A framework for development of concurrency and I/O in servers
Gautier Loyauté

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Development of concurrency and I/O in servers and middleware becomes more and more complex:

- minimization of latency;
- maximization of bandwidth;
- no consensus on the best concurrency model;
- select the model best adapted to the hardware.

Applications are modeled by a directed graph, in which each stage (or vertex) corresponds to an atomic unit of treatment and edges correspond to channels (method calls, local queues or sockets) between them.

We describe here the implementation of a simple “Echo” server which uses three stages. The directed graph models the interconnection of its stages:

```
accept ----> read ----> write
```

Specifications and code generation are 100% Java! This ensures the portability of the applications developed using our framework.

### Development process

This table summarizes the development steps of our framework:

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The developer has to define the interface for input and/or output events for each stage. These events allow the communication between stages.

**Example:**

For the initial stage, only an output interface is defined:

```
public interface OutputAcceptEvent {
    void acceptSaburoSocket(SaburoSocket s);
}
```

For a final stage only an input interface is defined:

```
public interface InputWriteEvent {
    void setReadByteBuffer(ByteBuffer b);
}
```

For any other stage input and output interfaces should be defined:

```
public interface InputReadEvent {
    ByteBuffer getReadByteBuffer();
}
```

### Stage description

The developer should implement the `handle(...)` method which corresponds to the instructions carried out by a stage. Its parameters are the input and/or output events and the context.

The context is the way to reach successor(s) in the graph.

**Example:**

```
public class AcceptStage {
    public void handleStageContext(final StageContext ctx, OutputAcceptEvent out) {
        SaburoSocket client = server.accept();
        out.setAcceptSaburoSocket(client);
        ctx.dispatchToSuccessor(out);
    }
}
```

### Communication generation

The interfaces previously defined of the input and/or output events which allow the communication between stages are automatically generated.

The implementation of the context is also automatically generated according to the concurrency model.

**Example:**

```
public class AcceptStage {
    public void handleStageContext(StageContext ctx, OutputAcceptEvent out) {
        SaburoSocket client = server.accept();
        out.setAcceptSaburoSocket(client);
        ctx.dispatchToSuccessor(out);
    }
}
```

### Concurrency selection

The concurrency model has to be selected in Java by the developer.

**Example:**

```
public interface ModelExecutorImpl {
    void run(StageContext ctx, StageManagerImpl manager, String type);
}
```

Currently, these two steps are hand-coded but could be generated automatically via an Eclipse plugin.