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Lt. Shree Chimanbhai Shukla

BCA SEM -5 J2EE

Shree H.N.Shukla College
Campus,
Street No. 2, Vaishali Nagar,
Nr. Amrapali Under Bridge,
Raiya Road, Rajkot.
Ph. (0281)2440478, 2472590

Shree H.N.Shukla College Campus,
Street No. 3, Vaishali Nagar,
Nr. Amrapali Under Bridge,
Raiya Road, Rajkot.
Ph. (0281)2471645

Website: - www.hnsgroupofcolleges.org
E-Mail :- info@hnshukla.com

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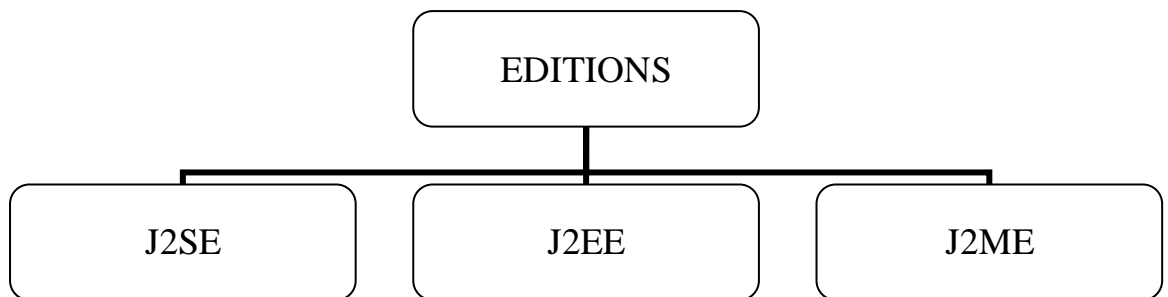| NO	CHAPTER NAME	CONTENT
1.	The J2EE Platform, JDBC (Java Database Connectivity)	(1)Introduction to J2EE (2)Enterprise Architecture Styles: Two-Tier Architecture Three-Tier Architecture N-Tier Architecture (3)Enterprise Architecture (4)The J2EE Platform (5)Introduction to J2EE APIs (Servlet, JSP, EJB, JMS, JavaMail, JSF, JNDI) (6)Introduction to Containers (7)Tomcat as a Web Container (8)Introduction of JDBC (9)JDBC Architecture (10) Data types in JDBC (11) Processing Queries (12) Database Exception Handling (13) Discuss types of drivers (14) JDBC Introduction and Need for JDBC (15) JDBC Architecture (16) Types of JDBC Drivers (17) JDBC API for Database Connectivity (java.sql package) (18) Statement, PreparedStatement (19) CallableStatement (20) ResultSetMetaData (21) DatabaseMetaData (22) Other JDBC APIs (23) Connecting with Databases (MySQL, Access, Oracle)

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Chapter -1 The J2EE Platform, JDBC (Java Database Connectivity)

Topic:- Introduction to J2EE:

Trailer:- (Only For Understanding)

(1) J2ee kya he aur kis liye use hota he .
(2) Kitne editions Java language me hote he.

Details:- (For Exam)

```
              ┌──────────────┐
              │  EDITIONS    │
              └──────┬───────┘
         ┌───────────┼───────────┐
    ┌────┴────┐  ┌───┴────┐  ┌────┴────┐
    │  J2SE   │  │  J2EE  │  │  J2ME   │
    └─────────┘  └────────┘  └─────────┘
```

J2EE stands for Java 2 platform Enterprise Edition.

It is used to develop multi tier architecture based applications. It is used to reduces the cost and complexity of developing multi-tier services.

It can be rapidly deployed and easily enhanced as the enterprise responds to competitive pressures. J2EE is an open standard which is provided by Sun Microsystems for application which run on servers.

It provides multi-tired architecture for commercial applications.

J2EE is used in order to maintain Speed, Security and Reliability of Server-Side technology.

It includes J2SE+ most of the other java technologies including JavaMail, Servlets, JSF, JMS, EJB and others. Most of the API is component- oriented.
They are used to provide interfaces for business oriented components for enterprise and distributed internet applications.

Java has emerged as one of the most of the mature and commonly used programming language for building enterprise software.

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- **Java - Three Platform/Editions:**

1. **J2SE** – stands for Java 2 Standard Edition and is normally used for Desktop Applications

2. **J2EE** - stands for Java 2 Enterprise Edition for applications which run on server. For example: Web Site/Web Applications.

3. **J2ME** - stands for Java 2 Micro Edition for applications which run on small scale devices like cell phones .for example: games

Students Outcomes:- Aware about java and its different editions and which edition is used for which purpose.

1 word Question Answer		
Sr. No.	**Question**	**Answer**
1.	J2SE stands for?	Java 2 Standard Edition
2.	J2EE stands for?	for Java 2 Enterprise Edition
3.	J2ME stands for?	Java 2 Micro Edition
4.	How namy Editions of Java?	3
5.	J2EE is used for?	Reduce complexity and cost of developing the application
6.	J2EE developed by _____	Sun Microsystem
7	J2EE provide feature like	Speed, security, realibility
8	EIS stands for?	Enterprise Information System

Topic :- Enterprise Architecture Types:

Trailer:- (Only For Understanding)

(1) Koy bhi software banta he to kitne layers hote he aur wo kese ekdusre ke sath connect hote he.

(2) Software banane ke liye architectures kese banate he.

(3) Client tier, Middle tier and Database tier ki jankari aur working area milega.

Details:- (For Exam)
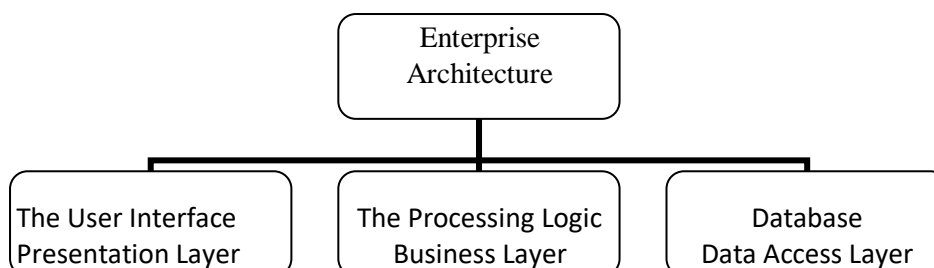
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A Software application composition can be broken down into three fundamental logical layers, The User Interface, The Processing, and Data.

1. The User Interface/ Presentation Layer
2. Processing Logic/Business Layer
3. Database/ Data Access Layer

1. The User Interface / Presentation layer:

This is Responsible for displaying interface to the user and collecting data from the user. Often called as the Presentation Layer. Its job is to presents stuff to the user and provides to the software system.

2. The Processing / Business layer:

In this layer, the application works and handles the important processing. The logical layer is called the business rules layer.

3. Database / Data Access Layer:

To read and store the Data. The part of the Software that is responsible for reading and writing data from whatever source is known as Data Access Layer.

There are four types of architecture which are as follows.

- Single-Tier Architecture
- 2 -Tier Architecture
- 3-Tier Architecture
- N-Tier Architecture

The Single Tier Architecture:

Simple Software application is written to run on a single computer such architecture is called as Single tier architecture. Because all of the application presentation, the business rules and the data access layer exit in a single computing layer.

Advantages:

Single tier system is relatively easy to manage and data consistency is simple because data is stored at only one place.

Disadvantages:

-> Now a day's single location is not sufficient because of changing business needs.
-> We can not share the data in large amount
-> It can not handle multiple users.

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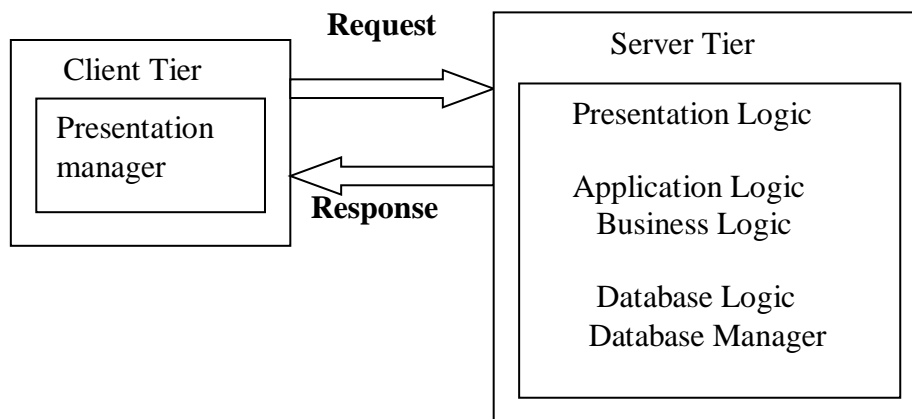|	
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2-Tier Architecture:

Application which is divided into two separate tiers Client machine and database Server machine called as Two Tier Architecture.

This is the traditional method of enterprise development. It includes presentation and business logic. In a 2-Tier application the processing load is given to the client while to the server simply controls the Traffic between the application and the Data.

Thin Client:

With 2 tier architecture, if the presentation manager resides only with client tier then the client is called as thin client.
other presentation logic, application logic, business logic, database logic and database manager resides with the server side.

Thick Client:

With 2 tier architecture,if the presentation manager, presentation logic, application logic resides with the client side then the client is called as thick client other like business logic,database logic and database manager resides with the server side.
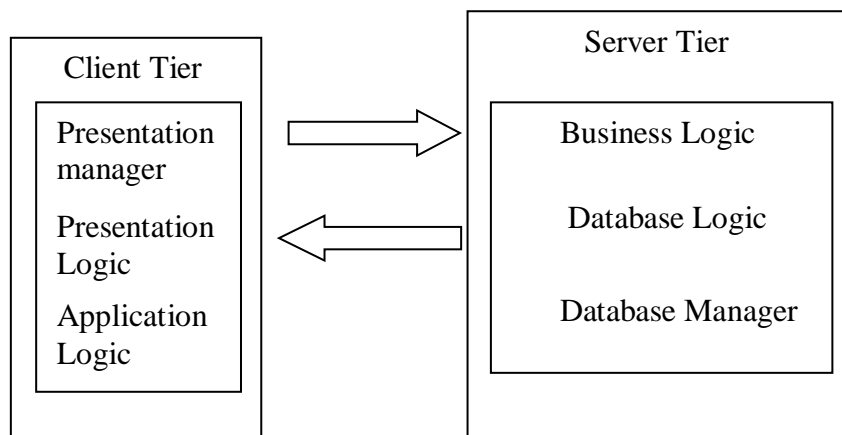
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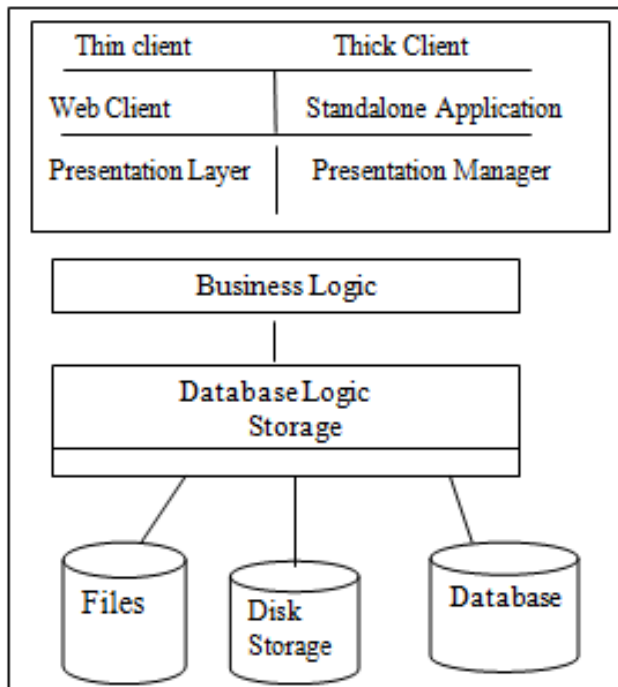| **2- Vaishali Nagar**	**3 – Vaishali Nagar**
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Advantages:

Any changes made in data access logic will not affect the presentation and business logic. With 2 tier architecture it is easy to develop an application.

Disadvantages:

- In case of limited resource pc, the performance would be suffered due to pc resources.
- It supports a lmited number of users.
- Each client requires its own connection and each connection requires CPU and memory.
- As number of connection increase, the database performance decrease.
- If the application requires more than one database request at a time it is not possible for the server to manage it.
- This architecture requires high maintenance.
- When the data is shared among various users, it will caused problem what is to be displayed to which user regarding the latest data.

3 –Tier architecture:-

Fig: 3 tier architecture

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Application which is divided into 3 tier namely Client tier, middle tier, and database tier is known as Three Tier Architecture.

Logic physically separates the business rules. Presentation layer and logic runs on Client machine, application and business logic runs on J2EE server and database logic is there with database layer.

Thin Client:
With 3 tier architecture,if the presentation manager resides only with client tier then the client is called as thin client, other presentation logic,application logic,business logic,database logic and database manager resides with the EIS tier(databse).

Thick Client:

With 3 tier architecture,if the presentation manager,presentation,application logic resides with client tier then the client is called as thick client.
Business logic is only with the business tier.
Database logic and database manager resides with the EIS Tier(database).

Advantages:

- It improves scalability since the application can be deployed on many machines.
- The database no longer required a connection from every client-it only requires connections from a smaller number of application server.
- It provides better reusability because the same logic can be initiated from many client or applications.
- It provides security because client does not have direct access the database.

Disadvantages:

It increases the complexity because to develop the 3 tier application is more difficult than developing a 2 tier application.

- ## **N-Tier Architecture:-**

An application which is divided into more than 3 tier can be called as N Tier architecture.In N tier architecture it is not decided how many tiers can be there,it depends on computing and network hardware on which application is deplolyed.

Basically it is divided into four layers: Application layer, Client tier, business tier (EJB) and database tier (EIS).

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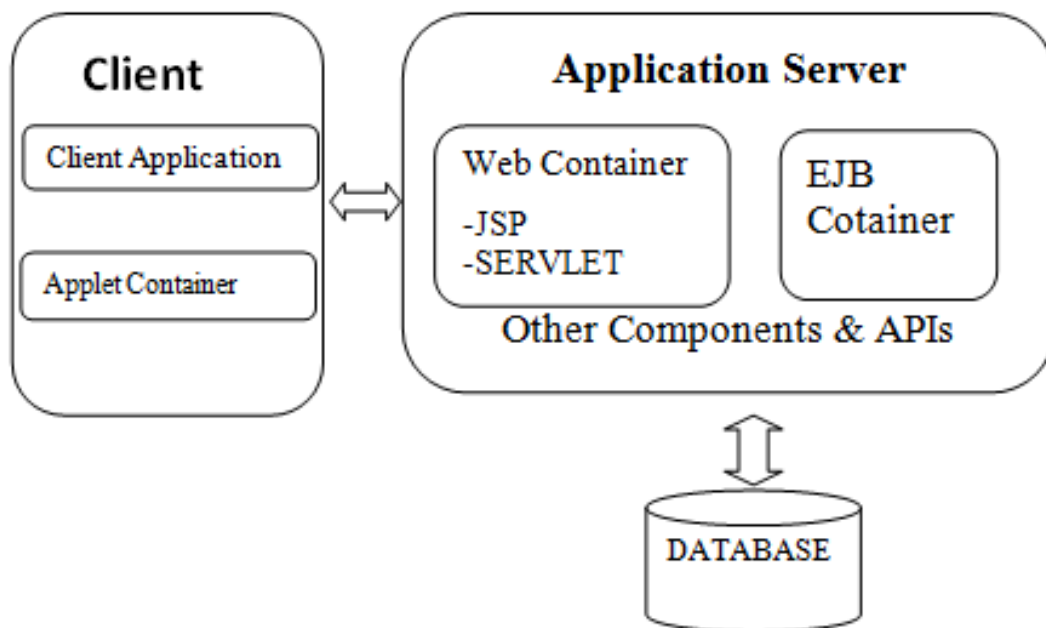|	
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Client Tier:

It consists of the user interface for user request and print the response.It runs on client machinme .It basically uses the browser or applet as client side application.

Web Tier:

It consists of JSP and Servlet dynamic webpages to handle HTTp specific request logons, sessions, accesses the business services and finally constructs response and send back to the client.

Business Tier:

It consists of the business logic for the J2EE application .For Example: EJB (Enterprise Java BeanS) the benefit of having a centralized business tier is same business logic can support different type of client like browser, WAP, other stand alone application.

EIS Tier (Database Tier):

It consists of the DBMS/RDBMS. It handles the users SQL request and generates appropriate response based on queries.
It also stores all persistent data in the database.

J2EE is based on N tier architecture application. J2EE makes easy to develop the Enterprise application based on 2, 3, more application layers. Here it also proves that J2EE is distributing computing framework and multi-tiered application.

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- **Advantages**

  1) Improved maintainability   4) Provides consistency
  2) Interoperability   5) Flexibility
  3) Scalability   6) Security

- **Disadvantages**

  It is having complex structure and difficult to setup and mainjtain all separated layers.

Students Outcomes :- Here the students can aware about different architectures of software development methods. How internal mechanism and layers are interconnected and responsibilities of different layers and tiers.

Topic:- Enterprise Architecture of J2EE

Trailer:- (Only For Understanding)

(1) J2EE internal kese kam karta he means J2EE ka architecture kesa he aur wo kon sa architecture follow karta he.

