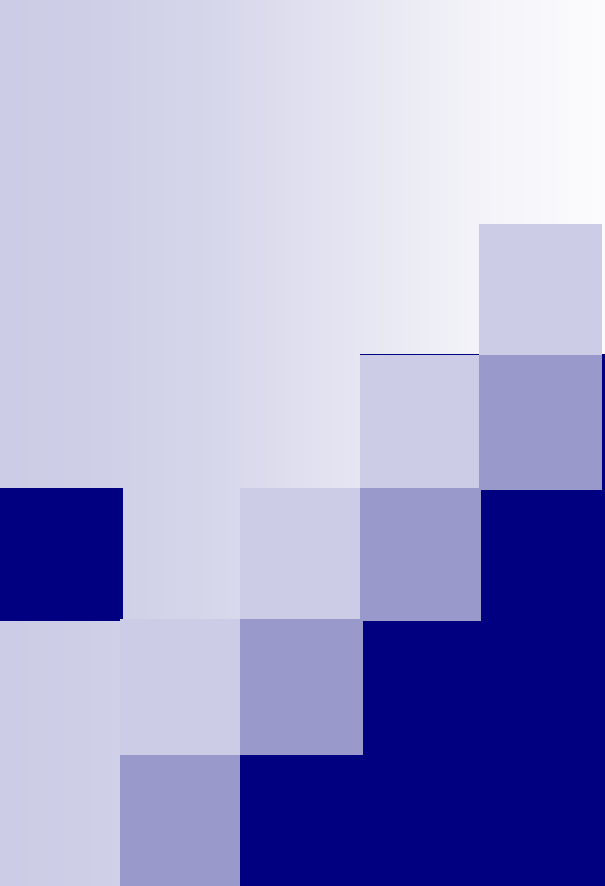




Network Computing Lecture 1

Professor Louise E. Moser
Spring 2012



Course Administrative Details

- **Lectures:** T Th 11:00am-12:15pm

HSSB, Room 1206

- **Discussion Sections:** F 10:00-10:50pm

Building 387, Room 103

- **Office Hours:**

- Prof Louise Moser: MW 11:15am-12:00, TTh 12:30-1:15pm

2164 Harold Frank Hall

- TA Yung-Ting Chuang: W 2:00-3:30pm, F 11:00am-12:30

ECI Lab Harold Frank Hall

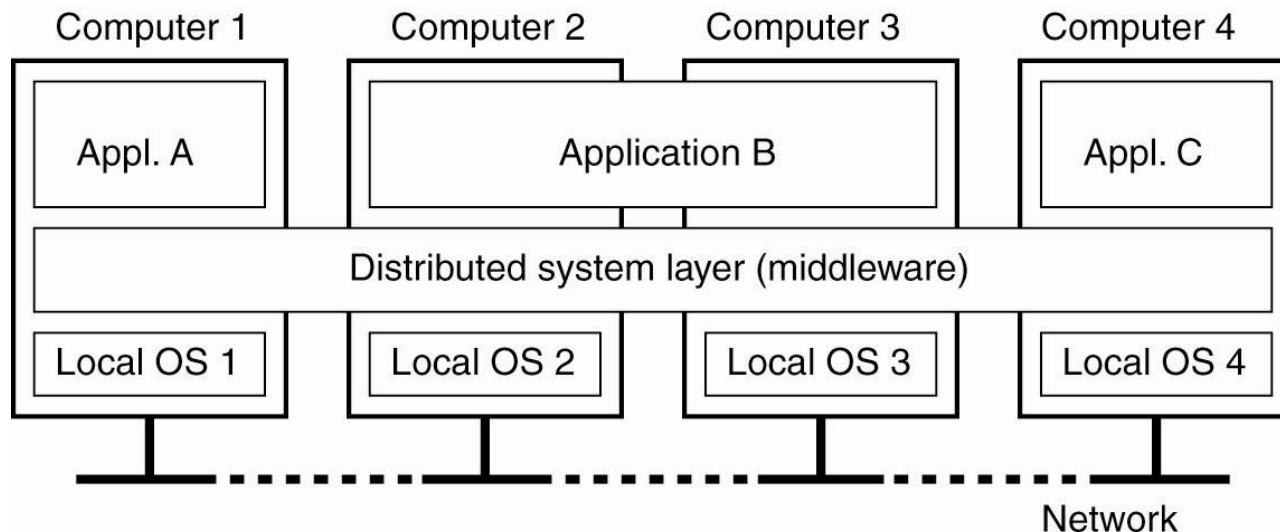
- **Grading:** Class Attendance / Participation 15%

