AOT Gridworld Exercise with JIAC VI

In this module, we are using JIAC VI to set up a simple gridworld. The Server agent as well as all messages sent and received by it will be provided by us (TUB) and the students will have to implement the SetupAgent and WorkerAgents and all interactions between them.

You need to have Maven and Java (jdk) installed to build the project and download dependencies. JIAC VI is implemented in Kotlin, but you can also use Java, however we strongly suggest Kotlin as the Kotlin-specific DSL is much easier to use. For an IDE with good Kotlin support we suggest using IntelliJ, others work well too.

Overview of Provided Code

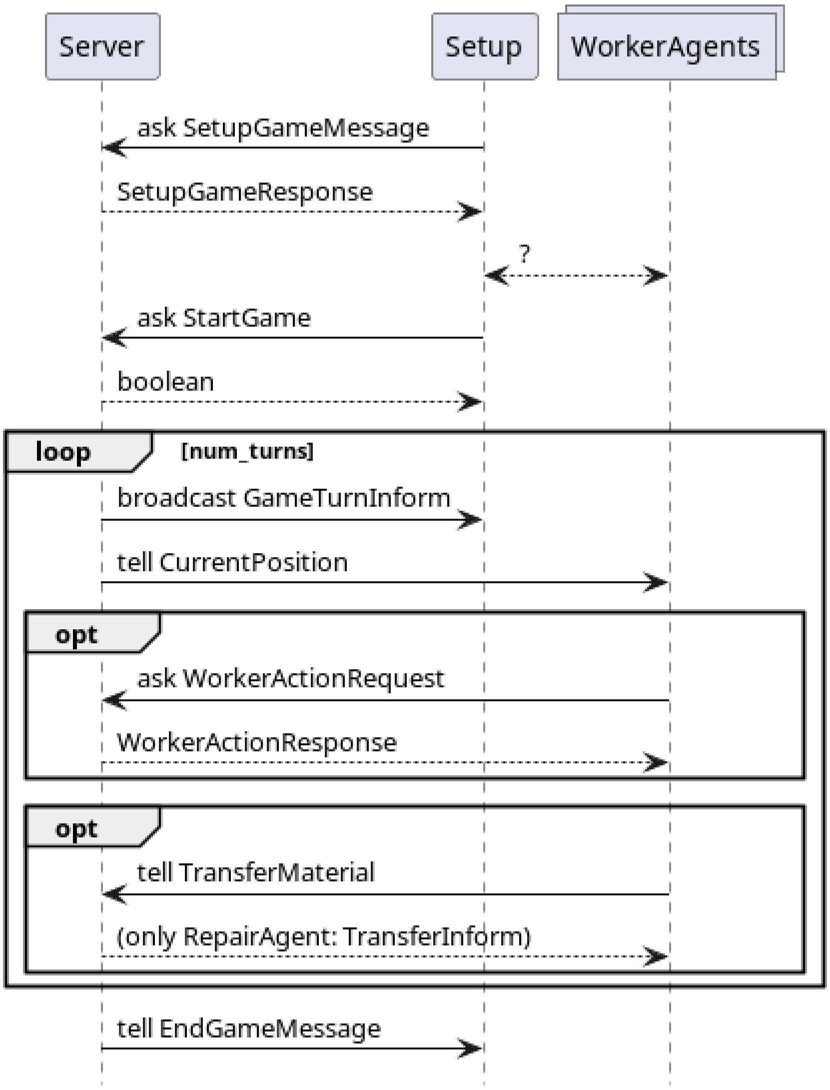
The code is using the JIAC VI agent framework developed by DAI-Labor.

