Middleware Architectures 1

Lecture 5: Application Server Architecture

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Overview

- Application Server Architecture
- Serving Requests
- Objects Distribution

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

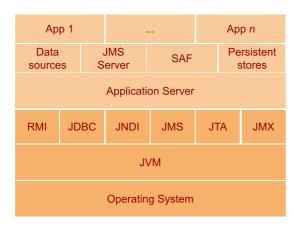
Web Tier – HTTP Server

- Web Server supports HTTP only
- HTTP request/response, security, proxy, caching

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- 3 -

Application Server Layers



console app, custom-built Web app, middleware apps

shared services used by applications - data sources, JMS queues, JCA adapters

Application Server core libraries, communication management, cluster communication, distributed cache

Java Technology

Java environment, memory management, garbage collection

OS services, I/O

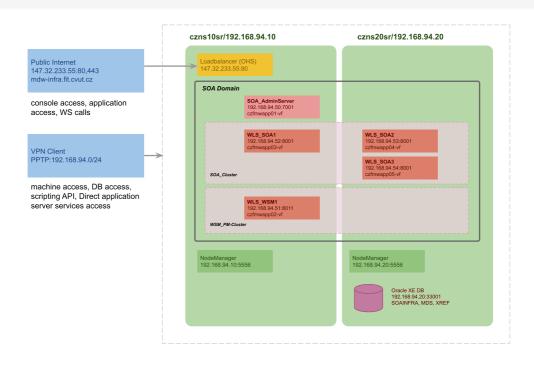
Features

- 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 multipe 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.

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- 4

Example Weblogic Infrastructure



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- 5 -

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

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- 6

Servlet Technology

- Technology to extend application server functionalities
 - A Java class that can respond to any type of requests
 - \rightarrow 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
 - \rightarrow HttpServlet provides HTTP protocol interface
 - \rightarrow HttpServletRequest represents HTTP request
 - \rightarrow HttpServletResponse represents HTTP response

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-7-

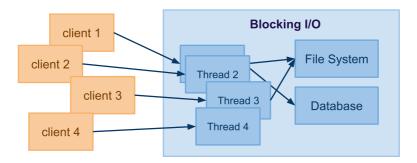
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- 8

Blocking (Synchronous) I/O



Inbound connection

- A server creates a thread for every inbound connection
- For example, 1K connections = 1K threads, big overhead
- A thread is reserved for the entire duration of the request processing

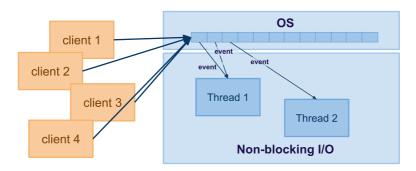
Outbound connection

- A thread is blocked when outbound connection is made
- When outbound connection is slow, the scalability is poor

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- 9 -

Non-Blocking (Asynchrnous) I/O



Inbound connections

- The connection is maintained by the OS, not the server app
- The Web app registers events, OS triggers events when they occur
- The app may create working threads and controls their number

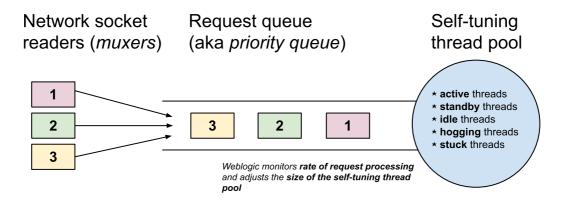
Outound connections

- The app registers a callback that is called when the data is available
- Event loop

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– 10 –

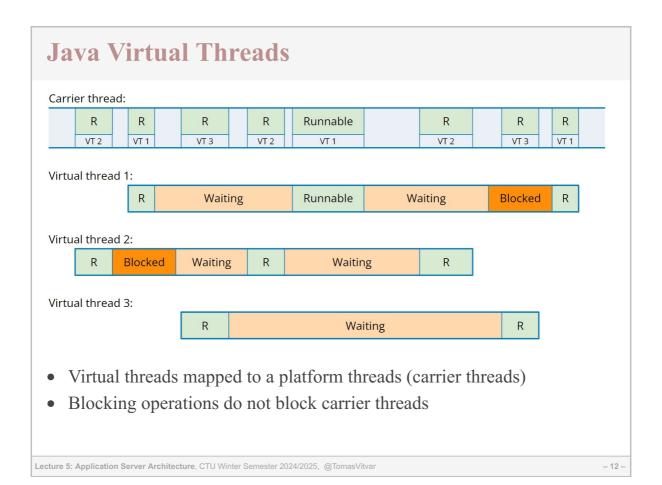
Components



- Muxer component that handles communication via network sockets.
- **Request queue** queue of requests to be processed.
- **Self-tunning 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.

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- 11 -



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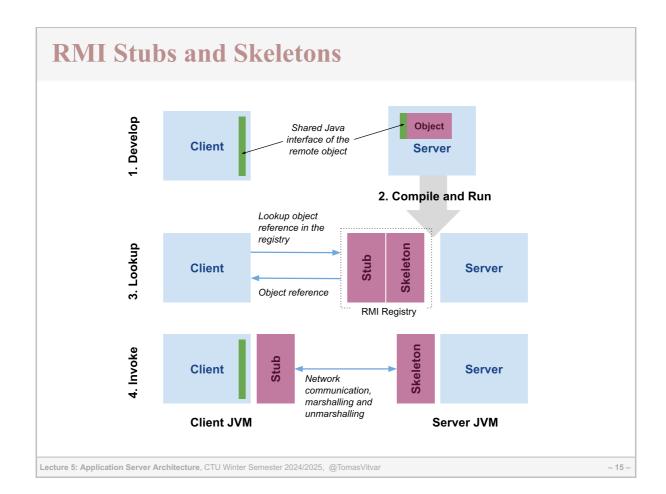
- 13 -

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 transmittion and vice-cersa

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– 14 -



Java Naming and Directory Interface

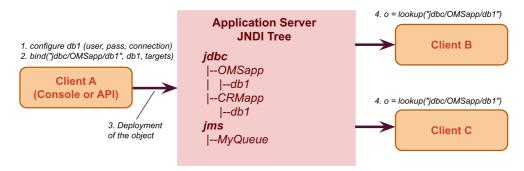
• Distribution of objects

- Application Server is a central directory for various objects
 - \rightarrow Datasources, JMS queues, etc.
- Clients store objects in the central directory
 - → Administrator configures objects using a console or 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 registeres 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
 - \rightarrow 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
 - \rightarrow The object is pre-configured from the server

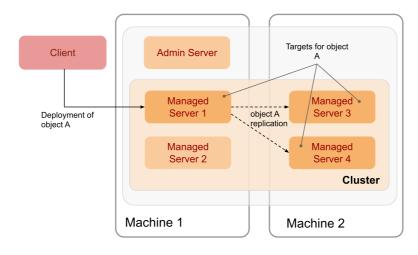
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- 17 -

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



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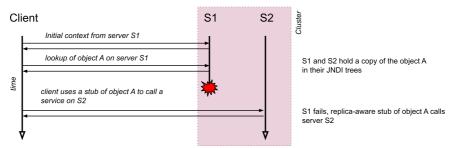
– 18 –

Object Failover

• Failover

- Failover = ability to locate an object on another server that holds a copy of the object without impact on the performace 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, **replicate-aware stub** calls the next server that holds the object copy

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– 19 –