Programming Assignments 70%

Final Term Paper 15%

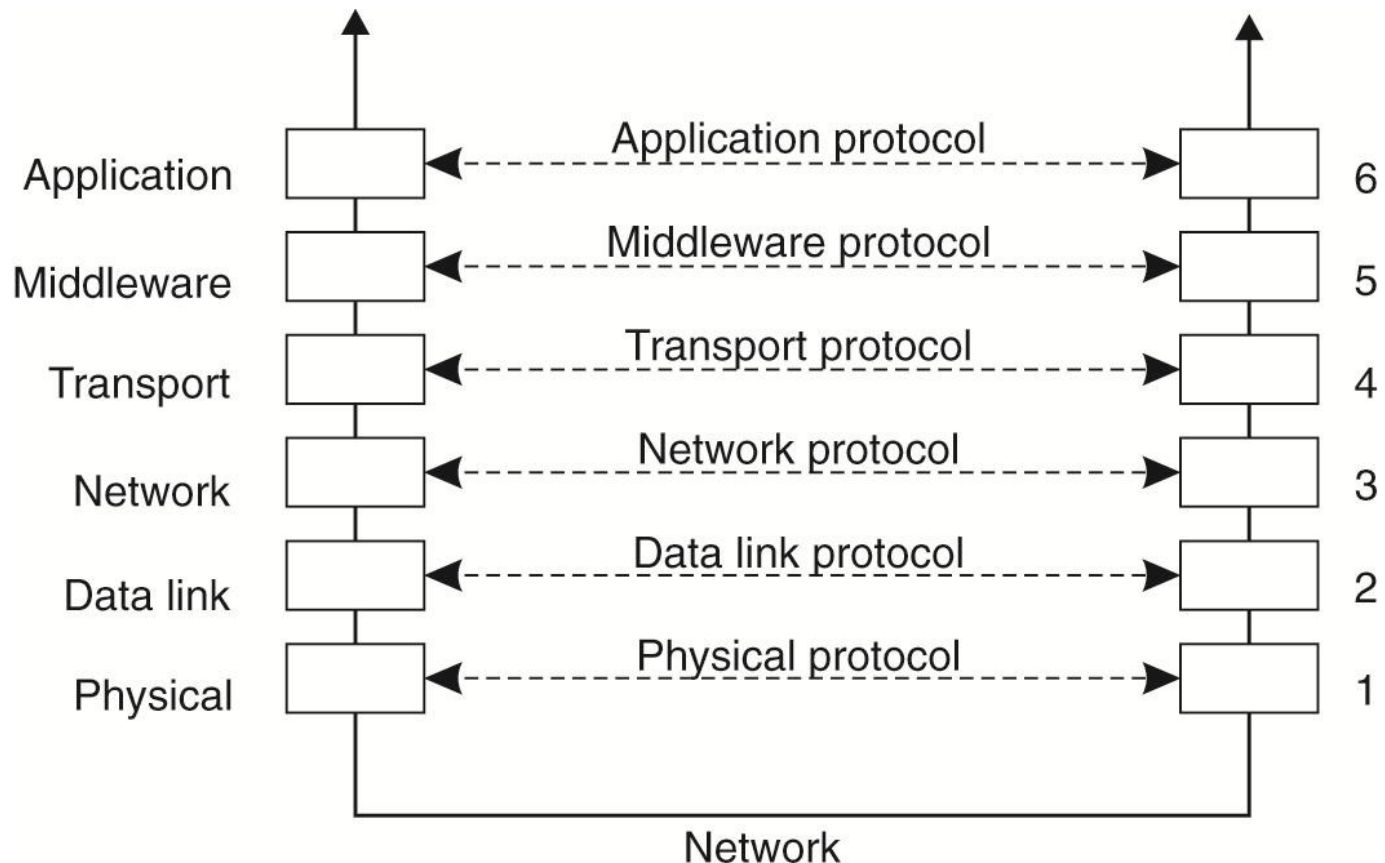
Distributed System vs. Computer Network

- Computer network - Interconnected collection of computers that operate autonomously and are managed directly and individually by the users
- Distributed system - Network of computers that are made to look like a single computer by software (middleware) that provides services transparently to its users



Reference Model

- Layers, interface, and protocols for distributed systems reference model



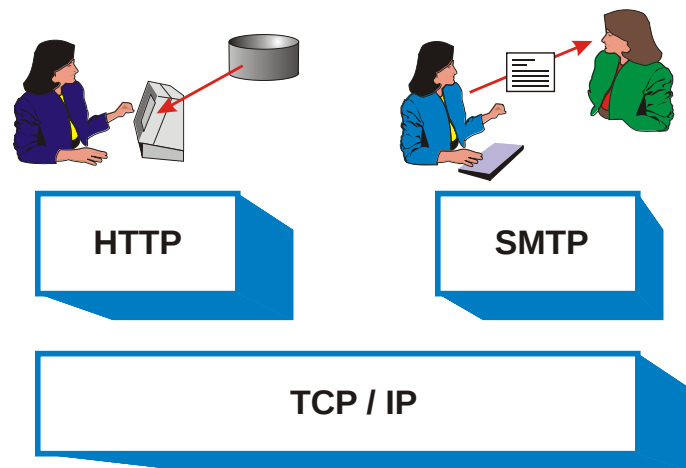
Networking over the Internet

- Transmission Control Protocol (TCP)
 - Point-to-point, connection-oriented, reliable, source-ordered