Details:- (For Exam)

The architecture of J2EE platform uses a multi-tier distributed application model. The application logic, according to the function will be divided into different component and application components make up a J2EE application.
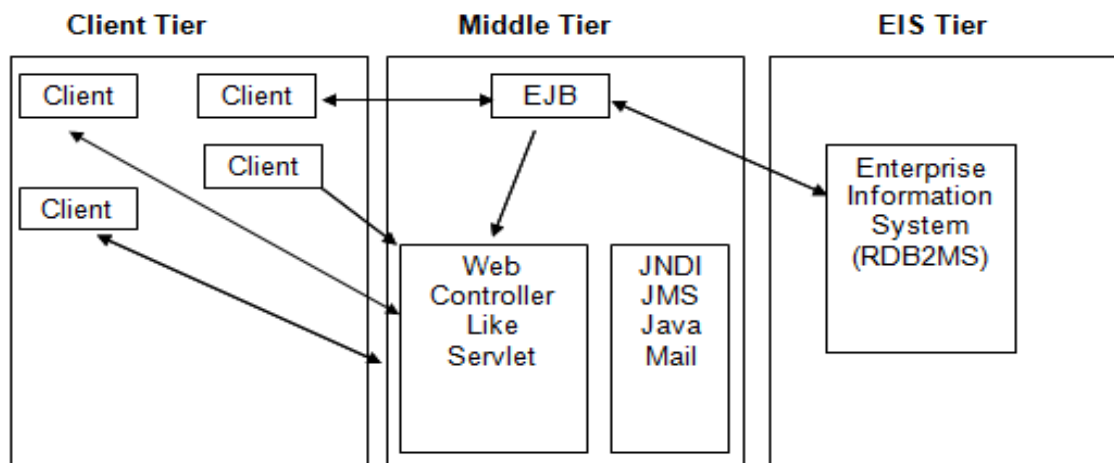
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The J2EE application consists of three or four tier.J2EE multi-tier application because the architecture has defined three tiers namely client-tier, middle tier and back end tier.

Client Tier:

It consists of the user interface for user request and print the response.It runs on client machinme .It basically uses the browser or applet as client side application.

Middle Tier:

It consists of Web container with JSP and Servlet dynamic webpages to handle HTTP specific request login, sessions, accesses the business services and finally constructs response and send back to the client.

It consists of EJB container which handles Enterprise Java Beans and applications to works with clients.It consists of the business logic for the J2EE application.

EIS Tier (Database Tier):

It consists of the DBMS/RDBMS. It handles the users SQL request and generates appropriate response based on queries.

It also stores all persistent data in the database.

1 Word Question Answer		
Sr. No.	**Question**	**Answer**
1.	Which layer Responsible for displaying interface to the user and collecting data from the user	User interface
2.	The other name of user interface is?	Presentation Layer
3.	The logical layer is also called?	Business rules layer
4.	The part of the Software that is responsible for reading and writing data from source?	Data Access Layer
4.	Simple Software application is written to run on a single computer such architecture is called as?	Single tier architecture
5.	In which system is relatively easy to manage and data consistency is simple?	Single tier architecture
6.	Application which is divided Client machine and database Server machine called as?	Two Tier Architecture
7.	With 2 tier architecture, if the presentation manager resides only with client tier then the client is called as?	Thin client
8.	In which architecture number of connection increase, the database performance degrades?	Two Tier Architecture
9.	In which architecture the database no longer	3- tier Architeture

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	required a connection from every client-it only requires connections from a smaller number of application server?	
10.	In which architecture client does not have direct access the database.?	3- tier Architeture
11.	which architecture called N tier architecture?	An application which is divided into more than 3 tier
12.	EJB stands for?	Enterprise Java BeanS
13.	JSP stands for?	Java Server Pages

Students Outcomes :- Here the students are going to be familier with J2EE real application or web interface structure.

Topic:- J2EE Components:

Trailer:- (Only For Understanding)

(1) J2EE me program banane ke liye kon kon se component milte he aur wo kon sa component kis use me aata he uski jankari yaha pe milegi.

Details:-

J2EE has been developed with a group of various components. With the help of these components our programs will work on internet.

[1] J2EE Runtime:-

The J2EE architecture provides the uniform mean of accessing platform level services via its runtime environment such services includes messaging, security, distributed transaction etc. The runtime infrastructure of it specifies the role and interface for the application and the run time on which the application could be deployed.

[2] J2EE API:-

In the enterprise services, the distributed services require access. These enterprise services include fraction processes, managing, multi-threading, database access to such services in its services APIs. The application programs in the J2EE can access there APIs through the container.

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Topic:- J2EE API: (Most IMP)

[1] Java Database Connectivity(JDBC 2.0) :-

The jdbc API lets you invoke SQL commands from the java programming method. This API is useful to connect our java database application with any relational database like ORACLE, MYSQL, MSACCESS.

[2] EJB :- (Enterprise Java Beans)

An enterprise beans is a body of code with field and method to implement modules of the business log. An enterprise bean can be considered as building block that can be used along or with other enterprise beans to execute business logic on J2EE server. It is useful to define server side component .

There are kinds of enterprise beans.

1). Session beans.
2). Entity beans.
3). Message beans.

[3] Java Servlet (JS)(2.3) :-

This API is used for building dynamic web application. The Java servlet technology lets you to define the http specific servlet classes. A servlet class extends the capability of server that host the application.

[4] Java Server Page(JSP 2.1) :-

This API provides easy way for building dynamic web application. The JSP technology allows you to combine java programming language code with static markup text based documents.

A JSP page is a document which contains two types of text.

- Static template data in text based format like html, xml.
- JSP elements that determine how the page constructs the dynamic contain.

[5] Java Server Faces (JSF) :-

JSF is the relatively the new technology that attempts to provide a rich user interface for the web application used in conjunction with servlet and JSP.

[6] Java Message Services (JMS 1.1) :-

The JMS API is a messaging standard that allows J2EE application components to create, send, receive and read messages.

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[7] Java Transaction API (JTA 1.0) :-

The JTA API provides the interface for the transaction. The J2EE architecture provides a default auto-commit. It is used to handle the transaction commit and roll back operation.

[8] Java Mail API (1.3) :-

Many application need to send e-mail notification for that J2EE platform includes the Java Mail API.

Java Mail Service provider allow application component can use to send an internet e-mail.

It has two parts.
- An application level interface used by the application to send mails.
- A services provider interface.

[9] Java Naming and Directory Interface (JNDI) :-

JNDI provides the naming & directory functionality. It provides the application with the methods for performing standard directory operations such as a J2EE application can store & receive any type of named java object.

Students Outcome:- Here students are very much aware with different APIs of J2EE. Appilcation Programming Interface (API) tools are very much helpful for performing different logics.

Topic:- CONTAINERS:

Trailer:- (Only For Understanding)

(1) J2ee application and web store karne ke liye jo space rakhta he use container kahete he to wo kitne types ke he uski jankari yaha pe he.

Details:- (For Exam)

- **Introduction to J2EE Containers :-**

Definition:

Containers are interface between a component and client.
It is a platform or place which sotres and supports component.
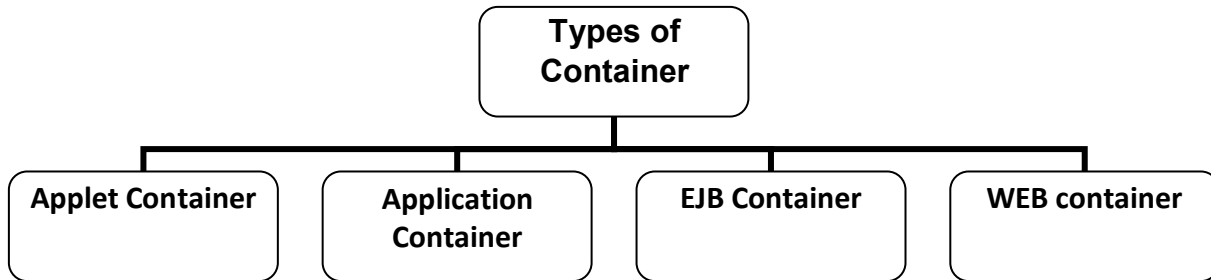Container provides communication platform between client and component.

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Containers are the central thing of J2EE architecture container are like the rooms in house, people and thing exists in a room and interface with the infrastructure through well defined interface.

```
                      Types of
                      Container

Applet Container   Application    EJB Container   WEB container
                   Container
```

Applet Container: Applet Container is a client container which is used to manage an execution of the applet on the browser.

Application Container: Application Container is a client container which is used to manage application client and their container.

EJB Container: EJB Container is a server container which is used to manage Enterprise bean component.

WEB container: WEB container is a server container which is used to manage an execution of the JSP and Servlet Components.

Students Outcomes:- Container is a platform or interface in which all components resides and stores. Four types of containers are there for storing different types of components.

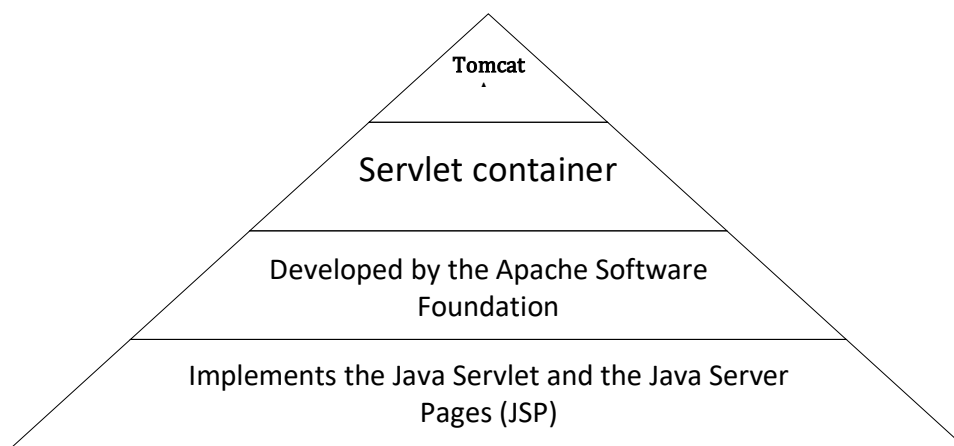| 1 word Question Answer		
Sr.No	**Question**	**Answer**
1.	**which** Container is a client container which is used to manage an execution of the applet on the browser	Applet Container
2.	**which** Container is a client container which is used to manage application client and their container.	Application Container
3.	**which** Containeris a server container which is used to manage Enterprise bean component?	EJB Container
4.	**which** container is a server container which is used to manage an execution of the JSP and Servlet Components	WEB container
5	Web container manage_____	JSP and Servlet
6	EJB Container manage_____	Enterprise beans

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7	Applet Container manage_____	Execution of applet from browser
8	JTA stands for_____	Java Transaction API
9	JNDI stands for_____	Java Naming and Directory Interface
10	JMS stands for_____	Java Messge Services
11	EJB stand for _____	Enterprise Java Beans

Topic:- Tomcat as a Web Container:

Tomcat

Servlet container

Developed by the Apache Software Foundation

Implements the Java Servlet and the Java Server Pages (JSP)

Trailer:- (Only For Understanding)

(1) J2ee servlet store karne ke liye Tomcat container available he uski jankari yaha pe milegi.

Details:- (For Exam)

Apache Tomcat is a servlet container developed by the Apache Software Foundation developed by the Apache Software Foundation (ASF).

Tomcat implements the Java Servlet and the Java Server Pages (JSP) specifications from Sun Microsystems, and provides a "pure Java" HTTP web server environment for Java code to run.

Apache Tomcat and Apache web server are not same. so do not be confuse with both concept.

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Apache Tomcat includes tools for configuration and management, but can also be configured by editing XML configuration files.

Different Versions:-

Tomcat 4.x

- Released 2001
- implements the Servlet 2.3 and JSP 1.2 specifications
- servlet container redesigned as Catalina
- JSP engine redesigned as Jasper
- Coyote HTTP connector
- Java Management Extensions (JMX), JSP and Struts-based administrations

Tomcat 5.x

- implements the Servlet 2.4 and JSP 2.0 specifications
- reduced garbage collection, improved performance and scalability
- native Windows and Unix wrappers for platform integration
- faster JSP parsing

Tomcat 6.x

- implements the Servlet 2.5 and JSP 2.1 specifications
- support for Unified Expression Language 2.1
- designed to run on Java SE 5.0 and later
- support for Comet through the CometProcessor interface
- is not packaged with an admin console as in past releases

CLASSPATH:

To set the classpath follow the steps:

(1) - Right click on my computer

(2) -go to Properties ⟶ Advanced⟶ Environment variable ⟶ New

(3) -give the Variable name = CLASSPATH

(4) set the path with
c:\ProgramFiles\ApoacheSoftwareFoundation\ApcheTomcat6.0\lib\servletapi.jar;

(5) -then press ok

Students Outcomes:- Tomcat is container and contain servlet in it and how to set the classpath?

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1 word Question Answer		
Sr.No.	Question	Answer
1.	**Who developed Tomcat?**	Apache Software Foundation
2.	_____ implements the Java Servlet and the Java Server Pages	Tomcat
3.	Apache web server and Tomcat are same?	No
4.	ASF full form_____	Apache Software Foundation
5.	JMX full form _____	Java Managment Extensions
6.	Tomcat 4.x released in _____	2001

Topic:- J2EE as Application Server

Trailer:- (Only For Understanding)

(1) J2ee application server ka role bhi nibhata he matlab aesa framework provide karta he.

(2) Server me jo responsibility honi chahiye vo J2ee service deta he aur kese work karta he uski jankari yaha pe milti he.

Details:- (For Exam)

An **application server** is a software framework that provides a generalized approach to creating an application-server implementation.

it is related to what the application functions are.

It is the server portion for implementation of instance of application.

An application server's function is dedicated to the efficient execution of procedures (programs, routines, scripts) for supporting its applied applications.

Most Application Server Frameworks contain a comprehensive service layer model.

An application server acts as a set of components accessible to the software developer through an API defined by the platform itself. For Web applications, these components are usually performed in the same running environment as its web server(s), and their main job is to support the construction of dynamic pages.

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Many application servers target much more than just Web page generation: they implement services like clustering, fail-over, and load-balancing, so developers can focus on implementing the business logic.

J2EE almost support and performs all the roles of application servers. In the case of Java application servers, the server behaves like an extended virtual machine for running applications, transparently handling connections to the database on one side, and, often, connections to the Web client on the other.

Other uses of the term may refer to the services that a server makes available or the computer hardware on which the services run.

Java Platform, Enterprise Edition or Java EE (was J2EE) defines the core set of API and features of Java Application Servers.

The Web modules include servlets, and JavaServer Pages.

Enterprise JavaBeans are used to manage transactions.

Some Java Application Servers leave off many Java EE features like EJB and JMS including Tomcat from Apache, and Jetty from Eclipse Foundation. Their focus is more on Java Servlets and JavaServer Pages.

There are many open source Java application servers that support Java EE like GlassFish server from Oracle.

A Java Server Page (JSP) executes in a Web container. JSPs provide a way to create HTML pages by embedding references to the server logic within the page.

Students Outcomes:- Here students will identify all the functinality and roles of application server and most of J2EE also can perform all the task as well as server.

1 Word Question Answer		
Sr.No.	Question	Answer
1.	JSP Stands for?	Java Server Page
2.	SOAP stands for?	Simple Object Access Protocol
3.	JMS stands for?	java Message Service

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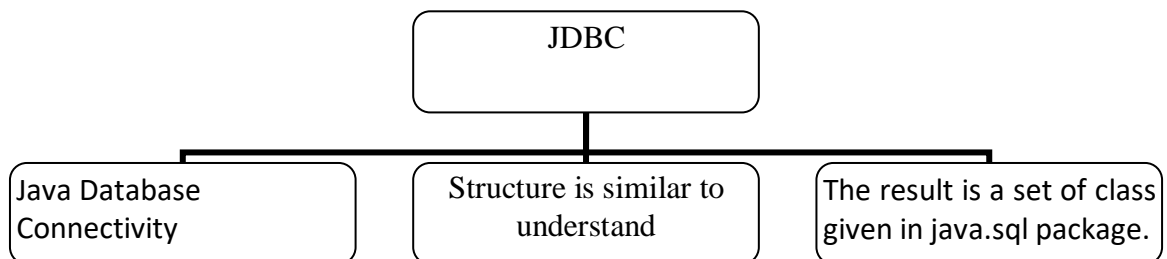**Nr. Amrapali Under Bridge**
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4.	RMI stands for?	Remote Method Invocation
5.	Application server is work for_____	Load balanceing, fail over, clustering, memory management etc
6.	Oracle provides which server?	Glassfish server

Topic:- Introduction and Need for JDBC:-

Trailer:- (Only For Understanding)

(1) Java aur J2ee ke program me agar data store karna jaruri hota he to program ko database ke pass pahochane ke liye driver ki jarurat padti he. JDBC wohi driver provide karne ke liye API he.

Details:- (For Exam)

```
                    ┌──────────────┐
                    │     JDBC     │
                    └──────────────┘
          ┌──────────────┼──────────────┐
┌─────────────────┐ ┌─────────────────┐ ┌─────────────────────┐
│ Java Database   │ │ Structure is    │ │ The result is a set │
│ Connectivity    │ │ similar to      │ │ of class given in   │
│                 │ │ understand      │ │ java.sql package.   │
└─────────────────┘ └─────────────────┘ └─────────────────────┘
```

JDBC Stands for the Java Database Connectivity.
The Role of the JDBC is to most important with respect to java database application.
If you are familiar with SQL and relation Database. The structure of JDBC API is similar and easy to understand.
JDBC API provides connectivity and Data access across the range of relational database.

