

# Middleware Architectures 1

## Lecture 4: Application Server Architecture

**doc. Ing. Tomáš Vitvar, Ph.D.**

tomas@vitvar.com • @TomasVitvar • <http://vitvar.com>



Czech Technical University in Prague

Faculty of Information Technologies • Software and Web Engineering • <http://vitvar.com/courses/mdw>



Modified: Mon Nov 01 2021, 13:16:18  
Humla v0.3

# Overview

- Application Server Architecture
- Distribution of Objects

# Application Server Overview

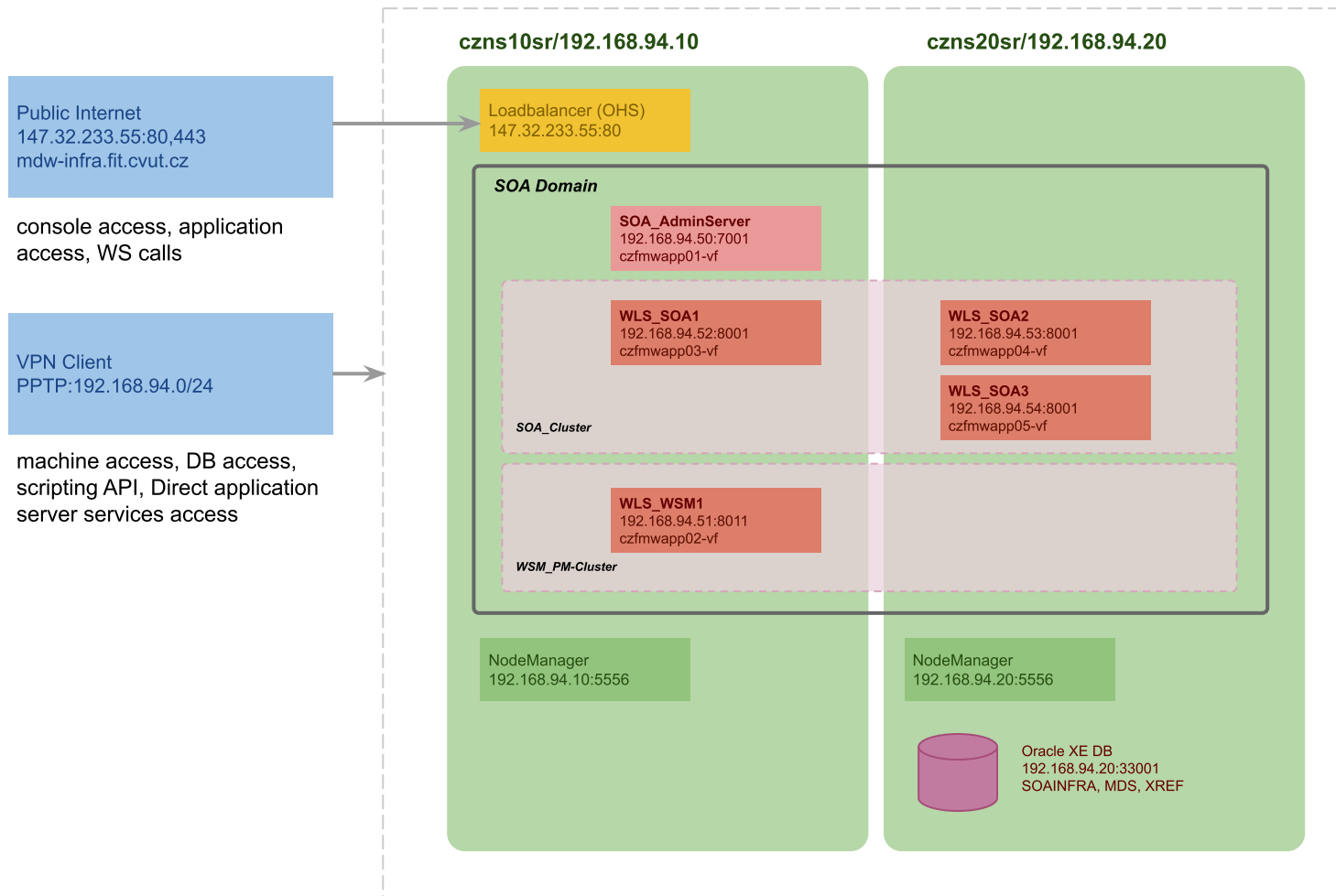
- An environment that runs an application logic
  - *A client communicates with the server using an application protocol*
- Application Server
  - *A modular environment*
    - *provides technology to realize enterprise systems*
    - *JEE containers – Java technology for AS components*
    - *Supports a variety of objects such as Servlets, JSPs, JMS*
  - *Provides services such as naming and directory, performance, failover*
  - *Provides Web server capabilities*
  - *Can be a single server or multiple servers*
- Web Tier – HTTP Server
  - *Web Server supports HTTP only*
  - *HTTP request/response, security, proxy, caching*