- User Datagram Protocol (UDP)
 - Point-to-point or multicast, connectionless, unreliable
- Internet Protocol (IP)
 - Point-to-point, connectionless, unreliable



Higher-Level Protocols

- Hypertext Transfer Protocol (HTTP)
 - Used to access Web pages
- Simple Mail Transfer Protocol (SMTP)
 - Used to send Email
- Both HTTP and SMTP operate over TCP/IP



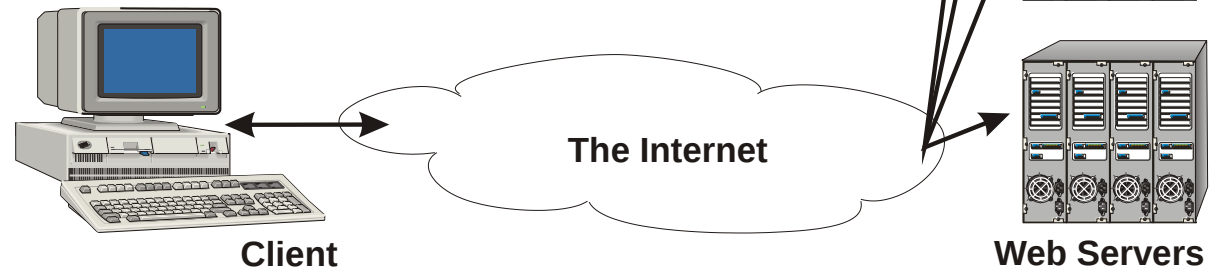


Client-Server Computing

- Server on one computer provides services to a client on another computer
 - Web Server (ece.ucsb.edu)
 - Email Server (mail.ece.ucsb.edu)
 - Travel Agent Server (travelocity.com)
 - Online Store Server (amazon.com)
- Server typically serves multiple clients at the same time