JDBC enables java application & applet common to the database.

The main idea behind this is we have been able to have different application to the different database. The java.sql.package gives us to facility to connect to every database.
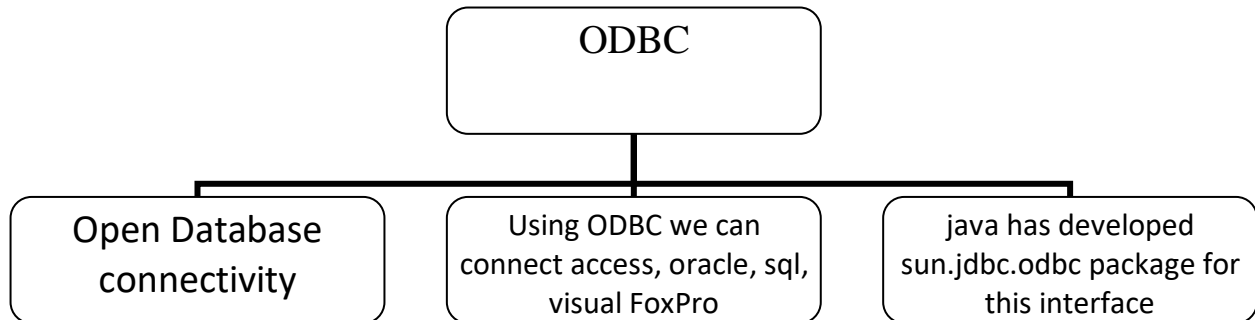
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JDBC-ODBC:

```
                    ┌─────────────────┐
                    │      ODBC       │
                    └─────────────────┘
        ┌───────────────────┼───────────────────┐
┌──────────────┐   ┌──────────────────┐  ┌──────────────────┐
│ Open Database│   │ Using ODBC we can│  │ java has developed│
│ connectivity │   │ connect access,  │  │ sun.jdbc.odbc     │
│              │   │ oracle, sql,     │  │ package for this  │
│              │   │ visual FoxPro    │  │ interface         │
└──────────────┘   └──────────────────┘  └──────────────────┘
```

ODBC stands for the Open Database connectivity, where we want to our regular database like access, oracle, sql, visual FoxPro etc. We have to use the JDBC ODBC driver, ODBC is standard which is purposed by Microsoft and we known that Microsoft is widely used in computer technology, so sun Microsystems has accepted **ODBC as Universal driver** and java has developed sun.jdbc.odbc package for this interface.

To connect JDBC using ODBC we have to develop one DSN(Data Source Name) for ODBC driver by using the Control panel 32-bit ODBC program from your window application.

The Steps for the Creating DSN are as follows.
→Double click on 32-ODBC Program
→Click on New Button
→Give the DSN Name
→Select appropriate Driver
→Click on to Complete Preparation

JDBC V/S ODBC:-

- ODBC can not be directly used with Java because it uses C interface. Calls from Java to native C code have number of drawbacks in the security, implementation, robustness and automatic portability of applications.

- **ODBC** make use of Pointer which has been totally removed from java.

- **ODBC** mixes simple advanced features together and has complex options for simple queries.But JDBC is designed to keep things simple while allowing advanced capabilities when required.

- **ODBC** requires manual installation of the ODBC driver manager and driver on all client machine.JDBC drivers are wriiten in Java and JDBC code is automatically installable, secure and portable on all java platform.

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1 Word Question Answer		
Sr.No.	Question	Answer
1.	JDBC Stands for?	Java DatabaseConnectivity
2.	ODBC stands for?	Open Database connectivity
3.	The result is a set of class given in which package?	java.sql package
4.	Which package gives us to facility to connect to every database?	java.sql
5.	sun Microsystems has accepted____as Universal driver	ODBC
6.	Which package is dwveloped by java?	sun.jdbc.odbc
7.	____is designed to keep things simple while allowing advanced capabilities when required.	JDBC
8.	____can not be directly used with Java.	ODBC
9.	____requires manual installation.	ODBC
10.	____ API Is collection of methods, classes and interfaces.	JDBC API

Students Outcomes:- Students will aware about JDBC API and different database driver. Also Universal driver for all database that is ODBC.

Topic:- JDBC Architecture:

Trailer:- (Only For Understanding)

(1) JDBC API database aur java connect karne ke liye use hota he. yaha background me wo kese process karta he uska theory and diagram aapko milega.

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Details:- (For Exam)

JDBC Architecture describes the interaction of JDBC API with java application and java applet. JDBC API consists of several call level interfaces for interaction with JDBC Driver Manager and JDBC driver for defining database.

JDBC API is responsible for transferring data between an application and a database.

The JDBC architecture is divided into two parts: JDBC API and JDBC Driver types.

JDBC API

JDBC API Is collection of methods, classes and interfaces that enable java applications to communicate with database.
For this database should be installed on the computer and RDBMS should provide a driver.
JDBC classes and interfaces defined in the package java.sql constitute the JDBC API.

The relations between a java program, JDBC API, the JDBC driver and database is shown in figure.
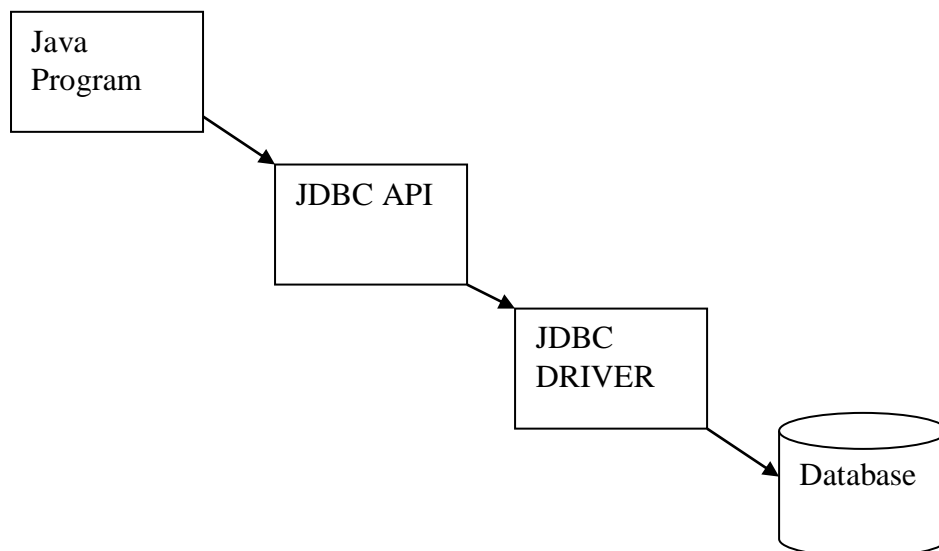
Using JDBC API a java application can perform insert, delete, update and select rows in a database.It can also retrieve the data from the database and show itin a proper formate to the user according to the SQL query.

The JDBC API can be used in 3 tier databse architecture.

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1 Word Question Answer		
Sr.No	**Question**	**Answer**
1.	JDBC Architecture describes the interaction of JDBC API with_____?	Java application and java applet
2	_____is responsible for transferring data between an application and a database.	JDBC API

Student Outcomes:- Students will surely get the background process and different jdbc connectivity process.

Topic:- JDBC Driver :-

Trailer:- (Only For Understanding)

(1) JDBC aur databases connect karne ke liye 4 types ke driver hote he.
(2) which driver is used for which database? uski jankari aapko yaha milegi.
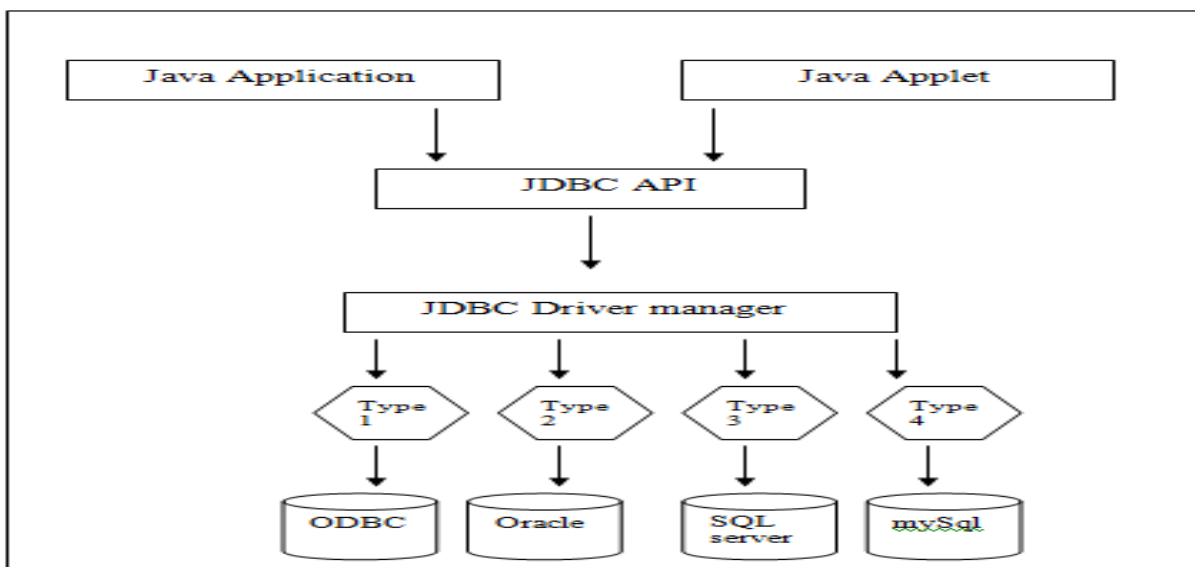(3) JDBC drivers me 4 Types ke driver he jo alag alag database ke sath connectivity karne ke liye use hote he.

Details:- (For Exam)

Type - 1 :- JDBC to ODBC Driver
Type - 2 :- NATIVE API Driver
Type - 3 :- JDBC Drivers/NET Protocol Driver
Type - 4 :- JDBC Driver/Native Protocol Driver

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* JDBC Drivers:

JDBC Drivers specification classifies JDBC drivers into four groups. Groups are referred to as JDBC Drivers types and address a specific need for Communicating with various DBMS

Type -1 : JDBC to ODBC Driver
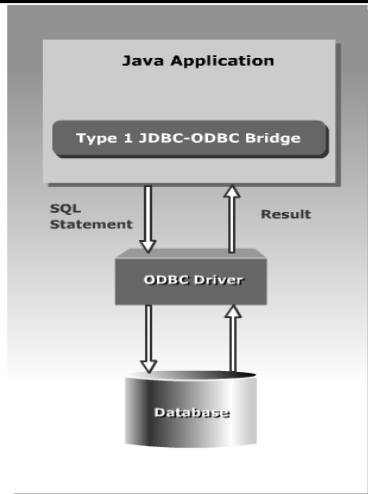
The JDBC-ODBC bridge driver converts all JDBC calls into ODBC calls and sends them to ODBC Driver.
The ODBC driver then converts the call to the database server. For example: MS ACCESS do not provide JDBC Driver.Instead they provide ODBC Driver.One can access such database by using ODBC-JDBC Bridge.

Advantages:

It allows access to any database

Disadvantages:

- This driver not fully written in java so not portable.
- Performance is slow compare to all drivers because JDBC calls are converted to ODBC calls and ODBC calls are converted to database specific calls. Same step in reverse order when query is obtained.
- Client system requires ODBC installation to use the drivers.
-Not good for web application or for large amount of database based application.

(2) Type-2 : NATIVE API Driver
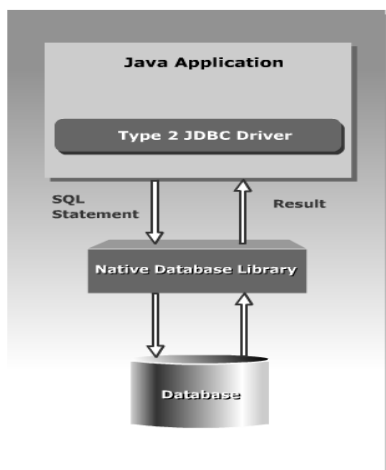
The Java/Native Code driver Communicates directly with database server. Therefore the vendor database library needs to be loaded on each client computer.It converts JDBC calls into database specific calls for databases.For example: Oracle will have native API

Advantages:
They offer better performance than JDBC-ODBC Bridge. Because as the layers of communication are less than type-1 driver and also use native API which is database specific.

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Disadvantages:

- Native API must be installed in client system and hence type-2 driver cannot be used for internet.
- It is not written in java which forms a portability issues
- If we change the database we have to change Native Api as it is specific to database.
- Mostly outdated because it is not thread safe.
- It is not suitable for distributed application.

(3)Type-3 JDBC Drivers/NET Protocol Driver:
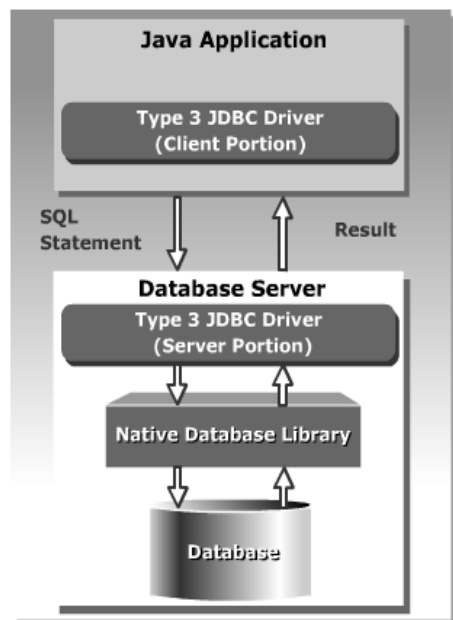
This drivers follows a 3 tired approach.In 3 tired approach JDBC requests are passed to a middle tier server.the middle Tier server then translates request to the database specific native connectivity interface and forward the request to the database server.If middle server is written in java can use type-1 or type-2 driver to forward the request to the database server.

It is used to connect client application/applet to database server over TCP/IP connection. The presence of any vendor database **library on client computer is not required because type-3 driver is servere based.**

Advantages:

- It is sever based so no need for any vendor database library to be present on client machine.
- This is fully written in java and hence portable, so it is suitable for web application.
- It provides portability, performance, security and scalability.
- Net protocol can be designed to make client JDBC driver very small and fast to load.
- It provides support for feature such as caching, load balancing, advanced system administration such as logging and auditing.
- Very flexible and allows access to multiple database using one driver
- They are efficient among all drivers.

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Disadvantages:

Type-3 driver requires database specific coding to be done on middle tier and it requires additional server for that. Additionally traversing the recordset may take longer because the data comes-through the backend server or backend database

(4)Type-4 JDBC Driver/Native Protocol
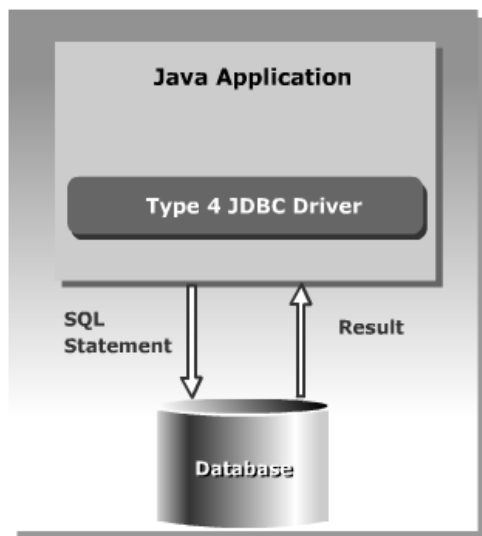
Type-4 driver are completely written in java to achieve platform indepence.It converts JDBC calls into vendor specific DBMS protocol.Therefore client application can communicate directly with the database server when type-4 driver is used.

Type-4 driver is better than other driver because type-4 driver do not have to translate database request to ODBC calls or a native connectivity interface or pass on to another server.

Advantages:

- They are written in java to achieve platform independence.it reduces deployment administration issues.It is most suitable for web application.
- Number of layers is very less Type-4 do not translate database request to ODBC or native connectivity interface or to pass to the server so performance is good.
- You do not need to install special software in the client machine.These driver can be downloaded dynamically.

Disadvantages:

Different driver is needed for each database.

1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	_____driver Communicates directly with database server?	Java/Native Code
2.	Which driver provides portability, performance, security and scalability?	JDBC Drivers/NET Protocol Driver
3.	_____are completely written in java to achieve platform indepence	JDBC Driver/Native Protocol
4.	_____driver can be downloaded dynamically?	JDBC Driver/Native Protocol

Students Outcomes:- JDBC architecture is base concept for starting practicals of connectivity programs. Here students aware with different drivers concept.

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Topic:- JDBC Data types:-

Trailer:- (Only For Understanding)

(1) all language have data and the types of data. yaha pe aapko ek table me sari data types milti he jo aapko comparision bhi batati he ki database me konsi data type he aur usko java me kis data type se match karna he.

(2) Data agar null hoga to kya kare vo bhi data type yaha pe aapko milegi.

Details:- (For Exam)

The JDBC driver converts the Java data type to the appropriate JDBC type before sending it to the database. It uses a default mapping for most data types.

For example, a Java int is converted to an SQL INTEGER.

Default mappings were created to provide consistency between drivers.

The following table summarizes the default JDBC data type that the Java data type is converted to when you call the setXXX() method of the PreparedStatement or CallableStatement object or the ResultSet.updateXXX() method.

