Java Network Programming Project

Vision

To write an application based on Fractal Component Programming model to support parameter sweep simulation programs.

The simulation program can be an executable file with some sets of data files.

In case of this project, we have implemented the simulation program ourselves and that is the multiplication of two huge matrices. But in general, it can use external executables and run them accordingly.

Architecture

Description

The architecture of this application consists of three parts **FrontEnd** component, **BagOfTasks** group and **Simulators** group.
BagOfTasks and Simulators group consist of arbitrary number of **UserTask** and **Simulator** components.
The **FrontEnd** component is connected to a GUI that is interacting with the user. The user can submit the input matrices with specifying the matrix file and then he should wait for the result.
FrontEnd component is bound to **BagOfTasks** group as *one-to-any* binding. It means that any given time one of the components in **BagOfTasks** group is selected. Also the group **BagOfTasks** is bound to **Simulators** group as *one-to-any* binding.
For feeding back the result to user, **Simulators** group has been bound to **FrontEnd** component as *one-to-one* binding thus when any simulator component is done with the simulation, it can announce the **FrontEnd** component.

Components

FrontEnd

- Interfaces
  - FEPublishTask (Client Interface) — Bound to BagOfTasks group
  - ResultAnnounce (Server Interface) — Bound to Simulators group
- Responsiblity: Divides the input matrices in this way that a row and a column from the first and second matrix is considered a task. This task is submitted to UserTask queues.

UserTask

- Interfaces
  - FEPublishTask (Server Interface) — Bound to FrontEnd component
  - UTPublishTask (Client Interface) — Bound to Simulators group
- Responsblity: Submits every task to one of the simulators in Simulator group.

Simulator

- Interfaces
  - UTPublishTask (Server Interface) — Bound to BagOfTasks group
  - ResultAnnounce (Client Interface) — Bound to FrontEnd component
- Responsblity: Computes the final element of the final matrix from the received row and column and send back the result to the FrontEnd component

Simulation

- Input: A file consists of two matrices. For each one, the first line is the dimension of the matrix and the next lines are the elements of the matrix
- Output: Generated on the GUI as a table indicating the produced matrix

Future Works

- Performance Improvement — Caching: UserTask components in BagOfTasks group can simply record that what rows and columns has been sent to each Simulator component. In this way, they can avoid sending again the previously sent row or column and save a lot of network bandwidth.
- Direct Job Submitting: In some cases, UserTask components can be considered as redundant layer in this architecture. Thus we can have direct job submitting from FrontEnd component to Simulator groups.
- Scheduler and Load Balancing: The main purpose of creating BagOfTasks group is for future extensions. We can implement scheduler and load balancer in this layer and avoid performance bottlenecks in a particular simulator component.

Developers

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