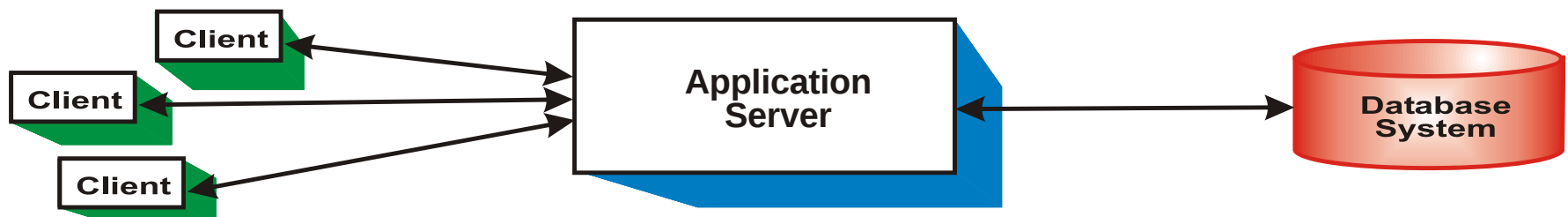
Web Servers

- Web Server listens for a client's requests on the well-known HTTP port 80
- Each client request gets one thing from the Web Server
- Several requests are usually necessary to get the text, formatting instructions, and graphics that are needed to present a Web page to a client



Three-Tier Architecture

- Client - Front-End Tier
 - Browser-based client or Web server
- Application Server - Middle Tier
 - Performs the business logic processing
- Database System - Back-End Tier
 - Stores the data in database records in database tables on stable storage, i.e., disk



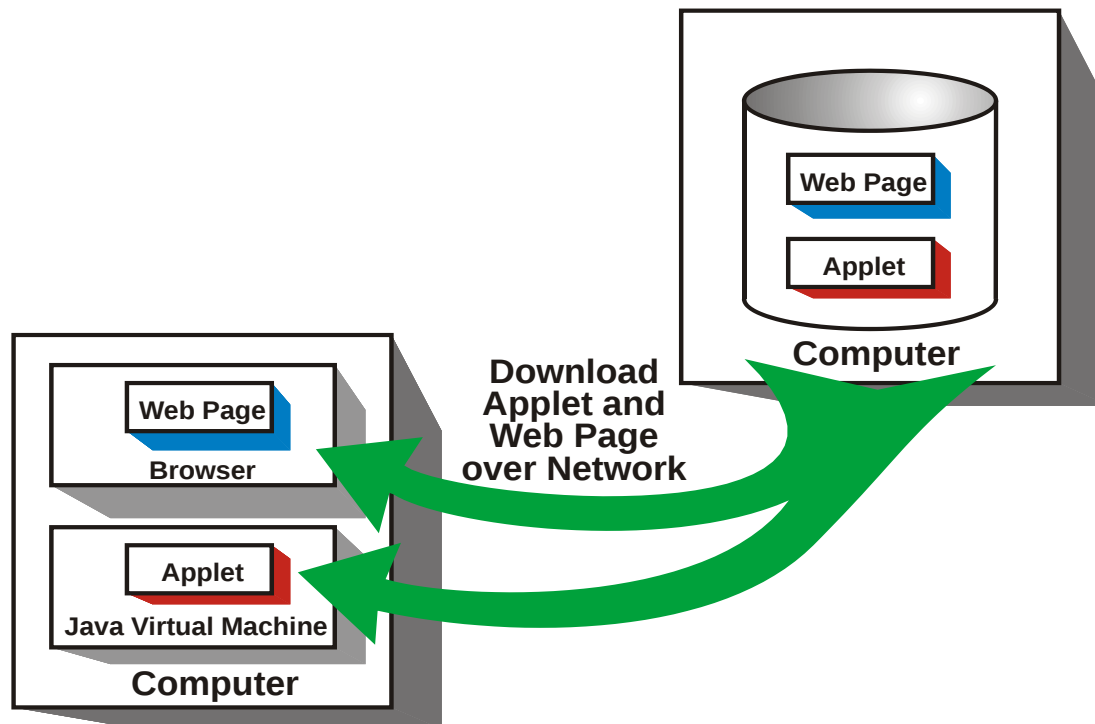


Networked Computing in Java

- Java provides various facilities that enable networked computing
 - Downloadable Applets
 - Java Sockets
 - Remote Method Invocation (RMI)
 - Servlets and Java Server Pages (JSPs)
 - Java Database Connectivity (JDBC)
 - Enterprise Java Beans (EJBs) and EJB Application Servers
 - Web Services

