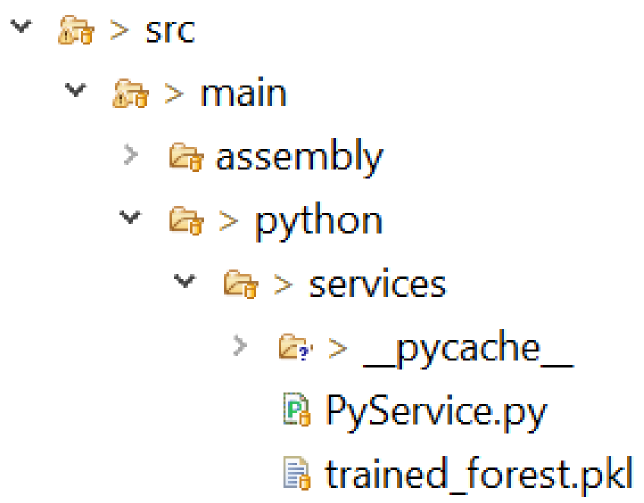


- Rename the "*`impl.model`*" as needed/desired
- Use `cmd` to run "*`mvn -U generate-sources`*" in the "*`impl.model`*" directory



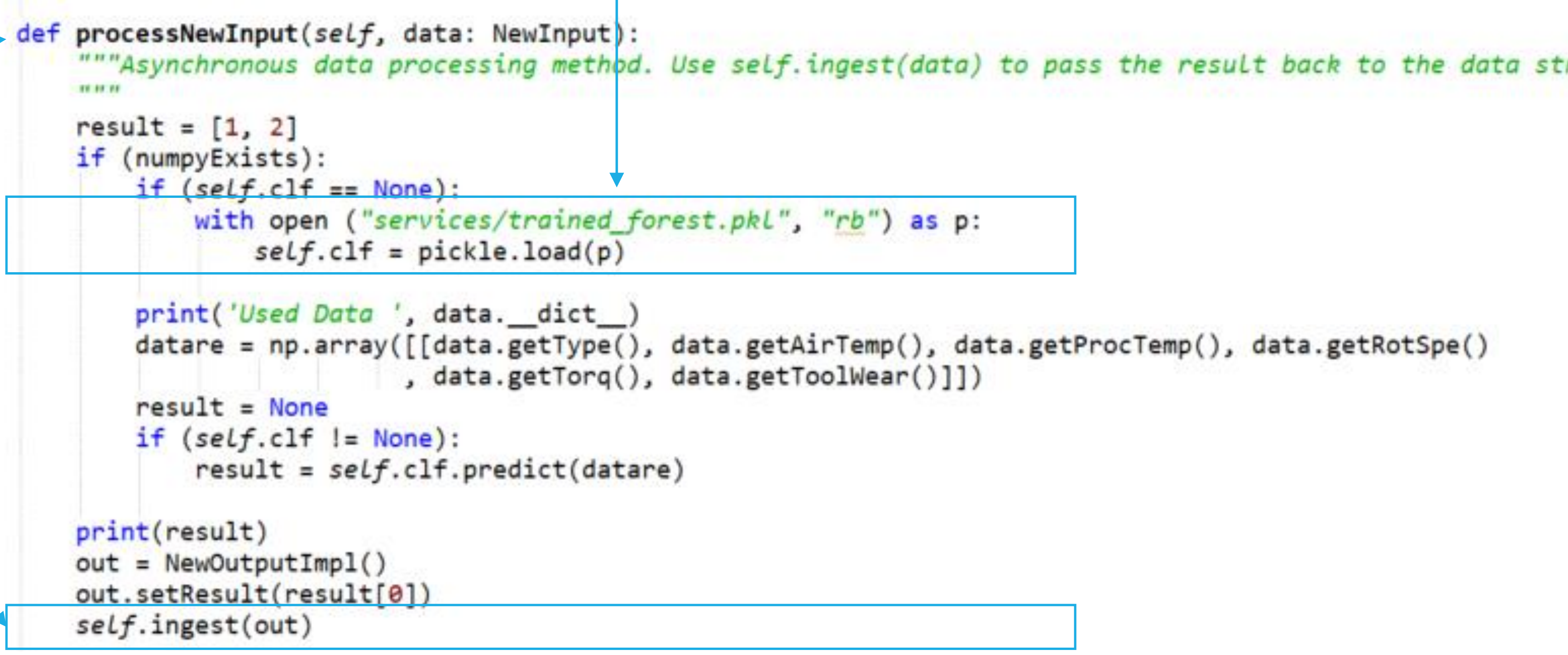
Adding Resources

- If you want to use a AI solution with a pre trained model you need to add the model in the same directory as the python service
- If you are working with a dev. container you first need to copy the model into the container using “*`docker cp`*”



Adding Functionality

- Here we have a example for a AI python service with a pre trained model
- When opening the resource add “*services/*” in front of the file name, as the files will be rearranged when building the application from it
- The method to edit is “*process<InputData Name>*“
- To pass on data utilise “*self.ingest()*”



```
def processNewInput(self, data: NewInput):
    """Asynchronous data processing method. Use self.ingest(data) to pass the result back to the data st
    """
    result = [1, 2]
    if (numpyExists):
        if (self.clf == None):
            with open ("services/trained_forest.pkl", "rb") as p:
                self.clf = pickle.load(p)

        print('Used Data ', data.__dict__)
        datare = np.array([[data.getType(), data.getAirTemp(), data.getProcTemp(), data.getRotSpe()
                          , data.getTorq(), data.getToolWear()]])
        result = None
        if (self.clf != None):
            result = self.clf.predict(datare)

    print(result)
    out = NewOutputImpl()
    out.setResult(result[0])
    self.ingest(out)
```

Finishing the Python Service

- After adding functionality to your other services and testing everything finish building the application as mentioned in “*How to Build an Application*”

Summary

- What we learned
  - How to build python services
  - How to add resources like models to the application
- How to go on
  - None