# Application Server Layers



- Features
  - *AS instance appears as a single process in the OS*
    - you can use standard OS commands to investigate its operation
    - AS listens on a single or multiple IPs (VIPs) and a tcp port
  - *AS is a Java process*
    - you can use Java tools to investigate its operation
    - Garbage collector stats, thread dumps, memory allocations, etc.

# Example Weblogic Infrastructure



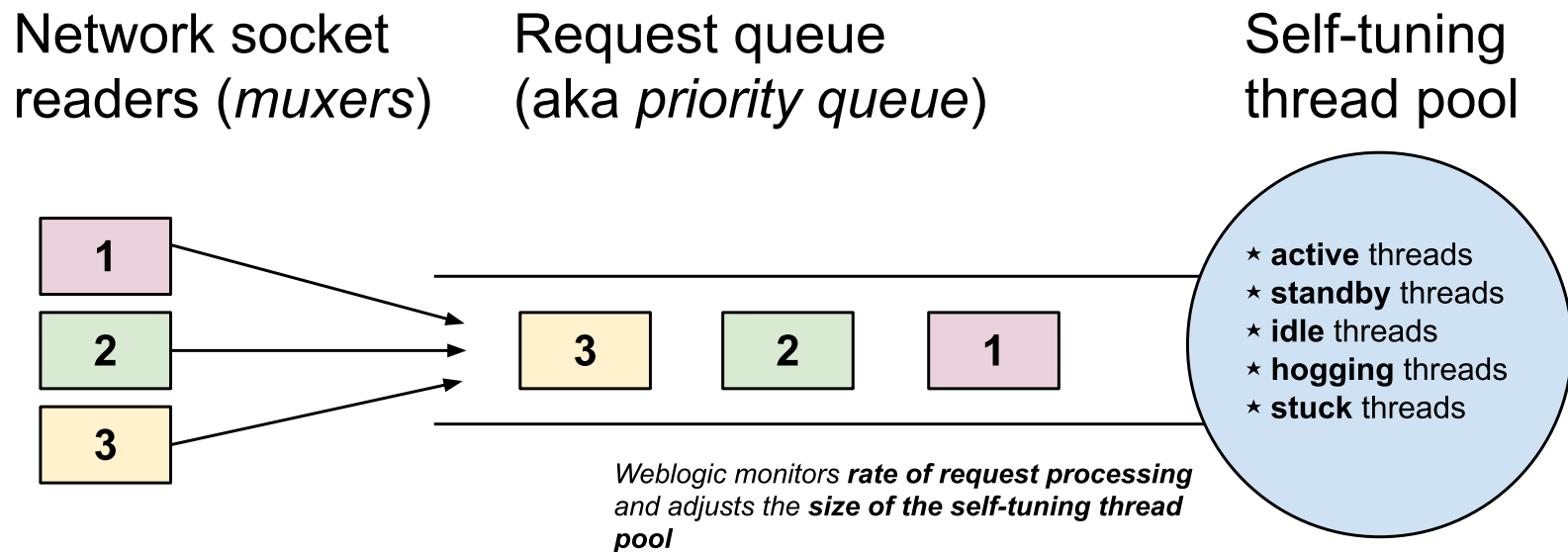
# Terminology

- Domain
  - *A group of servers with specific configuration of applications and objects*
- Administration Server
  - *An instance of application server that manages the domain*
- Managed Server
  - *An instance of application server running instances of applications and objects*
- Cluster
  - *A group of managed servers; they contain the same copy of applications and objects*
- Machine
  - *A physical machine and OS running one or more servers (Admin or Managed)*
- Node Manager
  - *A process that provides an access to admin and managed servers on the machine*
- Load Balancer
  - *A network element that distributes client requests to managed servers based on a specific algorithm*

# Servlet Technology

- Technology to extend application server functionalities
  - *A Java class that can respond to any type of requests*
    - *A servlet defines an interface for a specific protocol*
    - *Your application implements the servlet's interface*
- Commonly used to respond to HTTP requests
  - *A basis for an application running on an application server*
  - *HTTP Servlet Java classes*
    - **HttpServlet** – *provides HTTP protocol interface*
    - **HttpServletRequest** – *represents HTTP request*
    - **HttpServletResponse** – *represents HTTP response*

# Handling Requests in Weblogic



- **Muxer** – component that handles communication via network sockets.
- **Request queue** – queue of requests to be processed.
- **Self-tuning thread pool** – a pool of threads in various states.
- **Work manager** – a configuration of **maximum threads** and a **capacity** that can be used to handle requests for a specific application/service.



