The Persistent Java Virtual Machine (PJVM)

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Golub's Law:
A carelessly planned project takes three times longer to complete than expected.
A carefully planned project will take only twice as long.

Topics

- Project Origins and Goals
- Other Persistent Java Virtual Machines
- JNI and Reflection Mechanisms
- PJVM Structure and Implementation
- PJVM Features
- Current Status (Demonstration)
- Future Plans

Project Origins and Goals

- Overhead of Running Java Applications
- For each application:
  1. Load program to implement the JVM (*java.exe*)
  2. Load and link system classes
  3. Load and link first application class
  4. Load and link other application classes
- Looking for a way to do steps 1-2 just once during a development session
- Evolving Into:
  - Development tool for experienced programmers
  - Learning tool for students

Other Persistent Java Virtual Machines

- Web browsers include a JVM
  - Instantiated the first time an applet is encountered
  - The JVM persists for the lifetime of the browser session
  - No way to reload a class except to exit and restart the browser
    - Efficient once applet is deployed, but awkward during development

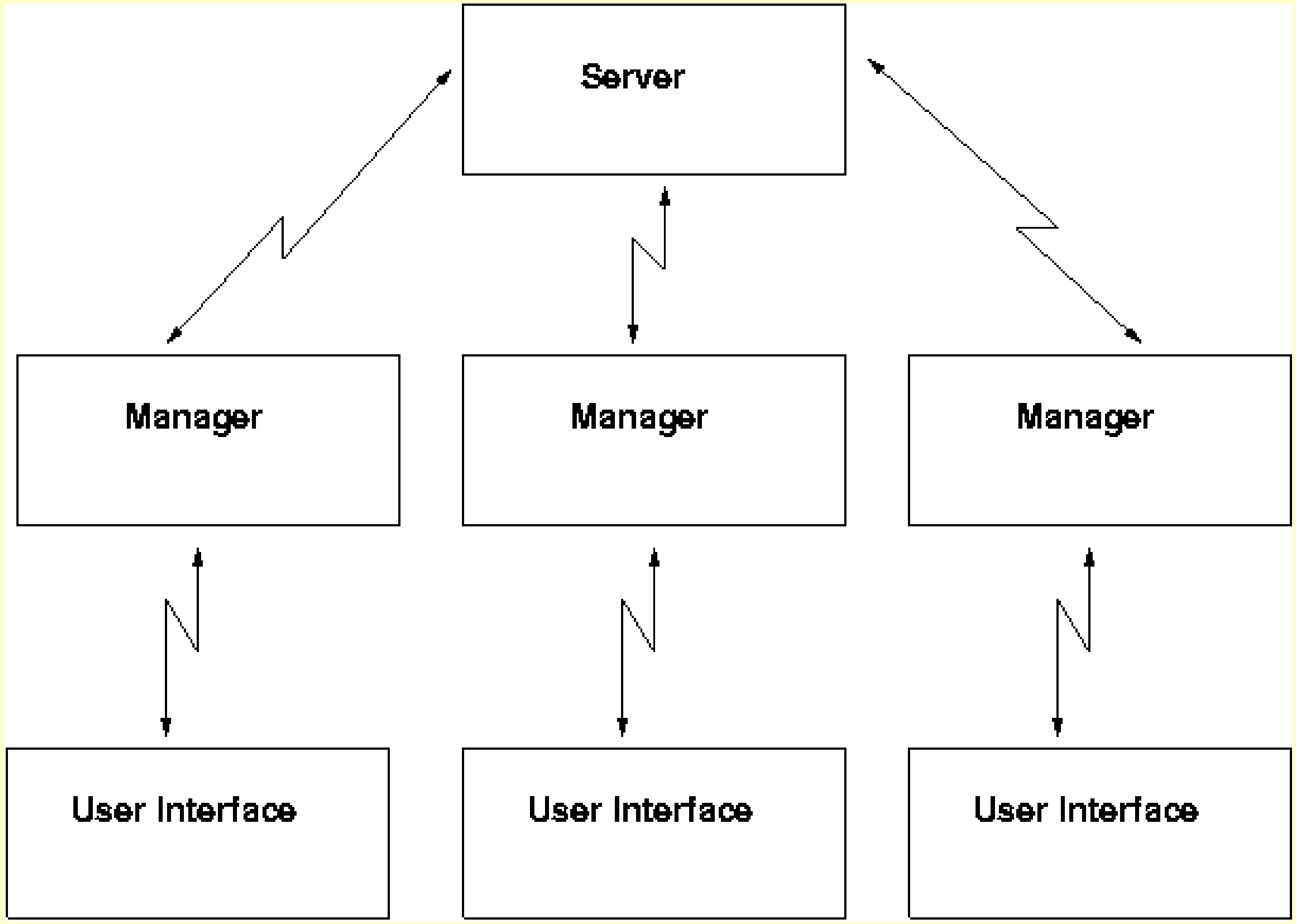
Resources Used for PJVM

- Java Native Interface (JNI)
  - Allows Java code to call C/C++ (native) code for performance-critical operations
  - Also lets C/C++ code create JVMs
- Reflection Mechanism
  - Java classes that provide methods for examining classes, methods, and objects
- Classloaders
  - Gives control over loading classes into a JVM dynamically