- `pom.xml` is the Maven project description, defining the dependencies and where to find them
- `Main.kt` is used for configuring and starting the `ServerAgent.kt` and `SetupAgent.kt`
- `ServerAgent.kt` defines the server side of the interaction; it will be explained in more detail below
- `Messages.kt` contains all the messages exchanged between the Server and the Client (i.e. SetupAgent and Workers) according to the protocol; you can add additional messages for the communication between the Agents in a separate module, but the given messages must *not* be changed or communication with the Server will not work
- `Models.kt` contains classes describing concepts in the Grid World; those are used by the Server to keep track of the current state of the game and its entities, but you can use the same classes in your agents, as well; note that some model classes are also used as part of messages and like the messages themselves should *not* be altered or communication with the official Server will not work
- `SetupAgent.kt`, `RepairAgent.kt` and `CollectAgent.kt` defines a simple stub that you can use as a starting point for your implementation

Most of the code is written in Kotlin, but it is fully compatible with Java, you can use Java libraries, classes and methods written in Java. If you are not familiar with Kotlin, you may also use Java for the decision logic and Kotlin only for the high-level reactive behavior of the agent.

Interaction between Server and Client

The following sequence diagram shows the messages exchanged between (i) the Server and the Setup and Workers, and the CNP between the Workers. The latter has to be implemented by you, thus there are no concrete messages shown.



The following messages are exchanged between the Server and the SetupAgent and WorkerAgents.

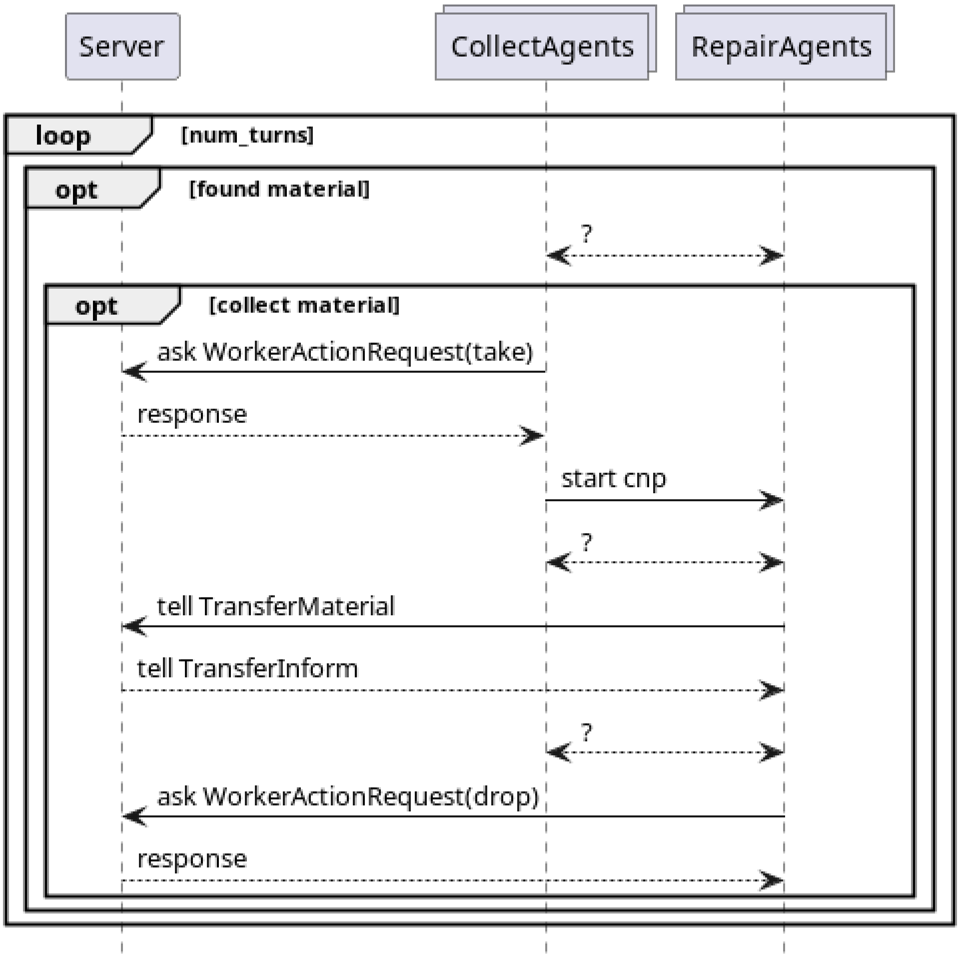
- the game is initialized by the SetupAgent with a `SetupGameMessage`, defining the gridfile which should be used.
- the Server replies with a `SetupGameResponse` holding information about the game, especially the IDs of each agent type and repair positions.
- After setting up your agent system you can start the game with `StartGame`
- in each turn
    - with `CurrentPosition` every Agent will be told the current turn, current position and a list of all materials in the neighbourhood.
    - the Server still broadcasts a `GameTurnInform` with the current turn, you can use this to sync your Agents but don't have to.
    - a Worker can make an `WorkerActionRequest` which is either a direction to move, take material (only Collector) or drop material (only Repair) at a repair point.
    - the server replies with an `WorkerActionResponse` which is a Boolean (`true` or `false`), as well as flag with details. To see the flags and their meaning check the comments in Model.kt
    - a Worker can also send a `TransferMaterial` message to get material from a CollectorAgent to a RepairAgent. However only the RepairAgent will be informed if this action is successful, due to CNP restrictions.
- finally, the Server sends an `EndGameMessage` to the Env informing them about the outcome of the game