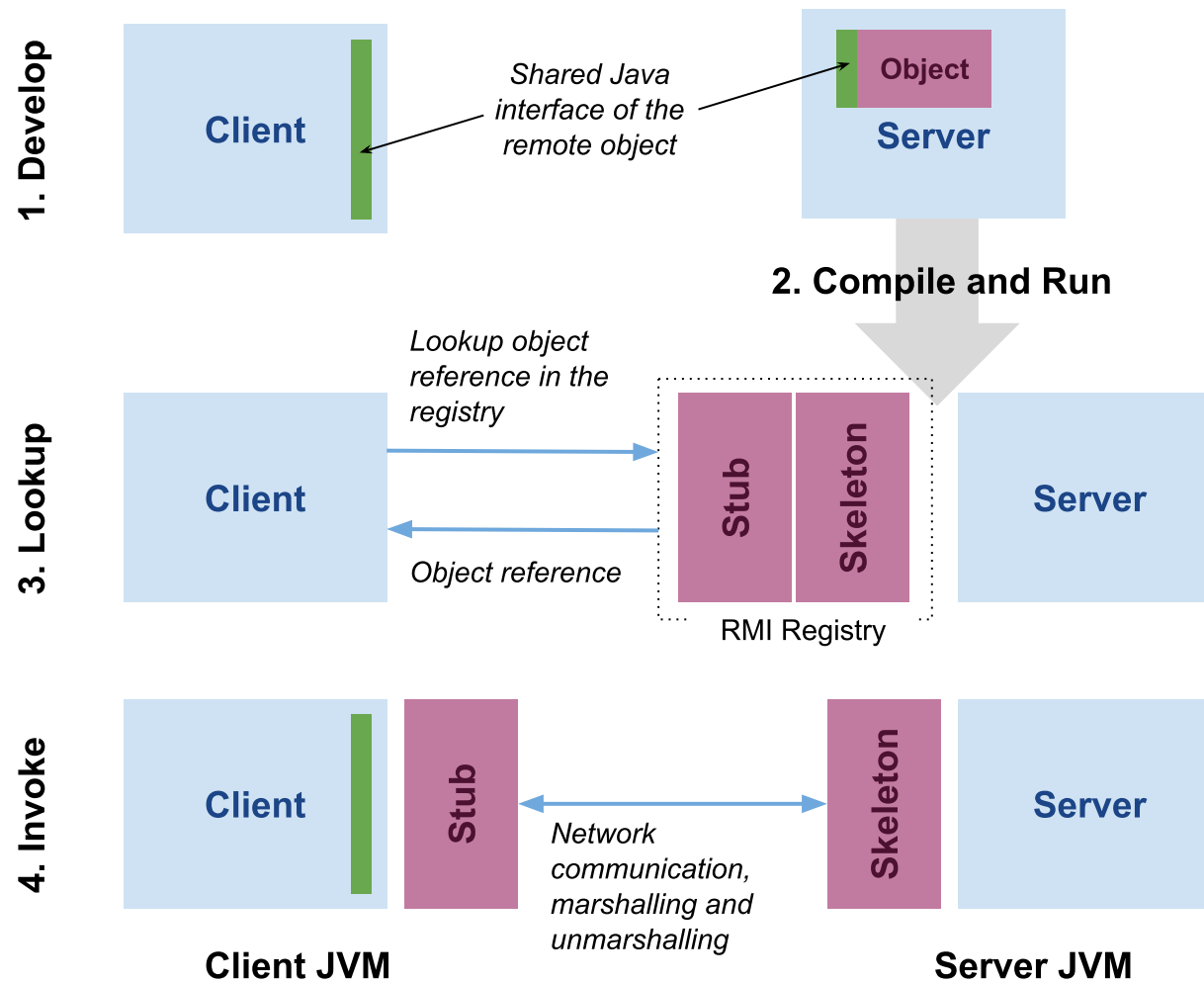
# Overview

- Application Server Architecture
- Distribution of Objects

# Remote Method Invocation

- Communication among Java-based applications
  - *Methods of a Java class can be invoked by other Java class remotely*
  - *Uses Java Remote Method Protocol (JRMP)*
    - *Java-specific application protocol over TCP/IP*
  - *Basis for JEE technologies, such as JMS*
- Terminology
  - ***Client*** – *a program that invokes a remote method*
  - ***Server*** – *a program that exports a remote object*
  - ***Stub*** – *a representation of the client-side object for communication*
  - ***Skeleton*** – *a representation of the server-side object for communication*
  - ***Registry*** – *a component that holds a stub*
  - ***Marshalling/Unmarshalling*** – *a process of transforming memory representation of the object to a form suitable for network transmission and vice-versa*

