IBD – Intergiciels et Bases de Données

Multi-tier distributed web applications

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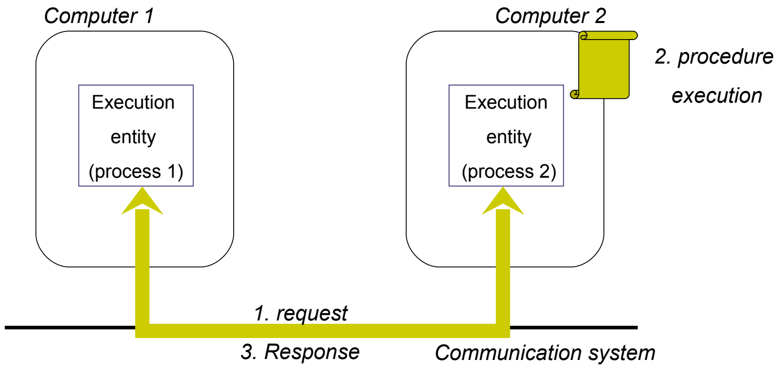
http://www-ufrima.imag.fr/ ⇨ Placard électronique ⇨ M1 Info ⇨ IBD

Overview of lectures and practical work

- Lectures
  - Introduction to distributed systems and middleware
  - Socket-based distributed systems
  - RMI-based distributed systems
  - Servlet-based distributed systems
  - JavaServer Pages for building distributed web applications
  - **Introduction to multi-tier distributed web applications**
- Practical work
  - Programming distributed systems with Sockets
  - Programming distributed systems with RMI
  - Programming distributed systems with Servlets
  - Project on multi-tier distributed web applications

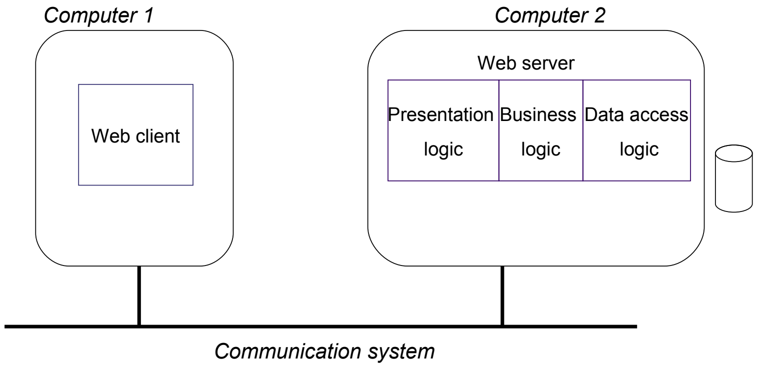
Client – Server



Motivations

- Processing a request on the server may successively involve several types of logic:
  - Data access logic
    - Example: read data from a persistent storage (e.g. a database)
  - Business logic
    - Example: use the read data to perform any application-specific processing
  - Presentation logic
    - Example: use the obtained result to build a user-friendly response to the client