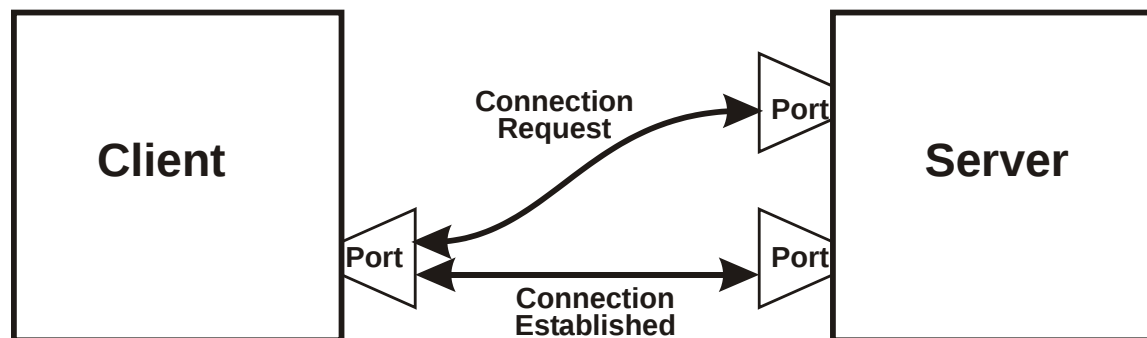
Java Applets

- An applet is a self-contained Java program that can be downloaded from a server computer over the Internet and run on your local computer



Java Sockets

- Server listens for clients' connection requests on a particular port
- Client requests a connection to the server using the server's port
- Server grants client a connection on another new port
- Client generates requests to the server using the new port
- Server performs operations and returns replies to the client

