Parallel design patterns ARCHER course

Case study: The actor model for ATC

Reusing this material

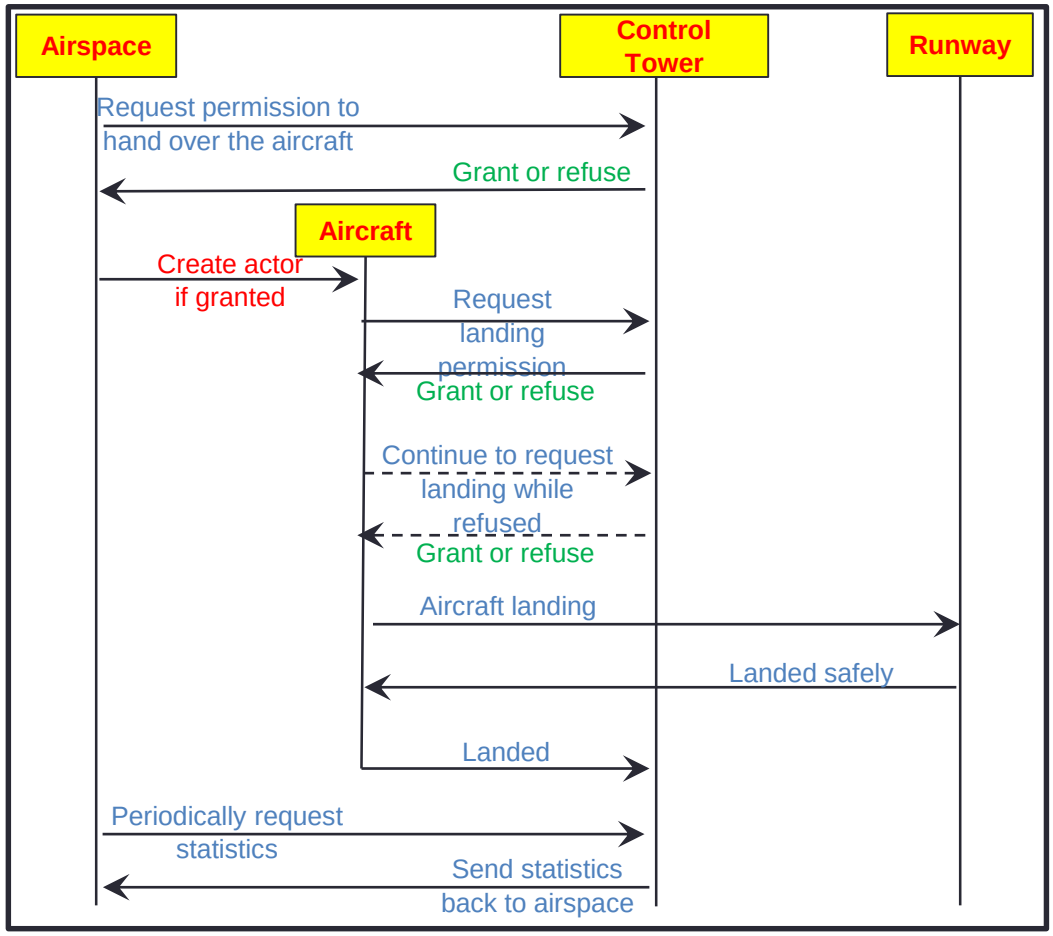
The problem

Use the actor pattern to model this via MPI

- Four types of actor
  - Air traffic control tower
  - Runway
  - Airspace (the operator introducing/handing aircraft to the ATC tower)
  - Aircraft

- Control tower, runway and airspace are created once at model start up and exist till the end
- Aircraft are much more dynamic, created as the model runs and many actors can be created (and can die)

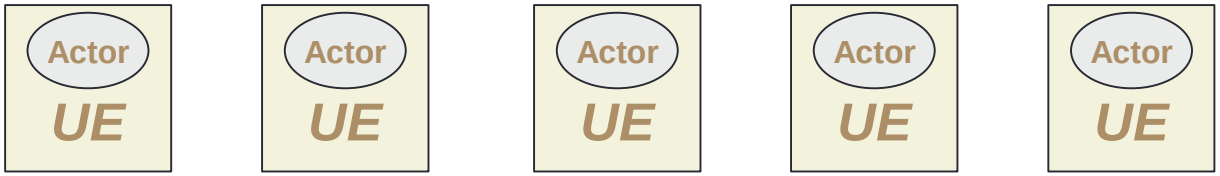
Interaction pattern



Some hints

- A skeleton implementation is included
  - Use it if you want, entirely up to you
  - Worked solutions are also available too

- I strongly suggest one actor per UE as much simpler to do



- I also provide the process pool implementation where workers are actors
- Lots of details in the hand out

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ProcessPool: Important Considerations

- Your code must call **`MPI_Init`** before any of the following calls
- Every process must call **`processPoolInit`**

- The master process keeps track of which processes are active, but any process can call **`startWorkerProcess`** to request that a new worker is created/awoken. An ID is returned by this call which can be used to send a message to the new process.
  - The communications between the master and worker required to make this happen occur “behind the scenes”

ProcessPool: Important Considerations

- The master process will probably do the job of creating the initial actors in the simulation
- All actors should be implemented using workers

```
while (workerStatus) {
     int parentId = getCommandData();
   // insert code here which implements being an actor


   workerStatus=workerSleep();     // This MPI process will
   sleep, further workers may be run on this process now
}
```

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ProcessPool: Important Considerations

- All actors **must** call **`shouldWorkerStop`** at regular intervals to allow the master to terminate the program if required. If **`shouldWorkerStop`** returns true, then it is **your** responsibility to ensure that the flow of control returns to the line after the call to **`workerCode`**

- `The process pool uses MPI tags 16384 & 16383`
  - `So avoid using these tags in your code`