SQL	JDBC/Java	setXXX	updateXXX
VARCHAR	java.lang.String	setString	updateString
CHAR	java.lang.String	setString	updateString
LONGVARCHAR	java.lang.String	setString	updateString
BIT	boolean	setBoolean	updateBoolean
NUMERIC	java.math.BigDecimal	setBigDecimal	updateBigDecimal
TINYINT	byte	setByte	updateByte
SMALLINT	short	setShort	updateShort
INTEGER	int	setInt	updateInt
BIGINT	long	setLong	updateLong
REAL	float	setFloat	updateFloat
FLOAT	float	setFloat	updateFloat

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DOUBLE	double	setDouble	updateDouble
VARBINARY	byte[ ]	setBytes	updateBytes
BINARY	byte[ ]	setBytes	updateBytes
DATE	java.sql.Date	setDate	updateDate
TIME	java.sql.Time	setTime	updateTime
TIMESTAMP	java.sql.Timestamp	setTimestamp	updateTimestamp
CLOB	java.sql.Clob	setClob	updateClob
BLOB	java.sql.Blob	setBlob	updateBlob
ARRAY	java.sql.Array	setARRAY	updateARRAY
REF	java.sql.Ref	SetRef	updateRef
STRUCT	java.sql.Struct	SetStruct	updateStruct

Handling NULL Values:

SQL's use of NULL values and Java's use of null are different concepts.

So how do you handle SQL NULL values in Java?

(1) Avoid using getXXX( ) methods that return primitive data types.
(2) Use wrapper classes for primitive data types, and use the ResultSet object's wasNull( ) method to test whether the wrapper class variable that received the value returned by the getXXX( ) method should be set to null.

Here is one example to handle a NULL value:

```
Statement stmt = conn.createStatement( );
String sql = "SELECT id, first, last, age FROM Employees";
ResultSet rs = stmt.executeQuery(sql);

int id = rs.getInt(1);
if( rs.wasNull( ) ) {
  id = 0;
}
```

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1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	_____ converts the Java data type to the appropriate JDBC type before sending it to the database.	JDBC driver
2.	____were created to provide consistency between drivers.	Default mapping
3.	How do you handle SQL NULL values in Java?	Avoid using getXXX ( ) methods that return primitive data types.

Students Outcomes:- Data types is main concept of any programming language. here during connection data types must be convert or supported to database and programming language.

Topic:- JDBC Process:

Trailer:- (Only For Understanding)

(1) JDBC process aapko batati he ki aapko program kese likhna he. step by step process sochni he aur usko program me implement karna he.

Details:- (For Exam)

Processing SQL Statements with JDBC

In general, to process any SQL statement with JDBC, you follow these steps:

- Establishing a connection. (connect java with any database)
- Create a statement. (create a bridge and statement for future query process)
- Execute the query. (pass the query for data fetching from database)
- Process the ResultSet object. (store fetched data in to resultset and back to program)
- Close the connection. (after geting data close the connection of database)

(1) Establishing Connections

First, establish a connection with the data source you want to use. A data source can be a DBMS, a legacy file system, or some other source of data with a corresponding JDBC driver. This connection is represented by a Connection object.

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(2) Creating Statements

A Statement is an interface that represents a SQL statement. You execute Statement objects, and they generate ResultSet objects, which is a table of data representing a database result set. You need a Connection object to create a Statement object.

There are three different kinds of statements:

- (1) Statement: Used to implement simple SQL statements with no parameters.
- (2) PreparedStatement: (Extends Statement.) Used for precompiling SQL statements that might contain input parameters.
- (3) CallableStatement: (Extends PreparedStatement.) Used to execute stored procedures that may contain both input and output parameters.

(3) Executing Queries

To execute a query, call an execute method from Statement such as the following:

- **execute**: Returns true if the first object that the query returns is a ResultSet object. Use this method if the query could return one or more ResultSet objects. Retrieve the ResultSet objects returned from the query by repeatedly calling Statement.getResultSet.
- **executeQuery**: Returns one ResultSet object.
- **executeUpdate**: Returns an integer representing the number of rows affected by the SQL statement. Use this method if you are using INSERT, DELETE, or UPDATESQL statements.

(4) Processing ResultSet Objects

You access the data in a ResultSet object through a cursor. Note that this cursor is not a database cursor. This cursor is a pointer that points to one row of data in the ResultSet object. Initially, the cursor is positioned before the first row. You call various methods defined in the ResultSet object to move the cursor.

(5) Closing Connections

When you are finished using a Statement, call the method Statement.close to immediately release the resources it is using. When you call this method, its ResultSetobjects are closed.

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1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	What is the first step of JDBC Process?	Establishing a connection.
2.	A Statement is an interface that represents_____.	SQL statement
3.	_____ used for precompiling SQL statements that might contain input parameters.	PreparedStatement
4.	_____ used to execute stored procedures that may contain both input and output parameters.	CallableStatement
5.	_____returns true if the first object that the query returns is a ResultSet object.	Execute
6.	_____returns one ResultSet object.	executeQuery
7.	_____returns an integer representing the number of rows affected by the SQL statement.	executeUpdate
8.	You access the data in a ResultSet object through_____.	Cursor
9.	When you are finished using a Statement, call the method _____.	Statement.close

Students Outcomes:- Here is a process steps for starting to ending the connectivity progress. create a bridge, go and final the database and table, then fire the query and fetch the result and come back to program and then close the connection.

Topic:- JDBC Exception Handling:-

Trailer:- (Only For Understanding)

(1) error ko handle kese kare? error ho to bhi aapna program kese run kare?
(2) error message kese easy banaye taki user aasani se samaj sake ke kya error he?

Details:- (For Exam)

Exception handling allows you to handle exceptional conditions such as program-defined errors in a controlled fashion.

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When an exception condition occurs, an exception is thrown.

The term thrown means that current program execution stops, and control is redirected to the nearest applicable catch clause. If no applicable catch clause exists, then the program's execution ends. JDBC Exception handling is very similar to Java Excpetion handling but for JDBC, the most common exception you'll deal with is java.sql.SQLException.

SQLException Methods:

A SQLException can occur both in the driver and the database.

Method	Description
getErrorCode( )	Gets the error number associated with the exception.
getMessage( )	Gets the JDBC driver's error message for an error handled by the driver or gets the Oracle error number and message for a database error.
getNextException( )	Gets the next Exception object in the exception chain.
printStackTrace( )	Prints the current exception, or throwable, and its backtrace to a standard error stream.

By utilizing the information available from the Exception object, you can catch an exception and continue your program appropriately. Here is the general form of a try block:

```
try {
  // Your risky code goes between these curly braces!!!
}
catch(Exception ex) {
  // Your exception handling code goes between these
  // curly braces, similar to the exception clause
  // in a PL/SQL block.
}
finally {
  // Your must-always-be-executed code goes between these
  // curly braces. Like closing database connection.
}
```

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1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	_____Gets the error number associated with the exception.	getErrorCode( )
2.	____Prints the current exception, or throwable, and its backtrace to a standard error stream.	printStackTrace( )
3.	____Gets the XOPEN SQLstate string. For a JDBC driver error, no useful information is returned from this method. For a database error, the five-digit XOPEN SQLstate code is returned. This method can return null.	getSQLState( )
4.	_____Gets the error number associated with the exception.	getErrorCode( )

Student Outcomes:- Error can be easily handle by exception handling.

Topic:- JDBC API FOR DATABASE CONNECTIVITY

Trailer:- (Only For Understanding)

(1) ye question practical program banane ke pahele ek bar jarur read karna he.
(2) yaha jo methods aur concept he vo aapko bahot program me kam aa sakti he.

Details:-(For Exam)

1) Connection Interface:

This defines connection to different database .This provides following methods.

(1) createStatement()
It is used to create a Statement object for sending SQL Statements to the database.

(2) prepareStatement()
It is used to create a Prepared Statement object for sending SQL request to database.SQL statement with or without IN Parameters can be pre compiled /parameterized and stored in a Prepared Statement object.

(3) PrepareCall ()
It is used to create a Callable Statement object for calling stored procedure of database. Callable Statement object provides method for setting up it's IN and OUT parameters and methods for executing call to stored procedure.

(4) Close ()
It is used to release connection.they do not wait for it to release it automatically.

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(5) Commit ()

It is used to save all the state of the database which are changed by transaction.

(6) rollback ()

It is used to cancel the effect of current running transaction.

(7) SetAutoCommit ()

It is used to do auto commit all the transaction .if we set auto commit with connection all SQL statements executed and committed together as individual transaction.It has Boolean type parameter .If we pass true then it enables the auto commit and if we pass false it disables the auto commit.

(8) isClosed()

It is used to check whether the connection has been closed or not.

(9) getMetaData()

It is used to get metadata(data about data)related to current connection with database.it provides information like table driver name, driver type, its version and so on.
It uses DatabaseMetaData interface object to get information about database drivers.

DriverManager Class

DriverManager class belongs to java.sql package. It consists of static method to manage JDBC Drivers.
Each and every driver must register with DriverManager class. There are many JDBC Drivers used for different JDBC servers.

For example: JDBC Drivers for MS ACCESS is different from ORACLE Driver. It controls interface between application and JDBC Drivers.

DriverManager class has one method getConnection() to establish connection with different database server.

Public static Connection getConnection (String url) throws SQLException
Public static Connection getConnection (String url, Properties info) throws SQLException
Public static Connection getConnection (String url, String username, String password) throws SQLException

1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	_____is used to create a Statement object for sending SQL Statements to the database	createStatement()
2.	_____ is used to execute this statements multiple	prepareStatement()

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	times.	
3.	_____ is used to create a Callable Statement object for calling stored procedure of database.	PrepareCall ()
4.	_____used to release connection.	Close ()
5.	_____is used to save all the state of the database which are changed by transaction	Commit ()
6.	_____is used to cancel the effect of current running transaction.	rollback ()

Students Outcomes:- This question is very helpful practical program purpose. Here students will get some necessory methods for practical programs.

Topic:- Statement Interface

Trailer:- (Only For Understanding)

(1) ye question theory and practical dono ke liye imp he.
(2) statement interface se aap apni query ko run karke database se aapka require data le sakte he jiski jankari yaha answer me diyi gayi he.

Details:-(For Exam)

Statement object is used to execute SQL statements and obtain the result produced after excuting the SQL statements.

It is having following methods.

 (1) executeQuery ():

It is used to fetch records from database using select query.It passes SQL statement as a parameter.It returns single Resultset Objects that contains rows, columns and metadata that represent data requested by query.Example:

        Statement st;
        St=con.createStatement ();
        ResultSet rs=st.executeQuery ("select * from tablename");

Syntax:
        Public static ResultSet executeQuery (String url) throws SQLException

(2) executeUpdate ():

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It is used to perform insert, update, and delete operation on record of database.It returns integer value indicating no. of records updated in database.It passes SQL as a parameter.

> Statement st;
> St=con.createStatement ();
> ResultSet rs=st.executeUpdate ("insert into tablename values (val1, val2…, valn");

Syntax:
> Public int executeUpdate (String url) throws SQLException

(3) execute ()

The execute () Statement is used when they returns Multiple result. It returns Boolean indication that if it returns true it defines that next result is ResultSet object and if it returnd false then it defines no of records updated or no more results.

> Statement st;
> St=con.createStatement ();
> String sql="create table tablename (fieldname type (size), fieldname type(size))";
> St.execute (sql);

Syntax: Public Boolean   execute (String url) throws SQLException

Types of statement interface:-

(1) Prepared Statement interface:-

Prepared Statement interface is derived from Statement interface.
It uses a template to create SQL request and uses a Prepared Statement object to send precompiled SQl statements with one or more parameters. It is more convenient to use a Prepared Statement object for sending SQL statements to database.

If you want to execute SQL statements many times Prepared Statement object reduces execution time in comparision to other Statement object.

Main feature of it is SQL statements is given to Prepared Statement object when SQL statements is created.so advantage of Prepared Statement object is that in many of the cases SQL statements is sent to database immediately,where it is compiled.

It also used to execute precompiled statements.

Creating object of Prepared Statement
> String sql="insert into tablename(field1, field1) values(?,?)";
> PreparedStatement pstm=con.prepareStatement(sql);

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Execute methods:

(1)   executeQuery ():

It is used to fetch records from database using select query. It passes SQL statement as a parameter. It returns single Resultset Objects that contains rows, columns and metadata that represent data requested by query. For Example:

```
String sql="select * from tablename where fieldname=? ";
setString(1,"C01");
PreparedStatement pst =con.prepareStatement ();;
ResultSet rs=pst.executeQuery ();
```

Syntax:

Public static ResultSet executeQuery throws SQLException

(2) executeUpdate ():

It is used to perform insert, update, and delete operation on record of database. It returns integer value indicating no. of records updated in database.It passes SQL as a parameter.

```
Statement st = con.createStatement ();
Int n=st.executeUpdate ("insert into tablename values (val1,val2,…..,valn");
```

Syntax:

```
Public int  executeUpdate  throws  SQLException
```

(3) execute ()

It is used to execute SQL statements which returns multiple results. It returns the Boolean indicating that value if it returns true then it defines that next result is ResultSet obkect and if it returns false then it defines that number of records updated or no more results is there.It passes any sql statements as parameter.

```
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.PreparedStatement;
```

(2) Callable Statement

The callable statement is useful to called stored procedure from within a J2EE object.

Stored procedure is a block of code and is identified by a unique name.

The type and style of code depend on dbms vendor and can be return in PL/SQL. The stored procedure is invoked by giving name of stored procedure.

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The callable statement uses three types of parameters when calling a stored procedure. These parameters are IN, OUT & INOUT.

The IN parameter contains any data that needs to be passed to the stored procedure and whose value is assign using the setXxx ().

The OUT parameter contains the value return by the stored procedure if any OUT parameter must be registered using the register OUT parameter () and then his later retrieve by J2EE component by using getXxx ().

The INOUT parameter is a single parameter that is use for both that is to pass information to stored procedure and to retrieve information from stored procedure.

In above program, the statement of try block creates a query that will call the stored procedure last no. order which retrieve the most recently used order number.

The stored procedure requires one parameter that is represented by " ? ".

The parameter is an OUT parameter that will contain last order no. following the execution of stored procedure.

The execute() of callable statement will be useful to execute the query. After the stored procedure is executed, getString() is called to return the value of specified parameter of stored procedure.

Syntax for stored procedure with IN parameters:
{call procedure_name [(?,?,…..)]}

Syntax for stored procedure with IN and OUT parameters:
{ ? = call procedure_name [(?,?,…..)]}

Syntax for stored procedure with no parameters:
{call procedure_name}

CallableStatement sctm=con.prepareCall ("{call insertdata(?,?)}");

Students Outcomes:- Here students aware with statement and its methods which is very helpful for database connectivity programs.

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Topic:- ResultSet

Trailer:- (Only For Understanding)

(1) Resultset ek bag jesa he. java program ye variable le ke database ke pass jata he aur vaha se require data resultset object me le kar vapas aa jata he.

Details:-

It is used to access the data of the table from database.
Resultset object stores the data of the table by executing the query.

It also maintains the cursor position for navigation of the data.Cursor can ove on first() , last() , previous() ,next() from the current row position.It also fetch data from the table using getXXX() method depends on columnType(getString(),getInt()etc.).It can fetch data either using getXXX().Index number always starts with one.

There are six methods of ResultSet object that are used to position the virtual cursor. They are first() , last() , previous() , next(),absolute() , relative() , and getRow().

Fields of resultset interface:
The Statement object created using creates Statements.

-TYPE_SCROLL_INSENSITIVE: It defines that the cursor can scroll but can not be modified or updated.

-TYPE_SCROLL_SENSITIVE: It defines that the cursor can scroll and also be modified or updated.

-TYPE_FORWARD_ONLY: It defines that the cursor from the current row moves forward only.

-CONCURE_READ_ONLY: It defines that cursor can scroll and also can be modified or updated.

Methods of ResultSet Interface:

(1) getString() : It is used to fetch the string type of records from table.It returns the String object.
(2) getInt() : It is used to fetch the integer type of records from table.It returns the String object.

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(3) getBoolean() : It is used to fetch the boolean type of records from table.It returns either true/false.

(4) getDouble() :   It is used to fetch the decimal type of records from table.It returns the double value.

(5) getFloat() :   It is used to fetch the float type of records from table.It returns the String object.

(6) getDate() : It is used to fetch the date type of records from table.

(7) getLong() : It is used to fetch the long type of records from table.

(8) getShort() : It is used to fetch the short type of records from table.

(9) getByte() : It is used to fetch the string type of records from table.

(10) getBlob() :   It is used to fetch binary representing large object from table can be image file,audio file,video file.

Example: ResultSet rs=st.executeQuery ("select * from emp");
                Int id=re.getInt(1);
                String name=rs.getString(2);
OR
Example: ResultSet rs=st.executeQuery("select * from emp");
                Int id=re.getInt("eno");
                String name=rs.getString("ename");

Navigation Method:

1. **first():** It is used to move the cursor position on the first record of the table.
2. **last():**It is used to move the cursor position on the last record of the table.
3. **next():**It is used to move the cursor position on the next record of the table.
4. **previous():**It is used to move the cursor position on the previous record of the table.
5. **afterLast():**It is used to move the cursor on after the last row.
6. **beforeFirst():**It is used to move the cursor on before the first row.
7. **relative(int row):** It is used to move the cursor on relative no.of rows.
8. **absolute(int rows):** It is used to move the cursor on absolute row.

Students Outcomes:- ResultSet interface is very important concept. It is used to collect the data from database and navigate the data to the users. students will get all the methods for writing methods for showing the data as per requirement of user.