Example 1



Computer 1

Web client

Computer 2

Web server

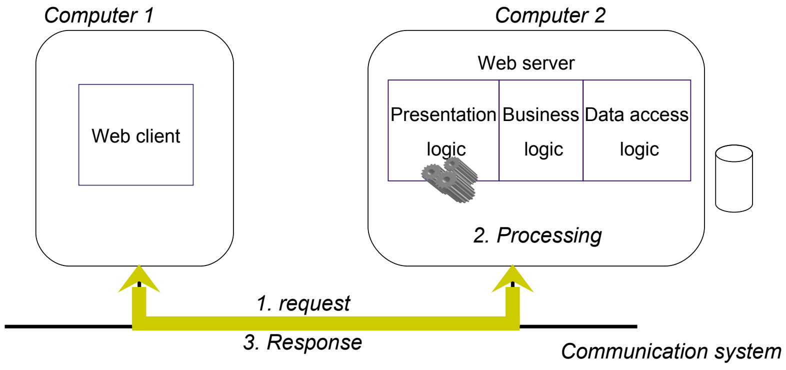
Presentation logic

Business logic

Data access logic

Communication system

Example 1



Computer 1

Web client

Computer 2

Web server

Presentation logic

Business logic

Data access logic

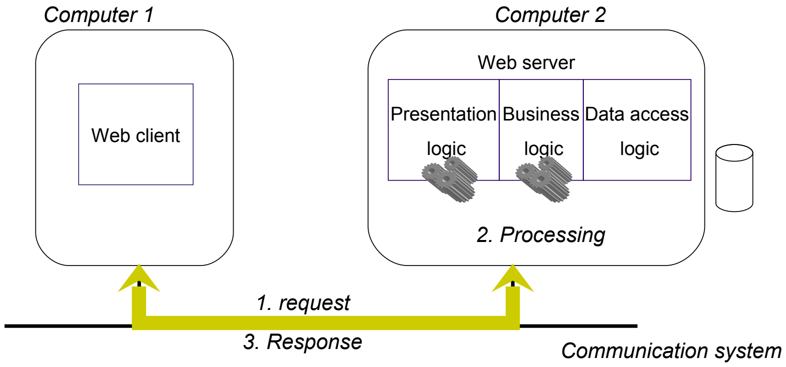
2. Processing

1. request

3. Response

Communication system

Example 2



Computer 1

Web client

Computer 2

Web server

Presentation logic

Business logic

Data access logic

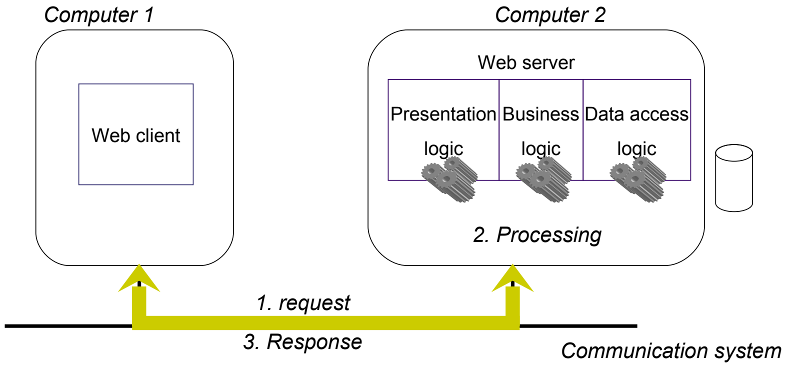
2. Processing

1. request

3. Response

Communication system

Example 3



Computer 1

Web client

Computer 2

Web server

Presentation logic

Business logic

Data access logic

2. Processing

1. request

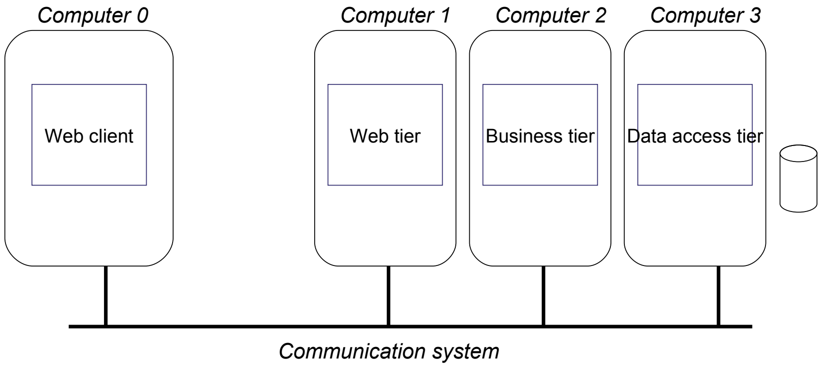
3. Response

Communication system

Motivations

- These types of logic may be more or less heavy in terms of processing time
- A unique server that hosts multiple types of logic may suffer from scalability issues in case of heavy workload (#concurrent web clients)
- Solution:
  - Separate the different types of logic in different servers
  - Multi-tier architecture

Overview of the multi-tier architecture



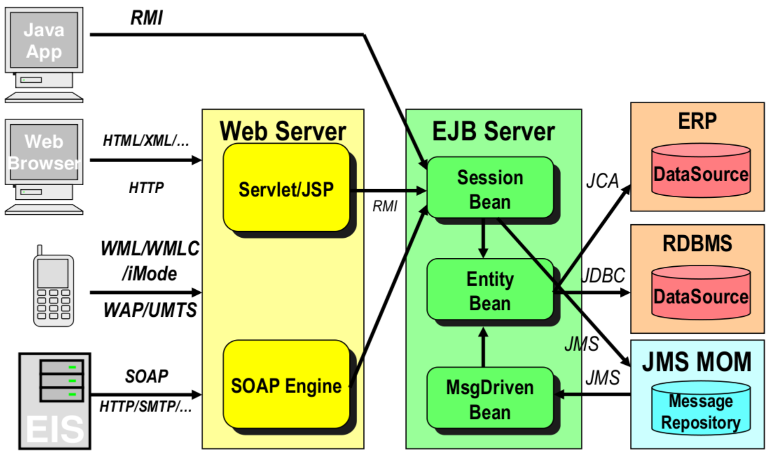
Multi-tier architecture

- Application servers
  - Goal: Simplify/Speed up business application development
  - Multi-tiers architecture
  - Host applications and provide them with services (persistence, security, ...)
- Java Enterprise Edition (formerly J2EE)
  - Developed by SUN since 1997
  - Based on Java
  - Many commercial/free implementations which may follow JEE specifications
    - Bea WebLogic,
    - IBM Websphere,
    - JBoss,
    - Jonas, ...