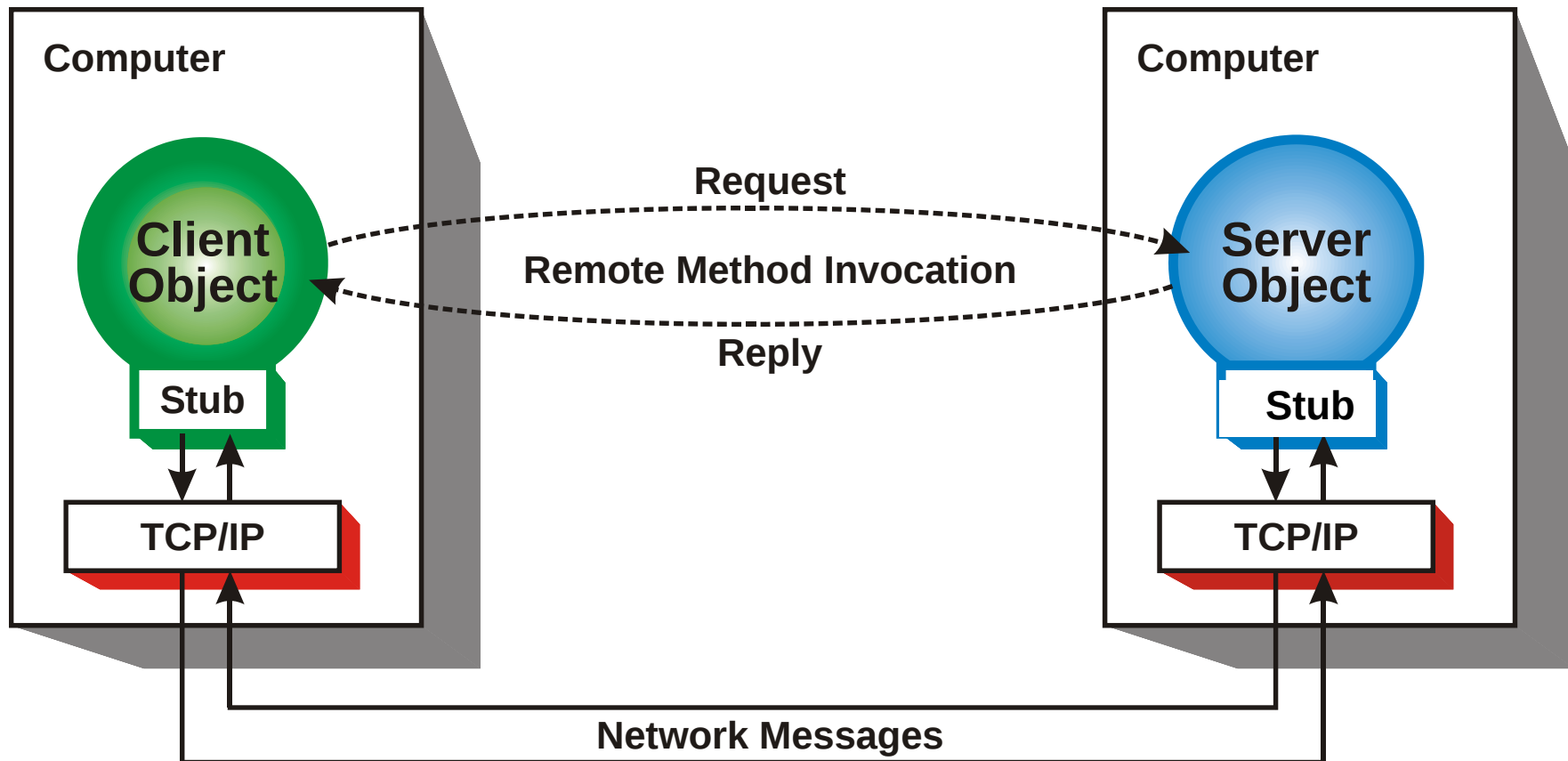




Java Remote Method Invocation (RMI)

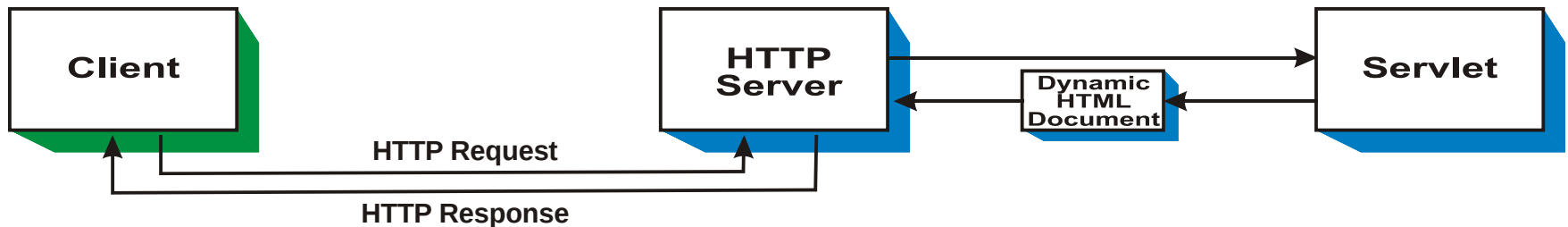
- Client invokes a method of a server across the network, using Remote Method Invocation (RMI)
 - Method name and its parameters are sent in a **request** message from the client to the server over TCP/IP
- Server processes the client's request and returns the results to the client
 - Results are sent in a **reply** message from the server to the client over TCP/IP

Java RMI



Java Servlets

- A Servlet creates HTML documents (Web pages) dynamically on-the-fly, rather than simply getting HTML documents that were previously created



