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Administrivia

- Reminder: Continue working on homeworks. Also think about project ideas.

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A Little About Distributed-Memory Programming in Java

- Java doesn't exactly provide explicit support for distributed-memory parallel programming.
- However, similar effects can be achieved with multiple Java programs on different machines communicating via socket-to-socket connections and with RMI.

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Distributed-Memory Programming in Java Using Sockets

- Client/server model:
 - Server sets up “server socket” specifying port number, then waits to accept connections. Connection generates socket.
 - Client connects to server by giving name/IPA and port number — generates a socket.
 - On each side, get input/output streams for socket. Program must define protocol for the two sides to communicate.

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Distributed-Memory Programming in Java Using RMI

- Motivation — for client/server applications, can be annoying to have to design your own protocol.
- Instead, idea is to define “remote objects” that can be treated (at program level) like any other objects — invoke methods.
- Typical use in client/server program:
 - Server creates some remote objects and “registers” them.
 - Clients look up server’s remote objects and invoke their methods.
 - Both sides can pass around references to other remote objects.
- Dynamic code loading possible too.
- Example — yet another version of simplified generic master/worker program.

Java RMI — A Short How-To

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- Define a class for remote objects:
 - Define interface that extends `Remote`
 - Define class that implements that interface, extends a Java “remote object” class. Can also include other methods, only available locally.
 - Write code using classes — if using as remote object, reference interface; otherwise can reference class.
- Compile and execute:
 - Compile as usual. (Prior to Java 1.5, an extra step was required to generate “stubs” to be used in communicating with remote objects as remote objects.
 - Make classes network-accessible.
 - Start `rmiregistry`.
 - Run server and clients as usual.

Distributed-Memory Programming in Java — Example

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- Example — simplified generic master/worker program, similar to the versions in OpenMP and MPI earlier this semester.
- Version using sockets is relatively straightforward — server creates a new thread for each client, only tricky bits are in making sure things are shut down properly. Notice use of `synchronized` in code to ensure thread-safe access to shared variables.
- Version using RMI is also straightforward, again except for code to shut down properly. Notice use of `synchronized` in code to ensure thread-safe access to shared variables; experiment suggests that RMI may use multiple threads to process concurrent requests.

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Distributed-Memory Java and *Implementation Mechanisms*

- Very similar to MPI, really — UE management is outside the scope of the libraries, synchronization is implicit. For sockets, communication is explicit; for RMI, implicit.

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Minute Essay

- None — sign in.