Multi-tier architecture (2)

- Web tier
  - Receives requests from web clients
  - Runs web components
  - May forward requests to the business tier
  - Returns web documents as responses (e.g. static HTML pages or dynamically generated web pages)
- Business tier
  - Receives requests from the web tier (may also be called directly)
  - Runs business components
  - May forward requests to the data access tier (through JDBC)
- Data access tier
  - Runs a database server
  - Receives requests from the business tier

Multi-tier architecture (3)



JEE multi-tier systems

- Web components
  - JEE web components are either servlets or pages created using JSP technology (JSP pages).
  - Servlets are Java programming language classes that dynamically process requests and construct responses
  - JSP pages are text-based documents that execute as servlets but allow a more natural approach to creating static content
  - Static HTML pages and applets are bundled with web components during application assembly

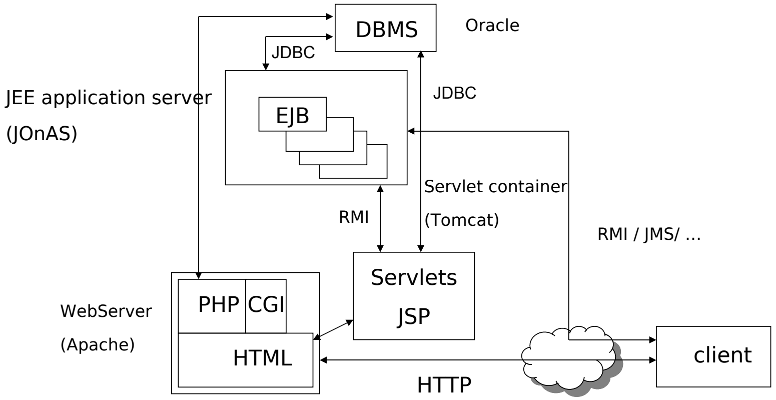
JEE multi-tier systems

- Business components
  - Meets the needs of a particular business domain
    - Ex: banking, retail, finance, ...
  - There are three kinds of enterprise beans: session beans, entity beans, and message-driven beans
  - Managed by an EJB container
    - Provides non-functional services
      - Lifecycle management
      - Persistence
      - Security
      - Transactions
      - ...
  - EJB may be distributed
  - EJB are invoked through different protocols (ex: RMI)

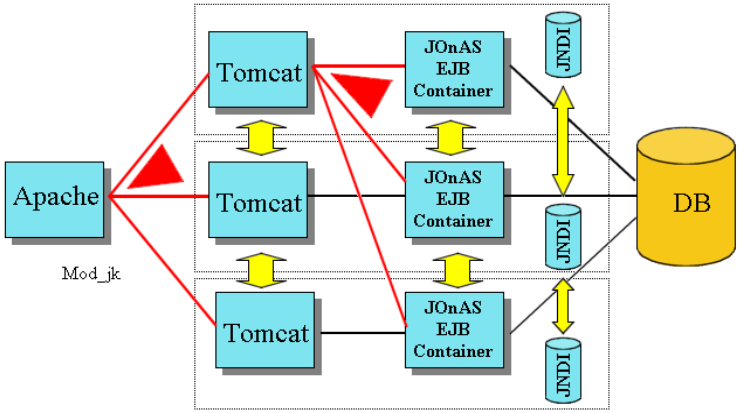
JEE multi-tier systems

- Business components
  - Session bean
    - Represents a transient conversation with a client (stateful or stateless)
    - When the client finishes executing, the session bean and its data are gone
    - Front-end to entity beans
  - Entity bean
    - Represents persistent data stored in the database.
    - Persistence may be managed by the bean or by the container
    - Concurrency is managed by the container
  - Message-driven bean
    - Combines features of a session bean and a Java Message Service (JMS) message listener.
    - Allowing a business component to receive JMS messages asynchronously.

A typical organization



Load balancing



Jonas Documentation

Incoming lectures and practical work on middleware

- Lectures
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  - Introduction to multi-tier distributed Internet services
- Practical work
  - Programming distributed systems with Sockets
  - Programming distributed systems with RMI
  - Programming distributed systems with Servlets
  - Project on multi-tier distributed web applications

References

- This lecture is extensively based on:
  - Sun Microsystems. The J2EE Tutorial http://java.sun.com/j2ee/1.4/docs/tutorial/
  - Jonas documentation http://wiki.jonas.objectweb.org/xwiki/bin/view/Main/WebHome
  - Courses given by D. Donsez http://membres-liglab.imag.fr/donsez/cours/
  - Courses given by S.Bouchenak http://sardes.inrialpes.fr/~bouchena/
  - Courses given by R.Lachaize http://sardes.inrialpes.fr/~rlachaiz