Also note that:

- workers are limited to one action per turn (`TransferMaterial` counts as well)
- grid file names should be relative to the class path root
- obstacles and repair points will be revealed at the start of the game

CNP usage

This diagram should help understand where you should implement your CNP.



Upon taking material your `CollectAgent` needs to start a CNP instance with your `RepairAgents` to identify an Agent to meet at a specific place and time to transfer the material. Afterward the `RepairAgent` can go on and drop (repair) a repairpoint of his choice.

Scoring

You are successful if you manage to repair the whole gridworld. The faster, the better however there is no threshold of turns to complete a gridworld to get a 100% score.

The Server

The `ServerAgent` is the agent running on the server side. You can look at the code to get a better understanding what the server does, and maybe to deduce how certain things need to be done in JIAC, but you should *not* alter the code. Remember that in the end your agents will run against a server agent hosted by us, using the original code, so any changes to the server may render your agents incompatible with our server!

The Client

The `SetupAgent` and 2 worker Agents can be used as a starting point for your implementation. In theory, you could implement both roles in the same agent, but is not allowed in this exercise. Also the `SetupAgent` should have no functionality in the actual gridworld game, like coordinating agents.

Besides the beans, you may also need to create additional classes for further messages between the Agents (only hinted in the sequence diagram), or further model elements for representing the state of the game. All new files belong in `*/myAgent/`. (Of course, you can also use the classes used by the Server, but as mentioned before, you should not modify those or your agents might not work any longer with a Server using the original classes.)

Reactive Behaviour and Messaging in JIAC VI

The agent's main behaviour is defined by overwriting the `behaviour()` function, using a specific notation:

```
override fun behaviour() = act {
    every(Duration.ofSeconds(s)) {
        // called in regular intervals
    }
    on<MsgX> {
        // react to message send to agent with `ref tell MsgX(...)`
    }
    respond<MsgX, MsgY> {
        // respond to query sent by `ref invoke ask<MsgY>(MsgX(...)) { res
-> ... }`
    }
    listen<MsgX>(topicX) {
        // react to broadcast message send over topicX
    }
}
```

Here, `ref` is a reference to another agent acquired with `val ref = system.resolve(name)`. Please refer to the server for more examples on how to use them. Of course, you do not have to put all the actual logic into those callback functions but can define more methods to be called. You can also look at the `jiac-vi-documentation.pdf`.

Running the Game

To start the game locally simply run the `Main` module of this project. Remember to specify a gridfile in the `SetupAgent` and send a `SetupGameMessage as well as a StartGame` message.

Gamelogs

By default, the game state will not be saved to a logfile. You can turn logging on in the `Main` module and specify a single logfile if you don't wish to save each new game on its own (this might be useful to monitor the gridworld).