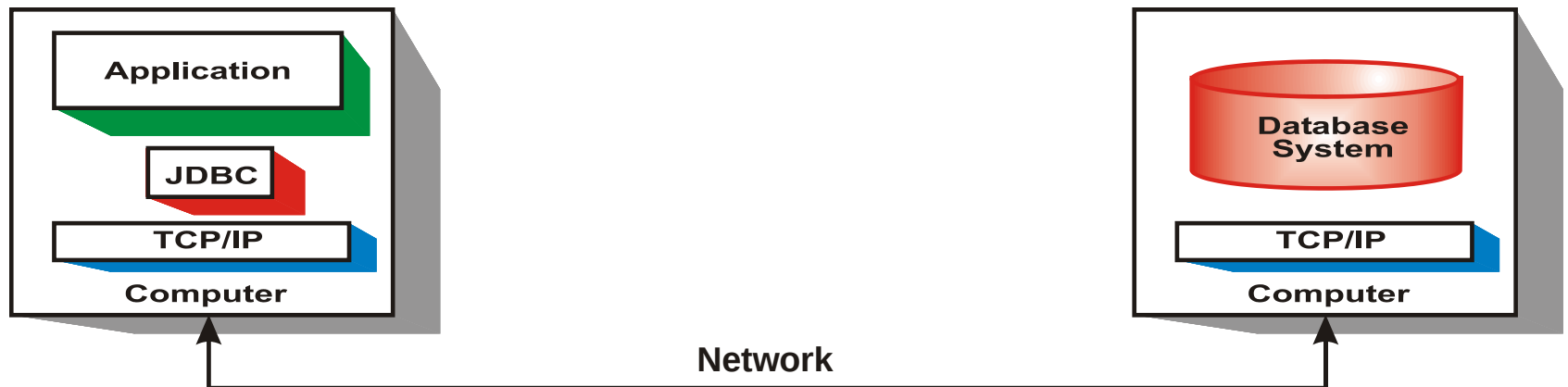


Java Server Pages (JSPs)

- Java Server Pages (JSPs) can also be used to generate dynamic HTML documents
- JSPs allow static HTML statements and dynamically generated HTML statements to be mixed together

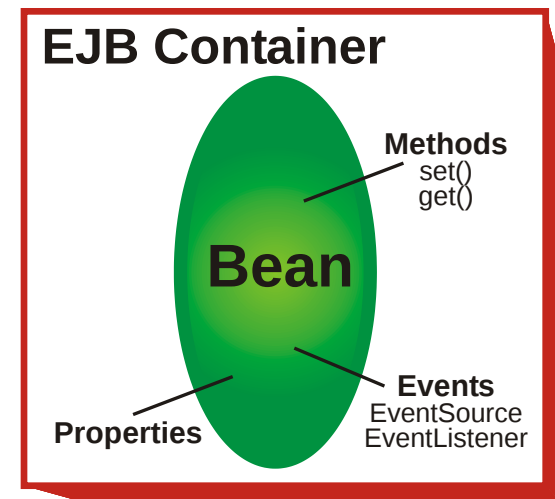
Java Database Connectivity (JDBC)

- Java Database Connectivity (JDBC) enables Java applications to connect to a Database Management System (DBMS)
- Using JDBC, Java applications can store and retrieve information using Structured Query Language (SQL) statements



Enterprise Java Beans (EJBs)

