UNIVERSITY OF TARTU
Institute of Computer Science

LTAT.06.007 Distributed Systems

Practical Seminar 5

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Recap

- Insights about different Performance Metrics
- Visualized Performance Metrics using JMeter Modular dashboard

Agenda

- **Goal:** To understand code migration through transparent communications in distributed systems.
- **Content:**
  - Java reflection utility
  - Implement code migration at method level of any sorting algorithm, e.g., bubble sort, quick sort, etc.
  - Sockets
- **Quiz**

After this lecture, you should be able to:

- Understand how code migration works

Session Content

Description

- Code migration from one process to another occurs using RPC (Remote Procedure Call) implementations.
- However, code also can be captured during runtime and migrated to external processes without modifying the binaries of the application being executed. This is called code offloading.
- In this practical seminar, we will explore how to migrate code during runtime between processes.
- We will combine RPC and socket primitives to achieve this.

Observation

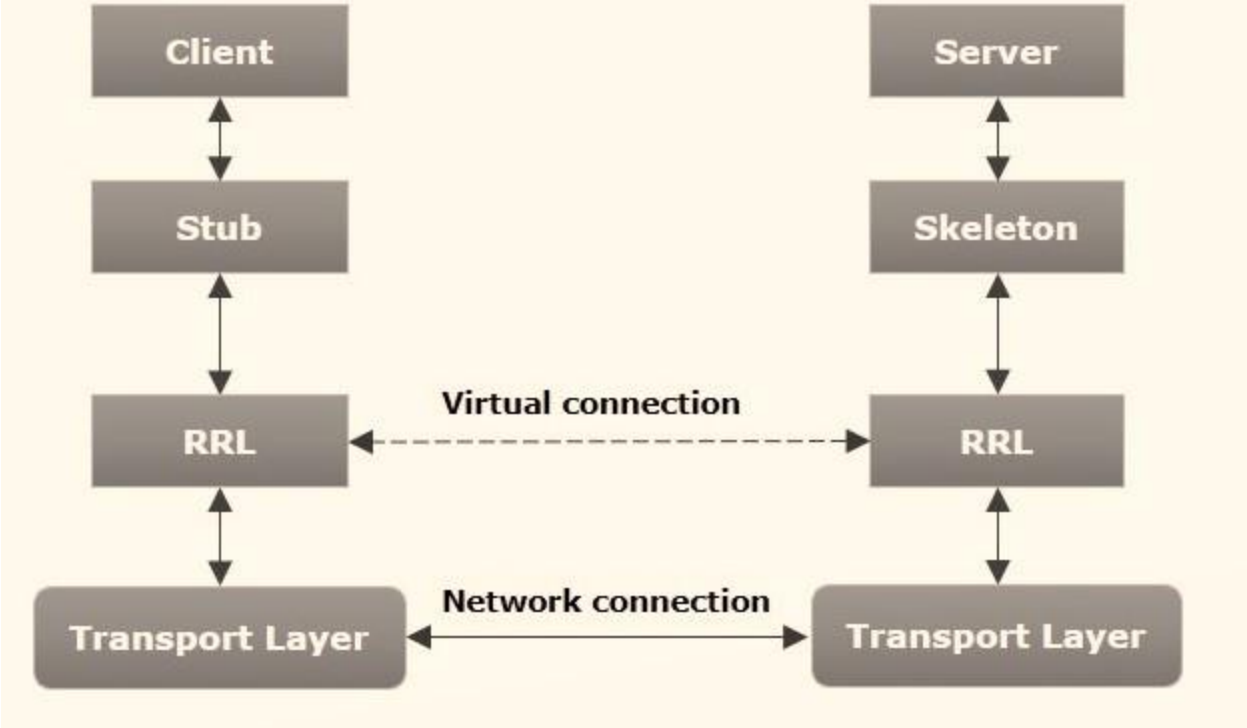
Instructions to complete this practical session can be found in the course website: https://courses.cs.ut.ee/2021/ds/spring/Main/Instructions1

Java Reflection Utility

- Feature in java programming language that allows us to examine or modify behaviour of methods , classes, interfaces at runtime.
  - Provided by *java.lang.reflect* package
  - gives us information about the class to which an object belongs and also the methods of that class which can be executed by using the object.
  - Through reflection we can invoke methods at runtime irrespective of the access specifier used with them.

Remote Method Invocation (RMI)

- Client makes a calls to the remote object, it is received by the stub which eventually passes this request to the RRL.
- When the client-side RRL receives the request, it invokes a method called **invoke()** of the object **remoteRef**. It passes the request to the RRL on the server side.



- The RRL on the server side passes the request to the Skeleton, which invokes the required object on server.
- The result is sent back all the way to client

Marshalling and Unmarshalling in RMI

- **Marshalling:**
  - Whenever a client invokes a method that accepts parameters on a remote object, the parameters are bundled into a message before being sent over the network.
  - These parameters may be of primitive type or objects.
    - If primitive type, the parameters are put together and a header is attached to it.
    - If the parameters are objects, then they are serialized.
- **Unmarshalling:**
  - At the server side, the packed parameters are unbundled and then the required method is invoked.

Code Offloading

- Offloading is the opportunistic process that relies on remote servers to execute code delegated by a Client.
- More at https://*buyya.com/papers/MobileCloud-IEEEComm2015.pdf*

Session Instructions at Course Page

Quiz

Content

- Lecture 5 (Communications)
- Two attempts
  - One in Seminar Session
  - Next available until Monday 23:50 (Deadline)
- Open Quiz in Moodle
- Total Quiz Points = 100

Observation

Quiz review is available after the quiz is closed

Questions?

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