# RMI Stubs and Skeletons



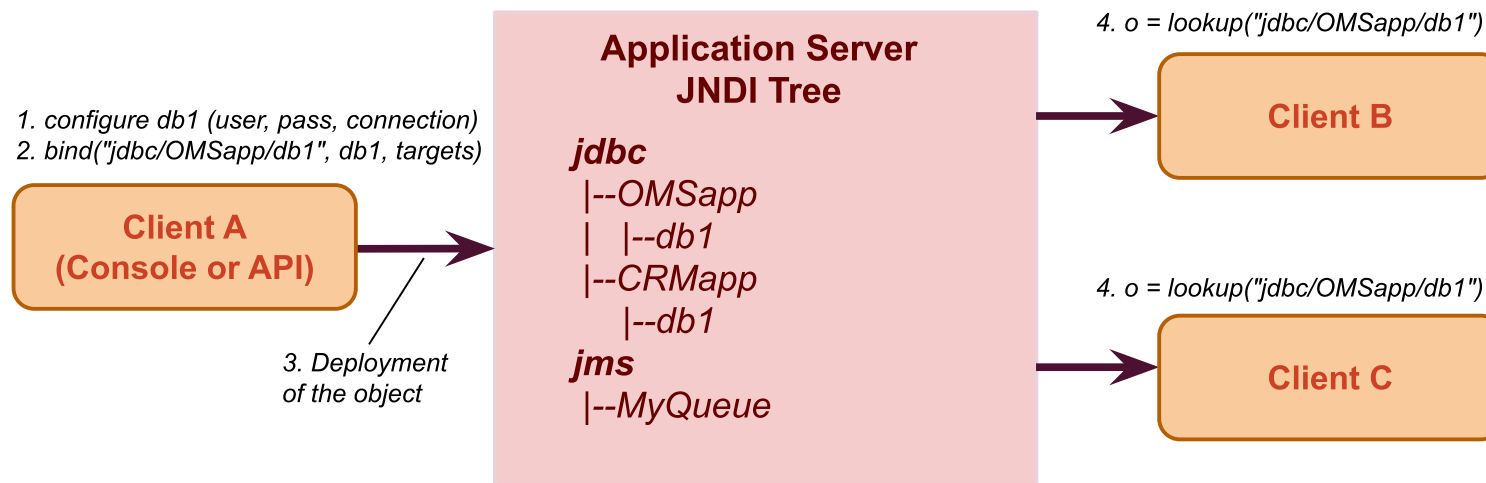
# Java Naming and Directory Interface

- Objectives
  - *Allows to access objects by names in various directory systems and their attributes*
  - *Independent of any specific directory service implementation*
  - *Enables to distribute Java objects across various systems in the environment*
- Terminology
  - *Binding – association between a name and a object*
  - *Context – a set of bindings*
- JNDI Provides:
  - *a mechanism to bind an object to a name.*
  - *a directory lookup interface*
  - *a pluggable service provider interface (SPI) – any directory service implmentation can be plugged in*

# Application Server and JNDI

- Distribution of objects
  - *Application Server provides central directory for various kinds of objects*
    - *Datasources, JMS queues and topics, etc.*
  - *Clients store objects in the central directory*
    - *Administrator configures objects using Application Server Console or via AS API*
  - *Clients retrieve objects from the central directory*
- Benefits
  - *replication of objects across clients*
  - *central configuration of objects' parameters*
  - *scalability – allowing/disabling connections as required*