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Topics:- OTHER APIs:-

Trailer:- (Only For Understanding)

(1) Meta data means "Data of data" or "Data about data".
(2) Other API of JDBC aapko database and resultset ke data ki details provide karta he.

Details:- (For Exam)

Meta Data :-

Metadata is about data (data about data). There are two types of metadata interface are available (1) ResultsetMetadata and (2) Database Metadata. The DatabaseMetaData interface is used to retrieve information about databases, tables, columns and indexes among other information about the DBMS.

ResultSetMataData:

This interface is used to obtain information about type and properties of the column in a ResultSetMataData are used to store following information of Resultset object:

- What is the number of columns in ResultSet?

- What is the name of columns?

- What is the type of columns in?

- What is the maximum size of columns?

- Can you put a null in this column?

Method	Description
getColumnCount()	Returns the number of columns contained in the ResultSet
getColumnName(int n)	Returns the name of the column specified by the column number
getColumnType(int n)	Returns the data type of the column specified by the column number.
isNullable(int column);	Indicates the null ability of values in the designated columns.

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DatabaseMetaData Interface:

This interface describes the database as whole. Many methods of DatabaseMetaData interface return list of information in the format of Resultset objects. It provides many methods that represent comprehensive information of the database.

- What tables are available?
- What is your username known to the database?
- Is the database in read only moe?
- What is the name of product?
- What is the name of driver?
- What is the version of driver?
-

Method	Description
getDatabaseProductname()	Returns the product name of the database
getUserName()	Returns the username
getURL()	Returns the URL of the database
getSchemas()	Returns all the schema names available in this database.
getPrimaryKeys()	Returns primary keys
getProcedures()	Returns stored procedure names
getTables()	Returns names of tables in the database.
getDriverName()	Retrives the name of JDBC Driver
getDriverVersion()	Retrives the version of JDBC Driver
isReadOnly()	Retrives whether this database is read only.

1 word Question Answer		
Sr.No.	**Question**	**Answer**
1.	DriverManager class belongs to which package?	java.sql
2.	DriverManager class has one method which is used to establish connection with different database server	getConnection()
3.	____ is used to fetch records from database using select query.	ExecuteQuery ()
4.	____is used to perform insert, update, and delete operation on record of database	executeUpdate ()
5.	_____ Statement is used when they returns Multiple result.	Execute()
6.	____ is derived from Statement interface.	Prepared Statement interface

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7.	Which statement is useful to called stored procedure from within a J2EE object.	Callable
8.	Which parameters callable statement uses?	IN, OUT & INOUT
9.	____ parameter is a single parameter that is use for both that is to pass information to stored procedure and to retrieve information from stored procedure	INOUT
10.	___is used to access the data of the table from database.	ResultSet
11.	How many methods of ResultSet object that are used to position the virtual cursor?	Six
12.	Which interface describes the database as whole?	DatabaseMetaData

Students Outcomes:- Students will get the detailed information about resultset and database. some time meta data is very necessory for performing some programming logic so by useing this concept student will get necessory information.

Topic:- Connecting with Databases:-

Trailer:- (Only For Understanding)

(1) This question is for practical purpose.
(2) Which package is used? Which classes and interfaces are require for programs?
(3) Driver and Database path all required information and process explained here.

Details:- (For Exam)

After you've installed the appropriate driver, it's time to establish a database connection using JDBC.

The programming involved to establish a JDBC connection is fairly simple. Here are these simple steps:

(1) Import JDBC Packages:

The **Import** statements tell the Java compiler where to find the classes you reference in your code and are placed at the very beginning of your source code.
To use the standard JDBC package, which allows you to select, insert, update, and delete data in SQL tables, add the following *imports* to your source code:

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(2) Register JDBC Driver:

You must register your driver in your program before you use it. You need to do this registration only once in your program.

Class.forName():

The most common approach to register a driver is to use Java's **Class.forName()** method to dynamically load the driver's class file into memory, which automatically registers it.

(3) Database URL Formulation:

After you've loaded the driver, you can establish a connection using the **DriverManager.getConnection ()** method.

URL have to pass as argument. A database URL is an address that points to your database.

Following table lists down popular JDBC driver names and database URL.

RDBMS	JDBC driver name	URL format
MySQL	com.mysql.jdbc.Driver	**jdbc:mysql://**hostname/ databaseName
ORACLE	oracle.jdbc.driver.OracleDriver	**jdbc:oracle:thin:@**hostname:port Number:databaseName
DB2	COM.ibm.db2.jdbc.net.DB2Driver	**jdbc:db2:**hostname:port Number/databaseName
Sybase	com.sybase.jdbc.SybDriver	**jdbc:sybase:Tds:**hostname: port Number/databaseName

All the highlighted part in URL format is static and you need to change only remaining part as per your database setup.

(4) Create Connection Object:

Using a database URL with a username and password you can connect with the database.

(5) Closing JDBC connections:

At the end of your JDBC program, it is required explicitly close all the connections to the database to end each database session.

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	1 Word Question Answer	
Sr.No.	**Question**	**Answer**
1.	_____ Method to dynamically load the driver's class file into memory, which automatically registers it.	Class.forName()
2.	You should use the _____ method if you are using a non-JDK compliant JVM, such as the one provided by Microsoft.	*registerDriver()*
3.	Java's _____will close the connection when it cleans up stale objects.	garbage collector

Students OutComes:- Here Last 5 topics are practical concept which should be clear to the students for performing practical programs.

 Note:- Above material and examples reference will be taken by many online platforms.

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Lt. Shree Chimanbhai Shukla

BCA SEM -5 J2EE

Shree H.N.Shukla College
Campus,
Street No. 2, Vaishali Nagar,
Nr. Amrapali Under Bridge,
Raiya Road, Rajkot.
Ph. (0281)2440478, 2472590

Shree H.N.Shukla College Campus,
Street No. 3, Vaishali Nagar,
Nr. Amrapali Under Bridge,
Raiya Road, Rajkot.
Ph. (0281)2471645

Website: - www.hnsgroupofcolleges.org
E-Mail :- info@hnshukla.com

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INDEX

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Chapter 2 – RMI (Remote Method Invocation) & Servlet

Topic:- RMI Definition :
Introduction to RMI :-

Trailer:- (Only For Understanding)

(1) What is Remote communication?
(2) How Remote commmunication done?
(3) How RMI Application works?

Details:- (For Exam)

"RMI is the technology which allows the client to connect   with Remote object communication and object to object communication between different JVM."

In Short RMI provides Remote Communication between programs written in java programming language.

RMI is the best example of distributed system over TCP/IP. Object to object communication will be possible between different JVM, using RMI.

Distributed computing refers to the application design in which programming and processsing the data are spread over the network.

RMI is the best example of distributed module.

Overview of RMI Application:

RMI Application is divided into two parts Client and Server. Server program creates some remote object and makes the references to them and waits for the client request to invoke methods on the Remote objects.

A client application get a remote reference to one or more Remote object from the server and invoke the methods on them. RMI provides this mechanism by which server and client communication and pass information.

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Distributed Object Application has to include three things:

1. Locate Remote Object:
An Application can use various mechanisms to obtain references to remote objects.

2. Communicate with remote objects
All communication between remote objects is handled by RMI. Remote communication look similar to regular Java Method invocation.

3. Load class definition for object that is passing around
Because RMI enables objects to be passes back and forth, it provides mechanism for loading an object's class definition as well as for transmitting an object's data.

Students Outcomes:- Aware about different RMI application layers and basic knowledge of distributed communication.

1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	RMI stands for?	Remote Method Invocation
2.	Which technology which allows the client to Remote object communication and object to object communication between different JVM?	RMI
3.	____is the best example of distributed module.	RMI
4.	All communication between remote objects is handled by____?	RMI
5.	Remote communication look similar to regular Java_____?	Method Invocation

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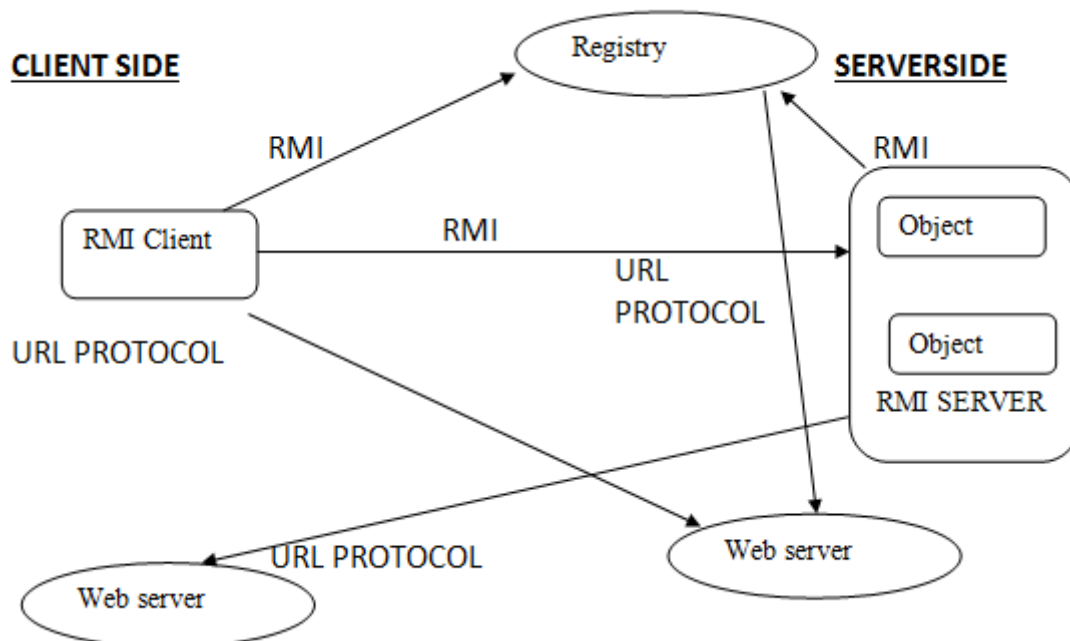**Raiya Road, Rajkot - 360001**
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Topic:- RMI Architecture:-

Trailer:- (Only For Understanding)

(1) How RMI works? and which is the internal mechanism or architecture?

Details:- (For Exam)

RMI Architecture defines that how the client request to the server for the remote objects ? and how the server processes for that request?

It is divided into four layers.

1. Application Layer
2. Stub / Skeleton Layer/proxy Layer
3. Remote Reference Layer
4. Transport Layer

Each layer can perform specific task/function like establishing the connection, assemble and disassembled the parameter and transmiting the object.

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All layers are independent from each other and they can be used based on client request for service as shown in figure.
RMI also supports Garbage Collection.

Application Layer

Application Layer consists of client side and server side java programme with remote objects.

Client can access remote methods through an interface that extends java.rmi.Remote.

Once the methods described then after remote interface have been implemented, the object must be exported using UnicastRemoteObject class of the java.rmi.server package.

The application will register itself with registry and it is used by client to obtain references of the objects.
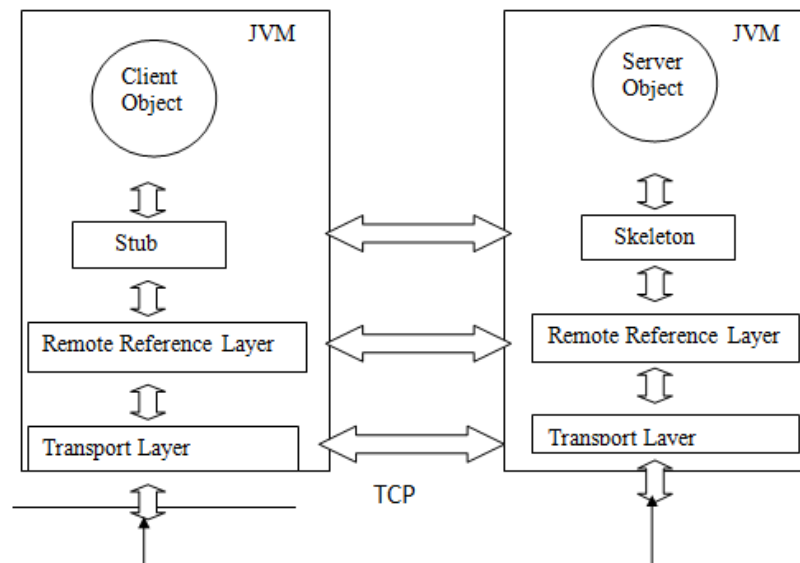
Proxy layer: (Most IMP)

Stub/skeleton layer is responsible for listening to the remote methods calls made by client and redirecting them to the server.
This layer consists of stub and a skeleton layer. The stub and skeleton are created using **RMI Compiler (RMIC).**
Stub is client side proxy representing the remote objects and communicates the method invocation to the remote object through a skeleton that is implemented on the server.
skeleton is server side proxy that communicates with the stub. It makes call to remote objects.So it is also know as proxy layer.

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The Remote Reference layer

It is an interface between proxy layer and Transport layer, it handles actual communication protocol. RRL interpretes the references made by the client to the remote object on the server. It present on clients and server. RRL on client receive requests for methods from stub, the request is then transferred to the RRL on server side.

It is responsible for establishing persistence and strategies for recovery of lost connections.

The Transport Layer

The Transport layer takes path of the communication or layer between client & server. It receives a request from client side RRL and establishes a connection with the server through server side RRL.

Transport layer has following responsibilities:
- It is responsible for handling actual machine to machine communication and default communication takes place through TCP/IP.
- It sets up the connection to the remote machines.
- It manages the connections.
- It moniters the connections. To make sure that they are live.

Topic:- STUB AND SKELETON

Trailer:- (Only For Understanding)

(1) Stub and Skeleton layers for Remote connection.
(2) What is proxy layer?

Details:- (For Exam)

STUB-Client side proxy.
   a. It presents the same remote interface as the object of the server.
   b. It works with JVM on client machine to serialize any arguments to a remote method call and sends this information to the server machine.
   c. The stub receives any results from remote method and returns it to the client.

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SKELETON Server Side proxy.

It receives the remote method call and any associated arguments. It works with JVM and RMI system on server to deserialize any arguments fro remote method call.

It invokes the appropriate method in the server.

It receives any return value from this method call and works with with JVM and RI system on server to serialize the return value and send information back to the client.

	1 Word Question Answer	
Sr.No.	**Question**	**Answer**
1.	_____defines the how the client request to the server for the remote objects and how the server processes for that request.	RMI Architecture
2.	RMI architrcture divided in to ____layers?	Four
3.	____ simply keeps track of addresses of remote objects that are being exported by the application and also name of the remote objects.	Registry
4.	____ consists of client side and server side java programme with remote objects.	Application Layer
5.	_____layer is responsible for listening to the remote methods calls made by client and redirecting them to the server.	Stub/skeleton
6.	____ layer consists of stub and a skeleton layer.	Proxy layer
7.	The stub and skeleton are created using____.	RMI Compiler (RMIC)
8.	____ is server Side proxy that communicates with the stub.	Skeleton
9.	____ is an interface between proxy layer and Transport layer.	The Remote Reference layer
10.	_____interpretes the references made by the client to the remote object on the server	The Remote Reference layer
11.	_____ Handle replicated object.	RRL
12.	_____ takes path of the communication or layer between client & server.	Transport layer

Students Outcomes:- Aware about proxy layers which is client side and server side.

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Topic:- RMI Package

Trailer:- (Only For Understanding)

(1) Which package and class require for RMI program?

Details:- (For Exam)

The Java.rmi.* package is require to import in all the program in order to communicate with server.

The Naming Class of RMI package has declared various methods.

1.bind ()- It is used to binds a specified remote name to remote object. Having two parameter (1)name of object and(2) object itself

Naming.bind("Hello",greeting);

2. unbind() It removes the binding object with remote object.Having single parameter.

Naming.unbind("Hello");

3. rebind() it is used to rebind name with remote object. Having two parameter (1)string message and(2)new object name

Naming.rebind("Hello",msg);

1. **lookup()-** It returns name of the remote object specified by the RMI URL.

Naming.Lookup(rmi://hostname/objectname);

2. **list()-** It returns the string array with name of objects bound in the registry .Having one parameter .
   Naming.list(URL);

UnicastRemoteObject:

The UnicastRemoteObject class defines a non-replicated remote object whose references are valid only while the server process is alive.

The UnicastRemoteObject class provides support for point-to-point active object references (invocations, parameters, and results) using TCP streams.

Objects that require remote behavior should extend RemoteObject, typically via UnicastRemoteObject.

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Steps for Developing RMI Application

1) Create an interface. (ex:- The interface is myRMIInterface.java).
2) Create a class that implements the interface. (ex:- myRMIImpl.java).
3) Create a server that creates an instance of this class
4) Create a client that connects to the server object using Naming.lookup()
5) Compile these classes.
6) Run the RMI interface compiler on the .class file of the implementation
   class (ex:- you'd say "rmic myRMIImpl").
7) Start the RMI registry (ex:- say "start rmiregistry").
8) Start the server class ("start java myRMIServer").
9) Run the client program ("java myRMIClient").

Sr.No.	Question	Answer
	1 Word Question answer	
1.	The____receives any results from remote method and returns it to the client.	Stub
2.	____ is imported in the entire program in order to communicate with server.	Java.rmi.*
3.	_____ returns name of the remote object specified by the RMI URL.	lookup()

Students Outcomes:- Aware about RMI package and its classes require for programs and steps for RMI application.

Topic:- Servlet Programming Introduction:-

Trailer:- (Only For Understanding)

(1) What is Servlet? (Dynamic web page)
(2) Which are the benifits of servlet?