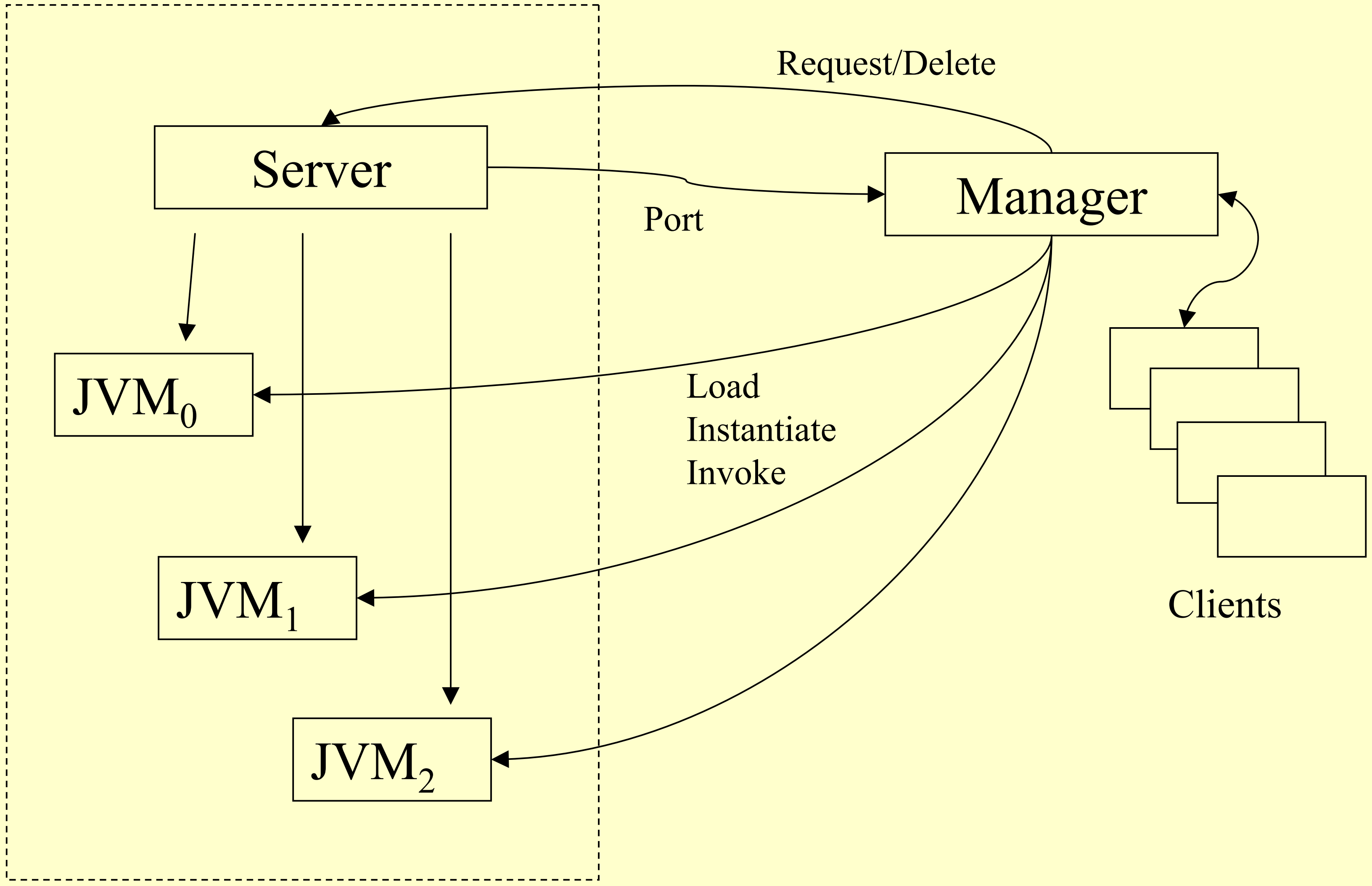
PJVM Structure and Implementation

- Server
  - Creates and destroys JVMs
  - Accepts requests to load classes, instantiate them, and to invoke methods.
- Manager(s)
  - Acts as liaison between Server and Clients
  - Provides isolation among users sharing a server
  - Manages networked interfaces between clients and a server
- User Interface (clients)
  - Written as C commands to make server requests and queries
  - Java GUI manages housekeeping across requests

PJVM Structure



Server – Manager – Client Interactions



PJVM Features

- Instantiate Single/Multiple JVMs
  - List JVMs
- Load local/remote classes into specified JVMs
  - List loaded classes for each JVM
  - List constructors/methods for each loaded class
  - Load multiple versions of a class
- Invoke constructors, static, and instance methods
  - Using primitives as parameters
  - Using references to objects as parameters
  - Using values returned by other methods as parameters
- Delete JVMs from Memory

Current Status (Demonstration)

- GUI, Manager, and Server all running on the same Linux machine

Future Plans

- Current source code available for download
  - Tar-gzip
  - Zip
- Full network implementation so that GUI clients run on user's local machine
  - Server may run remotely
  - Manager runs locally
- Display more information
  - Memory utilization
  - Class file timestamps and dependencies
  - Class files loaded by system classloader
  - Objects not created by PJVM clients
- Debugging support
  - Single-step, breakpoints, etc.
- Port to other platforms
  - NT, OS X