# JNDI Example

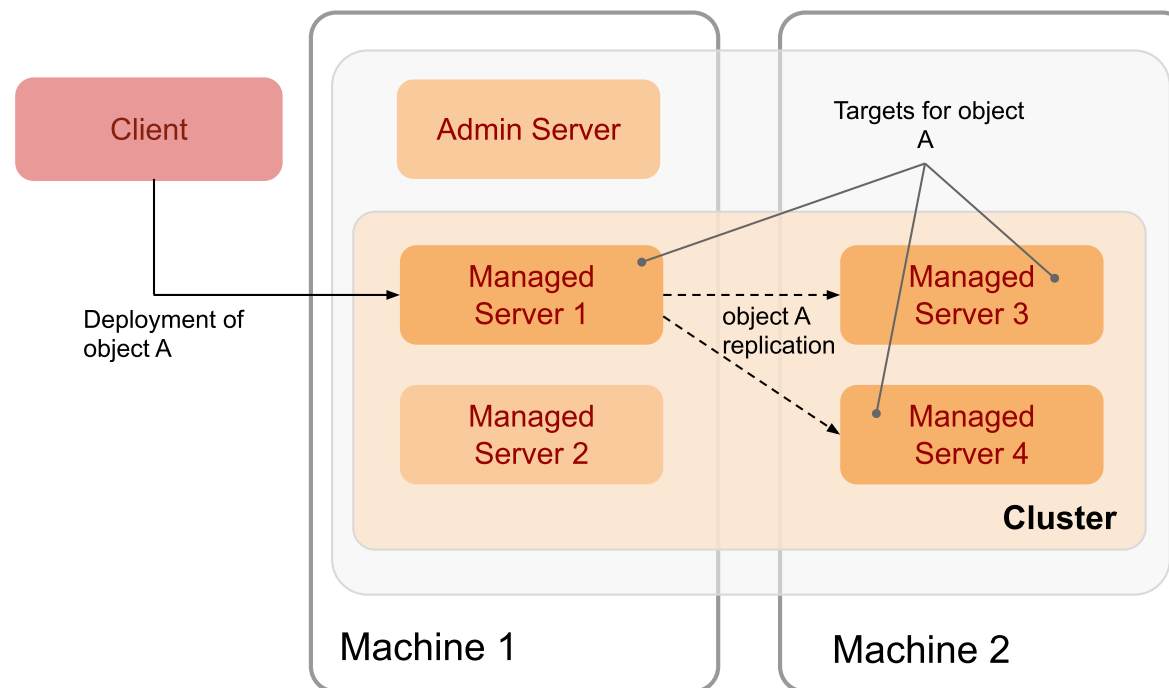


- Example Scenario

- Client A creates a datasource, configures it and registers it in the JNDI tree
  - Client A is a Admin server console app
- Client B and C lookup the object under specific JNDI name and retrieves the object from the tree
  - They get the object from the tree and use it to connect to the DB
  - They do not need to know any DB specific details
  - The object is pre-configured from the server

# Deployment to Cluster

- Deployment of an object
  - Client deploys to one managed server in the cluster
  - Object gets replicated to its targets
    - Targets can be configured for the object, usually all servers but can be selected servers



# Cluster-wide JNDI Tree

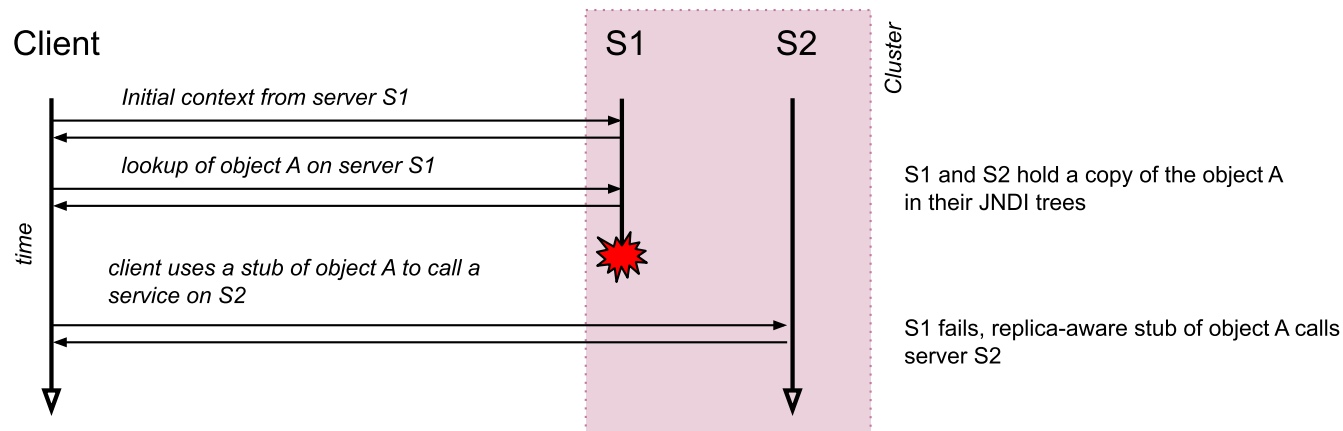
- Cluster
  - *Every managed server has its own JNDI tree*
  - *Servers in a cluster sync up their JNDI trees as per the target configuration*
    - *A stub of the object appears in every managed server's JNDI tree*
    - *They use JNDI replication service*
- When a client retrieves an object from the tree
  1. *Client connects to the cluster using the cluster address*
  2. *Client creates an initial context (represents a naming service)*
  3. *Client uses the initial context to lookup objects*
  4. *Client uses the stub of the object to call the service*



# Object Failover

- Failover
  - *Failover = ability to locate an object on another server that holds a copy of the object without impact on the performance and configuration*

## Replica-aware stub of object A, failover in cluster



- A client gets a stub of the object by calling **lookup** on the context
- A client uses the stub of the object to access the object on the server
- When a server fails, **replica-aware stub** calls the next server that holds the object copy