Details:- (For Exam)

Initially in the early days CGI was used to write server side scripting to create dynamic web pages with most of the languages like C, C++ and also with JAVA.
But when user request for something server need to create different process for each and every HTTP request of client.

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After giving response to the client and executing the CGI script server should release the system resources.

It takes much execution time at the cost of performance. It was also expensive to open and close database connection for each client.

To overcome these limitations servlet was introduced by sun Microsystem.

➢ Servlet :-

The primary reason for development of servlet is limitation of html because it can be used to create only static pages and nothing more but technology and usage of internet so it increase the people's demand for more than static pages (dynamic pages).

Today of web page should show forms accepts input from the users and access the databases, it can store, receives and process the data, re-act the need of the user etc.

A servlet can be loaded dynamically and expand functionality of the server.

A servlet is similar to the script except that the servlet runs under the JVM on the server. So it is safe and portable.

A servlet is dynamically loaded module that services request from the web-browser.

Servlet can be used for any number of web-related applications for example developing an e-commerce web site becomes one of the most common usage for the java servlet.

Benefits of Servlets: (IMP)

1. **Performance:**

Its performance is better than CGI because it is not necessary to create the separate process to handle each HTTP request, it executes within the address space of web server.so it saves the memory resources and make performance better than CGI.

2. **Platform Independence:**

A number of web-server from different vendor supports Servlet API. It is written in Java so program developed for this API can be run on any environment without re-compilation.

3. **Security:**

Servlet run under the JVM and it is secured .It is also using java security manager .it is server side component, so it inherits the security provided by the web server.

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4. **Efficient Servlet Initialization Code:**

It is only executed for the first time when the web server loads it. Once the server has been loaded, it is only a matter of calling the service to handle the new request. So it is efficient for each & every request.

5. **Persistent:**

Servlets can maintain the state between requests. Once the servlet has been loaded, it takes its state in the memory until the last request will arrive. Taking the advantage of persistent characteristic of servlet will improve the performance of applications.

6. **Portable:**

Servlets are developed using java therefore they are portable.

7. **Robust:**

Servlets are developed with the jdbc. So they provide maximum robust solution with the help of java's well defined exception hierarchy, garbage collection, network support, file support etc.

8. **Extensible:**

Servlets are developed in pure OOP like java. So that can be extended & polymorphed into new object which sets your needs. The best example is of search engine tool which you can put on your each & every page which will be used to search different things on different pages.

9. **Flexible:**

Servlets are quite flexible because it can be added to a static page using the servlet tag <servlet>.

10. **Secure:**

Servlets are run on server side & gives us the facility & security internally provided by the web servlet.

Students Outcomes:- Aware about servlet creation and its benifits. How servlet runs and how it works from serverside? Students understood the importants of servlet for different advantages.

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1 Word Questin Answer		
Sr.No.	Question	Answer
1.	To overcome the limitations _____wa created?	Servlet
2.	Servlet runs under_____?	JVM
3.	Servlet's performance id better than_____?	CGI
4.	Servlet's code is executed for the first time when the web server loads it.	True
5.	Once the servlet has been loaded, it takes its _____in the memory until the last request will arrive	State
6.	Taking the advantage of _____characteristic of servlet will improve the performance of applications.	Persistent
7.	Servlets are developed using java therefore they are_____.	Portable
8.	Servlets are quite flexible because it can be added to a static page using the servlet tag _____.	<servlet>

Topic:- Servlet Architecture/Servlet API :

Trailer:- (Only For Understanding)

(1) The packages require for packages.d

Details:- (For Exam)

There are two packages that make up the servlet architecture. They are as follows:

(1) Javax.servlet package (2) javax.servlet.http package

The javax.servlet package contains the generic interface and classes that are implemented & extended by all servlets.

The javax.servlet.http package javax.servlet contains the classes that are extended while creating the http specific servlet.

➔ **Javax.servlet package having following classes and interfaces.**

1) **Servlet Interface:** It is having methods which define life cycle of servlet.
2) **ServletConfig Interface:** It provides the basic or initialization parameters of the servlet.
3) **ServletContext Interface:** It provides the runtime environment to the servlet.It also logs the event using log ().

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4) **GenericServlet Class:** It implements the Servlet, ServletConfig, Serialization interface.
5) **ServletRequest Interface:** It is used to read the client request.
6) **ServletResponse Interface:** It is used to write the response data.
7) **ServletException Class:** It defines the servlet occurred error.
8) **UnavailableException Class:** It defines that servlet is temporarily or permanently not available.
9) **ServletInputStream Class:** It provides input stream o read the data from the client request.
10) **ServletInputStream Class:** It provides output stream to write the data as request to client.
11) **SingleThreadModel interface:** It provides the mechanism to make servlet thread safe.

➔ **Javax.servlet.http package having following classes and interfaces.**

1) **HttpServletRequest Interface:** It allows the servlet to read data from HTTP request.
2) **HttpServletResponse Interface:** It allows the servlet to write data to an HTTP response.
3) **HttpServlet Class**: It provides the methods for handling HTTP request and HTTP response.
4) **Cookie Class:** It used to store the state information at client side or on the client machine.
5) **HttpSession Interface:** It used to create session and provides the way of reading and writing the session and accessing the information related to session.
6) **HttpSessionBindingListener interface**: It informs the object that it is bound or unbound to the session
7) **HttpSessionEvent class:** It wraps up the session change events.
8) **HttpSessionBindingEvent Class:** It defines that when session should be bound or unbound with the object value and its attribute.

Topic:- Servlet Implementation

Trailer:- (Only For Understanding)

(1) How to create servlet? different methods to create servlet.

Details:- (For Exam)

Servlet Implementation

To implement servlet in the program there are four ways. we can use anyone from following classes or interface to create servlet program.

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- **Servlet Interface**
- **GenericServlet Class**
- **HttpServlet Class**
- **SingleThreadModel Interface**

1. Servlet Interface

All the user defined servlet should inherit the servlet interface .Its having following methods.

(1) init()

It is called by servlet container to initialize the servlet itself. It is called only once when servlet engine loads the servlet. It finishes its work before service() starts for request and response.

Basic format of init () is as follows:

> public abstract void init(ServletConfig config) throws ServletException

(2) service()

It used to read client request and write the response data to the client. It passes two parameters first the object of ServletRequest interface and second is the object of ServletResponse interface.

If any error occurs during the request and response or input and output it throws IOException and ServletException. Basic format of service () is as follows:

> Public abstract void service (ServletRequest req, ServletResponse res) throw ServletException, IOException

(3) destroy()

This method is called by servlet Container automatically when objects or resources like memory, thread etc need to be destroyed or servlet stops it execution.Basic format of destroy() is as follows:

> Public abstract void destroy ()

(4) getServletConfig()

It returns the ServletConfig object which contains initialization parameter and startup configuration of servlet. It passed as a parameter in the init(). Basic format of getServletConfig() is as follows:

> Public abstract ServletConfig getServletConfig()

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(5) getServletInfo()

It returns the basic information related to the servlet such as author name, version, etc. Basic format of getServletInfo () is as follows:

> Public abstract void getServletInfo ()

2. Generic Servlet Class

It belongs to the javax.servlet package. It implements the servlet, ServletConfig, serializable interface in it.

It is extended to provide the protocol based things like FTP, SMTP protocol but it is not having a HTTP protocol facility. So most probably with web application we need to extend the HttpServlet Class.

Generic servlet class provides the implementation of servlet interface because in most of the classes they are required to use service() to handle request and response.

Hierarchy of Genericservlet class as follows:
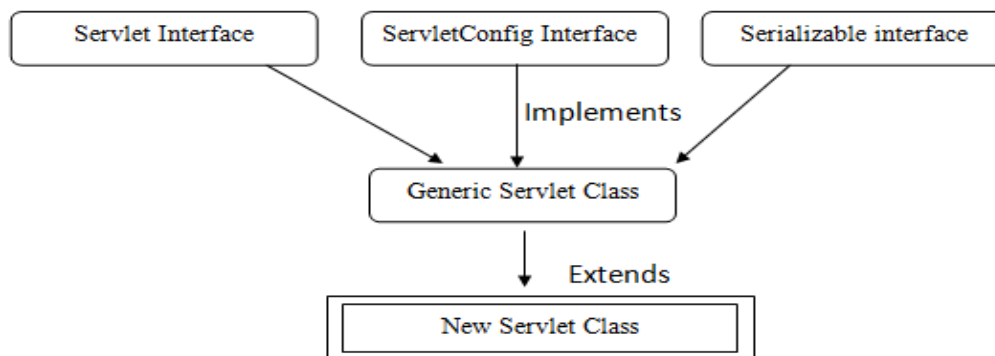
(1)init()

It is called by servlet container to initialize the servlet itself. It is called only once when servlet engine loads the servlet.
Basic format of this method is:

> public abstract void init(ServletConfig config) throws ServletException

(2) service()

It provides the servlet request response facility to each and every servlet should override this method directly writing service () with the program or indirectly using doXXX () of HttpServlet class. Basic format of this method is:

> Public abstract void service (ServletRequest req, ServletResponse res) throw ServletException, IOException

CS – 25 Advance Java Programming (J2EE)   Page 16 of 37

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(3) destroy ()

It is called by servlet container at the end of the execution. We can override this method in our subclass to do some clean up task, when servlet is taken out of service.

Basic format of destroy () is as follows:

Public abstract void destroy ()

(4) log ()

log () is used to write the server log file.
we can use in two ways. **First method** log (String message) method writes the servlet name and message to web container log file and
Second method log (String message, Throwable t) writes the servlet name and the exception stack trace of the given Throwable Exception to web container log file.

Basic format of destroy () is as follows:

Public void log (String message)
Public void log (String message,Throwable t)

(5) getInitParameter()

It is used to get the initialization parameter. If the parameter does not exists it returns null.
Basic format of this () is as follows:

Public string getInitParameter (String name)

(6) getInitParameterNames()
It returns the name of initialization parameter names in the form of enumeration.

Basic format of this () is as follows:

Public Enumeration getInitParameter Names ()

(7) getServletContext()
It returns the object of ServletContext. Basic format of this () is as follows:

Public ServletContext getServletContext ()

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(8) getServletName()

It returns the name of the servlet. Basic format of this () is as follows:

Public String getServletName ()

```
//Program of simple servlet
import java.io.*;
import javax.servlet.*;

public class simple_servlet extends GenericServlet

 {

public void service (ServletRequest req, ServletResponse res) throws ServletException,IOException

        {
                res.setContentType ("text/html");
                PrintWriter out=res.getWriter ();
                out.println ("<b><i>Generic servlet example</i></b>");
                out.close ();
        }
    }
```

HTTP SERVLET CLASS

HttpServlet class extends GenericServlet Class. It is commonly used by programmers when developing servlet that receive and process HTTP requests, because it is having HTTP protocol functionality. Hierachrchy of HttpServlet class is shown below.

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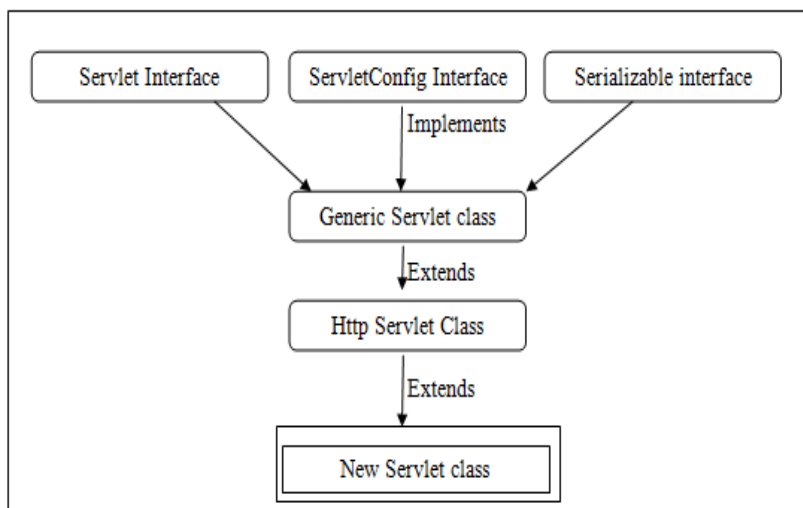
Methods of HttpServlet Class are as follows:

(1) doGet()

doGet() is called by servlet via service() to handle an Http request. A GET request allows client to sent form data to server. With the get request the form data is attached to the end of the URL sent by the web browser to the server as a query string. The amount of form data that can be sent is limited to the maximum length of the URL. Basic format of doGet() is as follows.

```
public void  doGet(HttpServletRequest  req, HttpServletResponse  res)throws
ServletException,IOException
```

(2) doPost()

doPost() is called by servlet via service() to handle an Http POST request. A POST request allows client to sent form data to server. With the post request, the form data is sent to the server separately instead of being appended to to the URL . This allows a large amount of data to be sent. Basic format of doPost() is as follows.

```
 public void  doPost(HttpServletRequest  req, HttpServletResponse  res)throws
ServletException,IOException
```

(3) doDelete ()

doDelete() is called by servlet via service() to handle an Http DELETE request. A DELETE request allows client to remove a document or web page from the server. Basic format of doDelete() is as follows.

```
 public void  doDelete(HttpServletRequest  req, HttpServletResponse  res)throws
ServletException,IOException
```

(4) doOption()

doOption() is called by servlet via service() to handle an Http OPTION request. An OPTION determines which Http method the server supports and sends the information back to the client by way of header.Basic format of doOption() is as follows.

```
 public void  doOption(HttpServletRequest  req, HttpServletResponse  res)throws
ServletException,IOException
```

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(5) **doPut()**

doPut() is called by servlet via service() to handle an Http PUT request. A PUT request allows client to sent place a file on the server and is conceptually similar to sending the file to the server via FTP. Basic format of doPut() is as follows.

> public void doPut(HttpServletRequest   req, HttpServletResponse   res)throws ServletException,IOException

(6) doTrace()

doTrace() is called by servlet via service() to handle an Http TRACE request. A TRACE request returns the header sent with the TRACE request back to the client. This can be useful for debugging purpose. This method is rarely overridden. Basic format of doTrace() is as follows.

> public void doTrace(HttpServletRequest   req, HttpServletResponse   res)throws ServletException,IOException

Single Thread Model

In CGI single instance creates multiple threads in order to process mulriple request and response. In the past also a single instance of a servlet creates multiple threads for multiple requests and response.

In this process the shared non local variables must be synchronized is implemented at the cost of system performance because thread waits in a queue for the current thread to complete its job.

Therefore synchronizing the code increases time to perform a single task,it downs the performance of the system.In certain cases synchronization may not be appropriate method to implement thread safely.so in such a case we need to implement the SingleThreaModel.

SingleThreadModel is implemented by SingleThreadModel interface. It ensures that servlet handle only one request at a time. This interface has no methods. If a servlet implements this interface you are guarantee by synchronizing access to single instance of servlet.

Note that SingleThreadModel does not solve all thread safety issues in some situation.

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Raiya Road, Rajkot - 360001
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1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	_____ Package contains the generic interface and classes that are implemented & extended by all servlets.	javax.servlet
2.	_____ It provides the runtime environment to the servlet.	ServletContext Interface
3.	_____ provides the methods for handling HTTP request and HTTP response.	HttpServlet Class
4.	_____ used to store the state information at client side or on the client machine.	Cookie Class
5.	_____ is called by servlet container to initialize the servlet itself.	Init()
6.	_____ It used to read client request and write the response data to the client.	Service()
7.	____method is called by servlet Container automatically when objects or resources like memory, thread etc need to be destroyed or servlet stops it execution.	Destroy()
8.	_____ is used to get the initialization parameter.	getInitParameter()
9.	In CGI single instance creates multiple _____in order to process mulriple request and response	Threads
10.	SingleThreadModel is implemented by_____.	SingleThreadModel interface
11.	_____ is called by servlet via service () to handle an Http request.	doGet()

Students Outcomes:- Aware about java and its different editions and which edition is used for which purpose.

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Topic:- Life cycle

Trailer:- (Only For Understanding)

(1) Servlet life cycle.

Details:- (For Exam)

Servlet Life Cycle:-

Servlets are snippets of Java programs which run inside a Servlet Container.

A Servlet Container is much like a Web Server which handles user requests and generates responses. Servlet Container is different from a Web Server because it can not only serve requests for static content like HTML page, GIF images, etc., it can also contain Java Servlets and JSP pages to generate dynamic response.

Servlet Container is responsible for loading and maintaining the lifecycle of the a Java Servlet. Servlet Container can be used standalone or more often used in conjunction with a Web server.

Example of a Servlet Container is Tomcat and that of Web Server is Apache.

There are three methods used to maintain the lifecycle of servlet.

1) **init()**
2) **service()**
3) **destroy()**

(1) **init()**

When the servlet is first created, its init () is invoked, so init is where you put one time setup code.

Most of the times your servlet deal only per-request data, and doGet or doPost are the only life cycle method you need.

occasionally one want to perform complex setup tasks when the servlet id first loaded,but not repeat those tasks for each request.

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init() is designed for this case it is called when the servlet Is first created,and not called again for each user request,so it is used for one time initialization,just as with the init() of applet.

This method is called once when the servlet is loaded into the servlet engine, before the servlet is asked to process its first request.