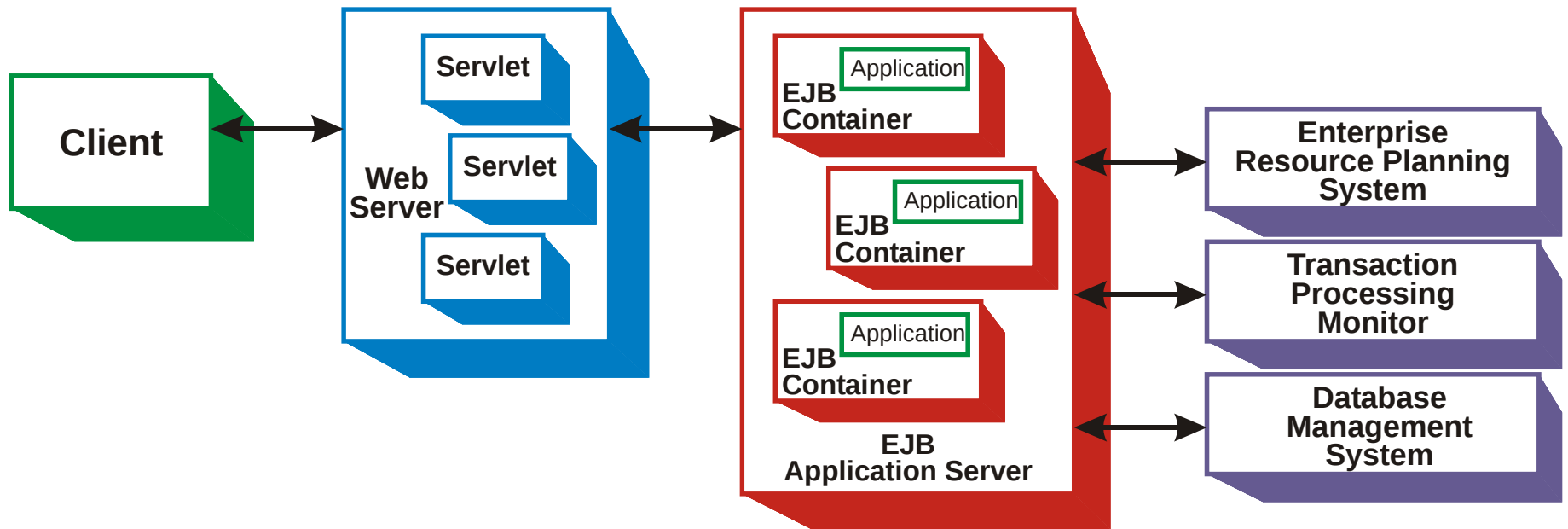
- Enterprise Java Beans (EJBs) are components that have properties, methods, and events by which they communicate with other beans
 - **set()** and **get()** methods assign and retrieve properties
 - **EventSource** and **EventListener** objects publish events and subscribe to receive events
- EJB containers provide services for the beans they contain, such as the following services:
 - Lifecycle
 - Security
 - Transactions



EJB Application Servers

- EJB application servers are server environments that typically provide
 - High-performance Web Server
 - EJB containers that provide services for the beans contained within them (see previous slide)
 - Integrated Development Environment (IDE) for building components and assembling applications from components
 - Interfaces to Database Management Systems, Transaction Processing Monitors, and Enterprise Resource Planning Systems
- Examples: IBM WebSphere, BEA WebLogic, Oracle 9I, JBoss (open source, free)
 - Sun acquired JBoss
 - Oracle acquired BEA and Sun

EJB Application Server Architecture



Web Services

- Web Services are Business-to-Business (B2B) services offered by one business application to other business applications over the World Wide Web
- In a typical Web Services scenario
 - A business application sends a request to a service at a given URL using the SOAP protocol over HTTP
 - The Web Service receives the request, processes it, and returns a response





Web Services Technology

■ eXtensible Markup Language (XML)

- Language that defines the syntax of Web Services documents so that the information in those documents is self-describing

■ Simple Object Access Protocol (SOAP)

- Protocol for the exchange of XML documents
 - What is required and optional in a SOAP message
 - How data are encoded and transmitted in a SOAP message

■ Web Services Description Language (WSDL)

- Language used to provide information about a Web Service, in XML, such as its name, operations that it supports, parameters for those operations, location to send requests

■ Universal Description, Discovery and Integration (UDDI)

- Registry that enables clients to find particular Web Services



Summary

- Networked computing is becoming more important and more widespread
- TCP/IP supports most forms of networked computing
- This quarter we will study various Java networked computing technologies in detail
- For each of these technologies, we will write networked computing programs in Java for a distributed e-healthcare application

Distributed e-Healthcare System

■ Some questions to be addressed

- Where and how should a person's health data be stored?
- Who has access to that health data? How do we protect the individual's privacy?
- What software do we need to implement for the patient? the physician? the pharmacist? who else?
- What Java networking technologies are most appropriate for different aspects of the distributed e-healthcare system?
- How do we make the system easy-to-use for the various parties involved?