The init method has a ServletConfig parameter. The servlet can read its initialization arguments through the ServletConfig object. How the initialization arguments are set is servlet engine dependent but they are usually defined in a configuration file.

init(servletconfig conf)

(2) service()

Each time the server receives a request for a servlet, the server needs a new thread and calls service ().
The service () checks the HTTP request type (GET, POST, PUT, DELETE etc) and calls doGet, doPut, doDelete etc. as appropriate. A GET request results from a normal request for a URL or from an HTML form that has no method specified.

A POST request results from an HTML form that specifically lists POST as the methods. If you have a servlet that needs to handle both POST and GET requests identically,you may be tempted to override service directly rather than implementing both doGet and doPost.

(3) destroy()

The service may decide to remove a previously loaded servlet instance, perhaps because it is explicitly asked to do so by the server administrator or perhaps because the servlet is idle for a long time.

Before it does, however, it calls the servlet's destroy method.

This method gives your servlet a chance to close database connection,halt background threads,write cookie or hit counts to disk ,and perform other such cleanup activities.Be aware ,however, that is possible for the we server to crash.
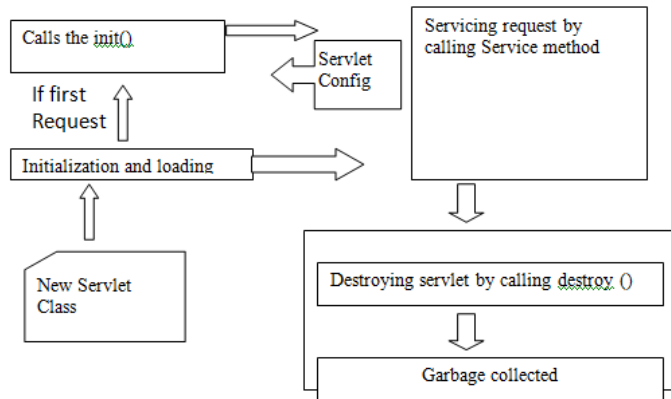
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1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	When the servlet is first created,its _____method is invoked	Init()
2.	The init method has a _____parameter.	ServletConfig
3.	Each time the server receives a request for a servlet; the server needs a new thread and calls _____.	service ()
4.	_____ method gives your servlet a chance to close database connection.	Destroy()

Topic:- ServletException:

Trailer:- (Only For Understanding)

(1) How to handle errors of any servelt?

ServletException:-

The javax.servlet defines two exceptions,
The first is ServletException which indicates that a servlet problem has been occured and
The second is UnavailableException which extends ServletException and indicates that servlet is unavailable.
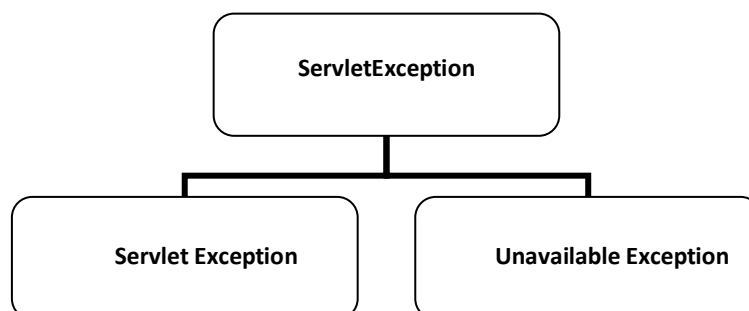
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(1) ServletException:-

Servlet Exception indicates that a servlet problem has occurred. The general form of Servlet Exception class is:

> public class Servlet Exception extends Exception

ServletException has following constructor.
- Public ServletException():Basic exception constructor
- Public ServletException (String msg): It creates a new servlet exception with a message.
- Public ServletException (String msg, Throwable t): It creates a new servlet exception with a message and a wrapped exception.

(2) Unavailable Exception:-

Unavailable Exception extends ServletException. It defines exception that a servlet throws to indicate that it is permanently or temporarily unavailable.when a servlet is permanently unavailable, something is wrong with it, and it can not handle request until some action is taken.

A system administrator may need to take corrective action.

Servlet container   can safely treat both type of unavailable exception in the same way.

General form of unavailable exception is:

> public class UnavailableException extends ServletException

UnavailableException has following constructor.
- Public UnavailableException():Basic exception constructor
- Public UnavailableException (String msg): It creates a new exception with a message that a servlet is permanently Unavailable.

This provides following methods:

I. **getUnavailableSeconds ()** : It returns the number of seconds the servlet expects to be temporarily available.

II. **getServlet ()**: It returns the servlet that threw this exception or null if the servlet instance was not provided to the constructor.

III. **IsPermanent ()**: It indicates that the servlet is permanently unavailable or not.

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Students Outcomes:- Aware about handling the errors.

	1 Word Question Answer	
Sr.No	**Question**	**Answer**
1.	Which exception indicates that a servlet problem has been occurred?	ServletException
2.	UnavailableException which extends _____.	ServletException
3.	_____ returns the exception that caused this servlet exception.	getRootCause ()
4.	I. _____ returns the servlet that threw this exception or null if the servlet instance was not provided to the constructor.	getServlet()

Topic:- ServletRequest and ServletResponse:

Trailer:- (Only For Understanding)

(1) how servlet request and response work done? and how this process will perform?

Details:- (For Exam)

Diagram of How Servlet is execute with Request and Response

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The ServletRequest interface is implemented by the server which enables the servlet to obtain the information about the client request.

ServletRequest and ServletResponse :

ServletRequest Class:-

Methods	Description
Void setAttribute(String name, Object obj)	It stores an attribute in the request. Mostly used with Request Dispatcher.
Object getAttribute(String name)	Returns the value of the attribute named name.
Enumeration getAttributNames()	It returns the array of the name of the attributes.
String getParameter(String prm)	Returns the value of the parameter named prm.
Enumeration getParameterNames()	Returns an enumeration of the parameter names for this request.
String[] getParameterValues(String nm)	Returns an array containing values associated with the parameter specified by nm.
String getRemoteAddr()	Returns the String equivalent of the client IP address.
String getRemoteHost()	Returns the String equivalent of the client host name.

ServletResponse Class

Methods	Description
PrintWriter getWriter() throws IOException	Returns a PrintWriter that can be used to write character data to the response. An IllegalStateException is thrown if getOutputStream () has already been invoked for this request.
void setContentType(String type)	Sets the content type for the response to type.

HttpServletRequest Class

Methods	Description
Cookies[] getCookies()	Used to obtain the array of cookie that are present in the request.
String getQueryString()	Returns the query string that is contained in the request URL.
HttpSession getSession()	Returns the current session associated with the request.

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HttpServletResponse Class

Methods	Description
Void addCookie(Cookie cookie)	Adds cookie to specified HTTP response.
String encodeURL(String url)	It encodes the URL by including session id in it, if encoding is not needed returns URL unchanged.
void sendRedirect(String url) throws IOException	Redirects the client to url.
void setHeader(String name, String value)	Used to set response header with given name and value.
void setStatus(int sc)	Sets the status code for HTTP response SC_MOVED_TEMPORALILY,SC_OK

Students Outcomes:- Aware about request and response cycle and different methods of different classes by which the programs can run easily.

1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	_____ Returns the value of the attribute named name.	getAttribute()
2.	_____ Returns the value of the parameter named prm.	GetParameter()
3.	_____ Returns the String equivalent of the client host name.	GetRemoteHost()
4.	_____ Returns a PrintWriter that can be used to write character data to the response.	getWriter()
5.	_____Redirects the client to url.	SendRedirect()

Topic:- Session Tracking Approaches

Trailer:- (Only For Understanding)

(1) How to handle session with diffrent concepts?
(2) There are four techniques by which server can track clients.

Details:- (For Exam)

When a user makes a page requests to the server, the server creates a temporary session to identify that user.
So when user goes to another page on the same site the server can recognize that user easily so a Session is temporary small unique connection between a server and the client enabling it to identify that user across multiple page requests or visit to that site.

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Http is a stateless protocol. Each request is independent of the previous one.

There are 2 important activities in session management.

- **Tracking the identity of a user**
- **Maintaining user state**

    It provides following mechanism to track the user state across requests.

    - URL rewriting
    - Hidden Form Field
    - Cookies
    - Http Session

1. URL rewriting

To maintain the session state the URL rewriting is the best practice. URL rewriting is based on the idea of inserting a unique id (generated by server) in each URL of the response from the server.
While generating the response to the first request, the server inserts this id in each URL. When client submit such a request to one such URL, the browser send this id back to the server the server can identify the id with all requests.

Advantage: User remains unknown and they are universally supported.
Disadvantage: It is tedious to rewrite the entire URL and it only works with dynamically created documents.

2. Hidden form fields :-

The component can include in the html form a field that is not displayed on the form. This field is called hidden field.
A hidden field is similar to the other fields of the form. The main thing is the value of hidden field will not be entered by user but it is assigned by the Component.

The date available in the hidden field will be treated same as the other regular fields.
The value of the hidden filed can be abstracted from the form and can be set by the browser as a parameter Example <input type = "hidden" name = "grno" value = "1">

In the above example, the grno is automated generated field. So the value will be assigned by the Component itself and not by the user. You can use the name grno at any place in the form just like a normal field.

Remember that hidden fields are useful when the user will be unknown for the particular value of the field.

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It can be used for following purposes.

- For tracking session as a users move around within site.
- Hidden fields are used to store background information in pages that are dynamically generated.

Advantages:
It is universally supported and allows anonymous users.

Disadvantages:

- It only works for a sequence of dynamically generated forms.
- It breaks down with static documents, emailed documents, and bookmarked documents.
- There are no browser shut downs.

3. Cookies :-

Cookies are small bits of textual information that a Web server sends to a browser and that the browser later returns unchanged when visiting the same Web site or domain.

All modern browser can receive cookies from web servers and then send them back along with requests.There is no limitation with cookies. All browser allow users to disable this functionality,which leads to browser not recognizing cookies.

Identifying a user during an e-commerce session. Many on-line stores use a "shopping cart" in which the user selects an item, adds it to shopping cart, and then continues shopping. Since the HTTP connection is closed after each page is sent, when the user selects a new item for his cart, how does the store know that he is the same user that put the previous item in his cart? Cookies are a good way of accomplishing this.

Avoiding username and password. Many large sites require you to register in order to use their services, but it is inconvenient to remember the username and password. Cookies are a good alternative for low-security sites.

Customizing a site. Many portal sites let you customize the look of the main page. They use cookies to remember what you wanted, so that you get that result initially next time.

Focusing advertising.
Cookies let the site remember which topics
Interest certain users and show advertisements relevant to those interests.

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The Servlet Cookie API

To send cookies to the client, a servlet would create one or more cookies with the appropriate names and values via new Cookie (name, value), set any desired optional attributes via cookie.
Add the cookies to the response headers via response.addCookie (cookie).

To read incoming cookies, call request.getCookies(), which returns an array of Cookie objects.

Creating Cookies

A Cookie is created by calling the Cookie constructor, which takes two strings: the cookie name and the cookie value.

Neither the name nor the value should contain whitespace or any of:
       [ ] ( ) = , " / ? @ : ;

Reading and Specifying Cookie Attributes

Before adding the cookie to the outgoing headers, you can look up or set attributes of the cookie. Here's a summary:

• getComment/setComment
Gets/sets a comment associated with this cookie.

public void setComment(String purpose)
public String getComment()

• getDomain/setDomain
Gets/sets the domain to which cookie applies. You can use this method to instruct the browser to return them to other hosts within the same domain.

public void setDomain(String pattern)
public String getDomain()

• getMaxAge/setMaxAge
Gets/sets how much time (in seconds) should elapse before the cookie expires.

public void setMaxAge(int expiry)
public int getmaxAge()

• getName/setName
Gets/sets the name of the cookie. The name and the value are the two pieces you virtually always care about.

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public void setName(String name)
public String getName()

• getPath/setPath
Gets/sets the path to which this cookie applies. If you don't specify a path, the cookie is returned for all URLs in the same directory as the current page as well as all subdirectories.

public void setPath(String uri)
public String getPath()

• getSecure/setSecure
Gets/sets the Boolean value indicating whether the cookie should only be sent using a secure protocol, such as HTTPS or SSL.The default value is false.

public void setSecure(Boolean flag)
public Boolean getSecure()

• getValue/setValue
Gets/sets the value associated with the cookie. Again, the name and the value are the two parts of a cookie that you almost always care about.

public void setValue(String value)
public String getValue()

• getVersion/setVersion
Gets/sets the cookie protocol version this cookie complies with.

Public void setVersion(int v)
Public int getVersion()

Placing Cookies in the Response Headers

The cookie is added to the Set-Cookie response header by means of the addCookie method of HttpServletResponse. Here's an example:

```
Cookie userCookie = new Cookie("user", "Demo");
response.addCookie(userCookie);
```

Reading all Cookies stored in Request object

```
Cookie c[] = request.getCookies();
if(c.length==0)
    out.println("<p> No Cookies in Your PC");
```

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```
   for(int i=0; i<c.length; i++)
   {
      out.println("<br> Cookie-" + (i+1));
      out.println("<br> Name : " + c[i].getName());
      out.println("<br> Value : " + c[i].getValue());
   }
```

4. Session API:

When we write any servlet, it is necessary for the developer to maintain sessions.

HTTPSession interface:-

It provides a way to identify a user across more than one page request or visit to a web site and to store information about that user.

An HttpSession class was introduced in the Servlet API. Instances of this class can hold information for one user session between requests.
      HttpSession session = request.getSession(true);

This method takes a Boolean argument. True means a new session shall be started if none exist, while false only returns an existing session.

Method	Description
getId()	Returns the session ID.
getAttribute(String attr)	Returns the value associated with the name passed in attr. Returns null if attr is not found.
getAttributeName()	Returns an enumeration of the attribute names associated with the session.
getValue(String name)	Return the object bound to the given name in the session's application layer data.Null if no such bindings.
getValueNames()	Returns array of string object specifying tha name of all objects bound to this session.
void invalidate()	Invalidates this session and removes it from context.
Boolean isNew()	Returns true if the server has created the new session and has not been used by the client otherwise return false.
void setAtttribute(String attr Object val)	Associates the value passed in val with the attribute name passed in attr.

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HttpSessionContext interface:-

HttpSessionContext provides access to all of the currently active sessions on the server. This can be useful for servlets that is inactive sessions,displaystatistics, otherwise share information. A servlet obtains a HttpSessionContext object grom getSessionContext() of HttpSession.

Method	Description
Enumeration getId()	Returns enumeration that contains the session id for all the currently valid session in the context.returns empty enumeration if there are no valid sessions.
HttpSession getSession(String sessionid)	Returns the session associated with the given session identifier.a list of valid session id can be obtained from getId()

1 Word Question Answer		
Sr. No.	**Question**	**Answer**
1.	_____is temporary small unique connection between a server and the client enabling it to identify that user across multiple page requests.	Session
2.	To maintain the session state the _____is the best practice.	URL rewriting
3.	The component can include in the html form a field that is not displayed on the form. This field is called_____.	hidden field
4.	____are small bits of textual information that a Web server sends to a browser and that the browser later returns unchanged when visiting the same Web site or domain.	Cookies
5.	_____ sets the name of the cookie.	setName
6.	A public interface HttpSession is a member of_____.	servlet.http
7.	___provides a way to identify a user across more than one page request or visit to a web site and to store information about that user.	HTTPSession

Students Outcomes:- Aware about session tracking for client and server by cookies and session.

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Topic:- Servlet Collaboration:-

Trailer:- (Only For Understanding)

(1) How two servlets works with each other and how they support by request forward and include?

Details:- (For Exam)

Sometimes servlets have to co-operate that is useful by sharing some information.
This communication can be called as Sort Servlet Collaboration.
The servlets which are collaborating can pass the shared information directly from one servlet to another.

Request Dispatcher Interface:-

It defines an object they receives request from the client and send them to any resources such as servlet, html file call JSP file and the server. The servlet container creates the Request Dispatcher.

They define two methods.
1. forward
2. include

(1) void forward (ServletRequest req,ServletResponse res) throws
ServletException,IOException

It will forward a request from the server to another resource. This method allows one servlet to do preliminary processing of a request and other resources to generate the response.

The request & response particular must be the object of the same class.

(2) void include (ServletRequest req, ServletResponse res) throws
ServletException,IOException

It will include a request from the server to another resource. This method allows both servlet to do preliminary processing of a request and generate the response.

Students Outcomes:- Aware about the methods by which servlet collobrate with each other.

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Topic:- Web.xml (Most IMP)

Trailer:- (Only For Understanding)

(1) web.xml file is configuration file. The process known as deployment descriptor.

Details:- (For Exam)

A web application's deployment descriptor describes the classes, resources and configuration of the application and how the web server uses them to serve web requests?

When the web server receives a request for the application, it uses the deployment descriptor to map the URL of the request to the code that ought to handle the request.

The deployment descriptor is a file named web.xml. It resides in the app's WAR under the WEB-INF/ directory. The file is an XML file whose root element is <web-app>.

web.xml defines mappings between URL paths and the servlets that handle requests with those paths. The web server uses this configuration to identify the servlet to handle a given request and call the class method that corresponds to the request method.

To map a URL to a servlet, you declare the servlet with the <servlet> element, then define a mapping from a URL path to a servlet declaration with the <servlet-mapping> element.

The <servlet> element declares the servlet, including a name used to refer to the servlet by other elements in the file, the class to use for the servlet, and initialization parameters.

You can declare multiple servlets using the same class with different initialization parameters. The name for each servlet must be unique across the deployment descriptor.

```
<servlet>
   <servlet-name>redteam</servlet-name>
   <servlet-class>myservlet</servlet-class>
   <init-param>
      <param-name>teamColor</param-name>
      <param-value>red</param-value>
   </init-param>
</servlet>
```

Students Outcomes:- Aware about xml configuration file for servlet. (Also known as deployment descriptor file)

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1 Word Question Answer		
Sr. No.	**Question**	**Answer**
1.	Sometimes servlets have to co-operate that is useful by sharing some information. This communication can be called as_____.	Servlet Collaboration
2.	_____ defines an object they receives request from the client and send them to any resources such as servlet, html file call JSP file and the server.	Request Dispatcher
3.	_____should be called before the response has been committed to the client.	Forward()
4.	_____ includes the contexts of resource in the response.	Include()
5.	____ defines mappings between URL paths and the servlets that handle requests with those paths.	Web.xml

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CHAPTER: 3   JSP   & Java Beans

NO	CHAPTER NAME	CONTENT
3.	JSP, Java Beans	(1) Introduction to JSP and JSP Basics • JSP vs. Servlet • JSP Architecture • Life cycle of JSP • JSP Elements: Directive Elements, Scripting Elements, Action Elements (2) Directives Elements (page, include, taglib) (3) Scripting Elements (Declaration, scriptlet, expression) (4) ⬜Action Elements (JSP:param, JSP:include, JSP:Forward, JSP:plugin) • JSP Implicit Objects • JSP Scope • Including and Forwarding from JSP Pages • include Action • forward Action • Working with Session & Cookie in JSP • Error Handling and Exception Handling with JSP • JDBC with JSP • JavaBean Properties • JavaBean Methods • Common JavaBean packaging

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Topic:- Introduction

Trailer:- (Only For Understanding)

What is JSP? Introduction and benefits.

Details:- (For Exam)

JSP is Java Server Pages (JSP) technology enables you to mix regular, static HTML with dynamically generated content.

JSP are run in a server side component known as JSP container which translate them into equivalent Java Servlet.

You simply write the regular HTML in the normal manner, using familiar Web-page-building tools. You then enclose the code for the dynamic parts in special tags, most of which start with   <% and end with %>. JSP typically comprised of:

- Static HTML/XML components
- Special JSP tags.
- Code written in the java language called"scriptlets".

Benefits of JSP

• No body can borrow the code
>   The JSP code written and runs and remains on the server.So issue of copy source code does not arise at all.
>   All of JSP's functionality is handled before the page is sent to browser.

• Faster loading of pages.
>   With JSP, decision can be made about what user want to see at web server prior to pages being dispatched. So only the content that the user is interested will be dispatched to the user. There is no extra code and extra content.

• No browser compatibility Issues.
>   JSP pages can run same way in browser.The developer ends up sending standard HTML to a user browser.This largely eliminates scripting issues and cross browser compatibility.
• JSP support
>   JSP is supported by number of web server like Apache, Microsoft IIS and PWS, Netscapes's FastTracks and Enterprise web server and others.Built in support for JSP is available Java Server from Sun Microsystem.

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• **Compilation**

JSP compiled before the web server processes it.This allows the server to handle JSP pages much faster, because in the older technologies such as CGI require the server to load an interpreter and the target script each time the page is requested.

• **JSP elements in HTML/XML pages**

JSP page look like HTML /XML page, it holds text marked with a collection of tags. While a regular JSP page is not a valid XML page, there is a   variant JSP tag syntax that lets the developer use JSP tags within XML documents.

Disadvantages of JSP

1. Attractive Java Code
Putting java code within web page is really bad design, but JSP makes it tempting to do just that.Avoid this as far as possible.It is done using template using.

2. Java Code required
To relatively simple things in JSP ccan actually demand putting java code in a page.

3. Simple task are hard to code
Even including page headers and footers is a bit difficult with JSP.

4. Difficult looping in JSP
In regular JSP pages looping is difficult .In advance JSP we can use some custom tags for looping.

5. Occupies a lot of space.
JSP consumes extra hard drive and memory space.

1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	JSP stands for?	Java Server Pages
2.	_____ Technology enables you to mix regular, static HTML with dynamically generated content.	JSP
3.	In advance JSP we can use some custom tags for___.	Looping.

Students Outcomes:- students can get the knowledge of JSP and its benifits.

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Topic:- Servlet v/s JSP

Trailer:- (Only For Understanding)

Different between jsp and servlet(most imp)

Details:- (For Exam)

Difference between Servlets and JSP	
Servlets	**JSP**
Servlet is a pure Java code.	JSP is a tag based approach.
We write HTML in servlet code.	We write JSP code in HTML.
We cannot run Java script at client side.	We can run Java script at client side.
Servlets are tougher to code.	JSP coding is easier.
By default session management is not enabled. We are required to enable it.	In JSP session management is enabled by default..
Servlets do not have implicit objects.	JSP does have implicit objects viz. request, response, session, out etc.
Packages are to be imported at the top of the servlet.	Packages can be imported anywhere in the JSPcode.

JSP and servlet both used for developing dynamic web content.

JSP is slightly more complicated .JSP contain mixture of HTML,javascript,JSP elements and directives.

The element in a JSP will generally be compiled by the JSP engine into a servlet.

One advantage of jsp over servlet is it allows logical division between what is displayed and the web server side code specification that dictates what content files the page.

It is easy to modify the look and feel of what is delivered by jsp without having to alter any web server side, java code specification.

JSP are documents – centric. servlet look and act like programs.

Some of the JSP functionality can be achieved on the client,using javascript.

While its true that anything done with a JSP can also be done with using a servlet.

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1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	_____ used for developing dynamic web content.	JSP and servlet both
2.	A servlet is a java class implementing the_____.	javax.sevlet
3.	_____ contain mixture of HTML, javascript.	JSP
4.	Some of the JSP functionality can be achieved on the client, using____.	Javascript

Students Outcomes:- students can get the knowledge of jsp and servlet difference.

Topic:- JSP Architecture Development

Trailer:- (Only For Understanding)

JSP request and response cycle from client to server and server to client.

Details:- (For Exam)

Fig: JSP Architecture
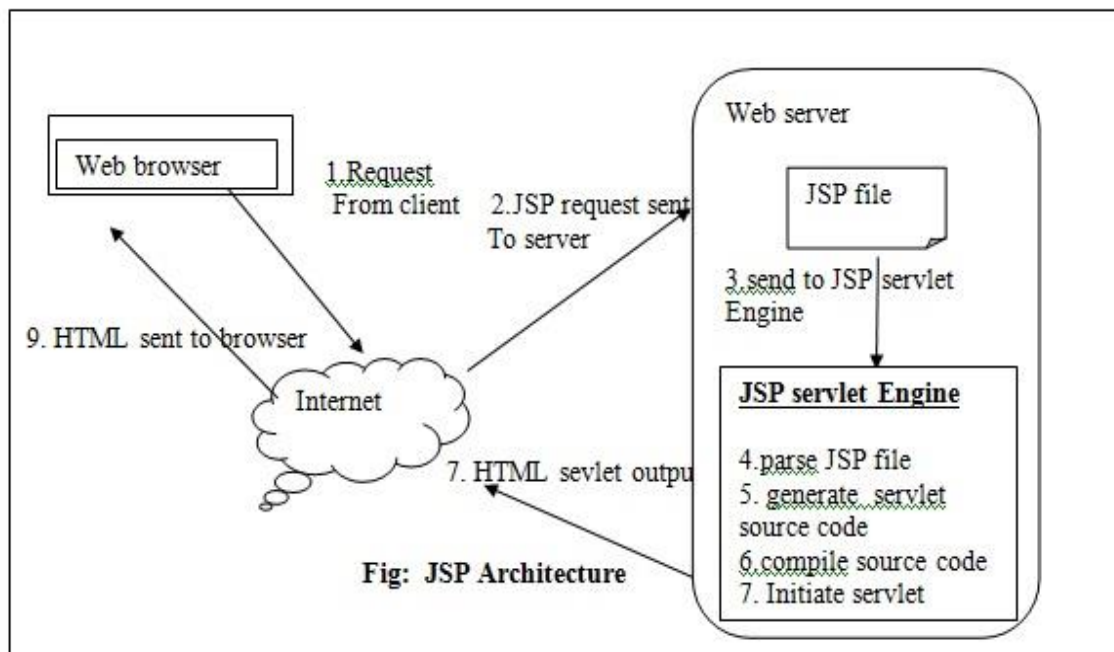
The purpose of JSP is to provide a declarative, presentation centric method of developing servlet.

Communication of web browser and web server in terms of JSP in shown below:

JSP are built by sun microsystem servlet techology. JSP contain java code and its file extension is jsp.

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JSP engine parse the .jsp file and creates a java servlet source file. then it compiles the source file into a class file,this is done first time only therefore JSP is probably slower than when first time it is accessed. After this compile servlet is executed and is therefore returned faster.

Step for JSP request shown in figure:

(1) When user goes to jsp page web browser make a request via Internet.

(2) JSP request then sent to the server.

(3) Web server recognizes the .jsp file and passes the JSP file to the JSP servlet Engine.

(4) If JSP file has been called for first time, Then JSP file is parsed, otherwise the servlet is instantiated.

(5) The next step is to generate a servlet from jsp file .the entire HTML required is converted to println statements.

(6) Servlet source code is compiled into class file.

(7) Servlet is instantiated, calling the init and service method.

(8) HTML from the servlet output is sent via the Internet.

(9) HTML results are displayed on the user's web browser.

1 WordQuestion Answer		
Sr.No.	**Question**	**Answer**
1.	JSP are built by_____.	sun microsystem
2.	Extension of JSP files is_____.	.jsp

Topic:- JSP LIFE CYCLE

Trailer:- (Only For Understanding)

How jsp works internally and what is the structure and life cycle of request and response.

Details:- (For Exam)

JSP enables you to write standard HTML pages containing tags that run powerful programs based on Java Technology.

The goal of JSP technology is to support separation of presentation and business logic.Web designer can design and update pages without learning the programming language.

Programmer for java platform can write codes without dealing with web page design's files are also converted into servlet at last.

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This process is done in the background by the Web Container.javax.servlet.jsp.HttpjspPage interface is used to create servlet from JSP file.
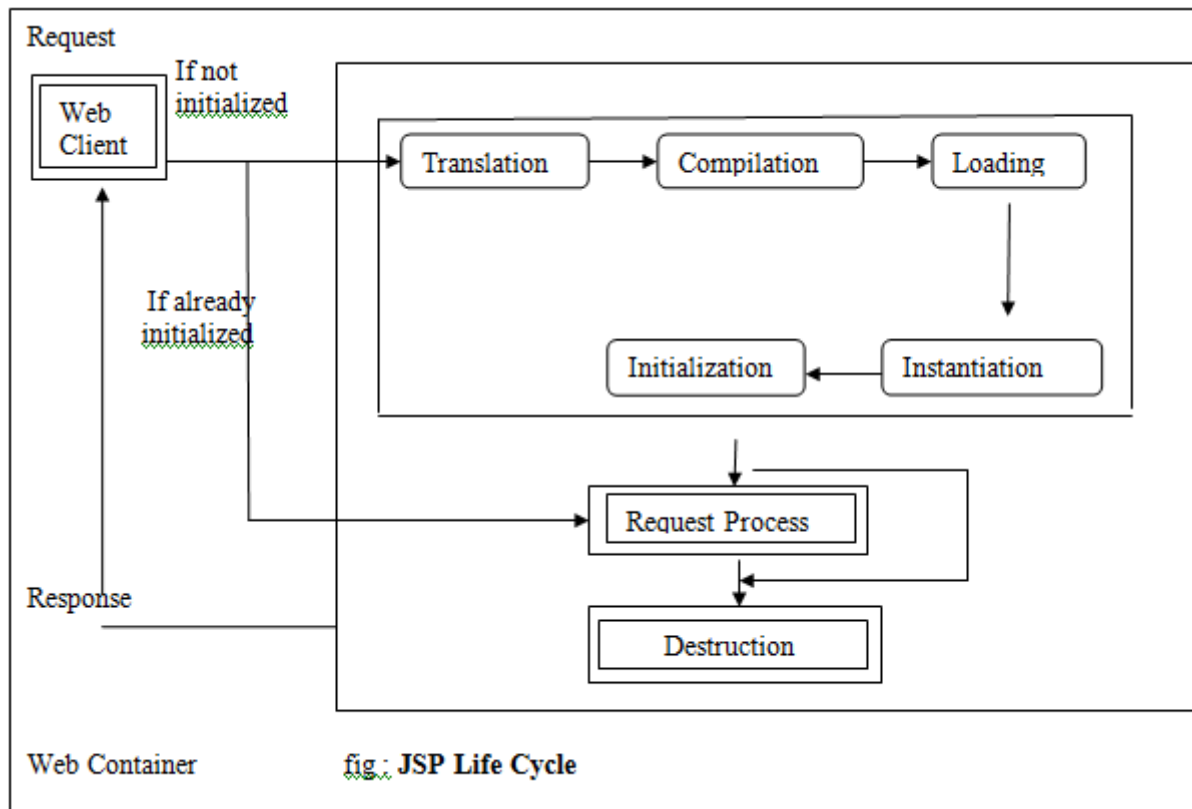
fig : **JSP Life Cycle**

Above figure shows that if the JSP page is requested first time by web client to web container, then requested JSP code is converted into servlet code **into the translation phase.**

After that in **compilation phase** converted servlet code is compiled and bytecode is created in the form of servlet class.

In next phase servlet class **is loaded into servlet engine** and servlet instance is created.After the creating instance it goes to the Request Process phase.

But If JSP is already initialized then it goes to Request Process phase directly.When JSP servlet class completes its execution it goes in to the Destruction phase.

After creating an instance of servlet class, following methods are called in turn accordingly which they are available under javax.jsp.JspPage.

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- **jspInit()**

    When jsp servlet instane is created, jspInit() called .You can use servlteContext object or ServletConfig object to get initial parameters.It is similar to init() of servlet.

Syntax of jspInit() is as follows:

    Public void jspInit()

- **_jspService()**

This is similar to service() of servlet .when jsp servlet instance is called ._jspService() is called where request and response object are sent.

Syntax of jspService() is as follows:

Public void _jspService(HttpServletRequest req,HttpServletResponse res)throws   Servlet Exception,IOException

- **jspDestroy()**

This is similar to destroy() of servlet .This method is called when the JSp servlet instance is destroyed from the web container.

Syntax of method is as follows:

Pubic void destroy()

Request-response cycle of JSP

1) Clinet sends an HTTP request for a JSP page to the server, either using a GET /POST method.

2) the browser identifies the JSP files and compiles and loads the corresponding servlet class if the servlet class is not already present in the JVM.The server calls the service() which often passes the request and response to the doGet() or doPost().

The servlet processes the input form the request and prepares an HTML page as a response.

3) The response is sent back to the client browser.

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1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	_____ enables you to write standard HTML pages containing tags that run powerful programs based on Java Technology.	JSP
2.	After JSP page converted in to servlet page which code is created?	Bytecode
3.	When jsp servlet instane is created_____is called.	jspInit()
4.	When jsp servlet instance is called_____ is called where request and response object are sent.	_jspService()
5.	_____ method is called when the JSp servlet instance is destroyed from the web container.	jspDestroy()

Topic:- JSP Elements

Trailer:- (Only For Understanding)

JSP elements means jsp components.

Details:- (For Exam)

JSP elements are instruction to JSPcontainer about what code to generate and how it should operate.

JSP elements have a special identity to jsp compiler because it starts and ends with special kind of tags.template data(HTML) code is not compiled by the jsp compiler and also not recognized by the jsp container.

It is also known as Component of the Jsp pages.

There are basically three type of JSP elements are as given follow.

- **Directive Elements**
- **Scripting Elements**
- **Action Elements**

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(1)   Directive Elelments

The role of directive is to pass information to the JSP container.
Syntax:

<%@ directive {attribute name="value"} %>

There are three type of directive elements are as given below.

- **Page Directive**
- **Include Directive**
- **Taglib Directive**

(1) Page Directive:

Page Directive is uses to specify attributes for the whole JSP page.syntax is as follows:

<%@ page [attribute1="value1"   attribute2="value2"………attributeN= "valueN"] %>

Where the attribute can be as follows:

Attribute Name	Use(description)	Default value
Language	It is used to define the language which is used with the scriptlet elements.Most probably its valid value is java only.	Java
extends	It defines fully qualified name of the super class of the jsp page.	
Import	It defines list of packages which are imported with the JSP page with its fully qualified name.	Javax.servlet.*, Javax.servlet.http.*, Javax.servlet.jsp.*,java.lang.*
Session	It defines the Boolean value indicating if jsp page require HTTP session then its value Is true else it becomes false.	True
Buffer	It specifies the size of buffer.	8 kb
autoFlush	It defines the Boolean indicating if it is true then it automatically flushed the buffer ad if false then it throws an exception buffer overflow.	True
isThreadSafe	It defines the Boolean indicating if it is true jsp page handles the all the request simultaneously from multiple threads if false then generates servlet declares that it	True

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	implements the SingleThreadModel.	
Info	It returns string message information related to jsp page using getServletInfo()	-
isErrorPage	It defines the Boolean indicating if it is true jsp page considered as error page and if false then it is normal page and implements it with other jsp page to handle exception.	False
errorPage	It defines the url of the error page we want to implement the error page with the other jsp pages we can use this directive.	
contentType	It specifies the MIME type and character encoding which used with generated servlet.	<%@ page contentType="text/html"%>
pageEncoding	It defines the character encoding of the jsp page	ISO 8859 -1 (Latin script)for JSP style and UTF-8 for xml style tags.

Syntax for all jsp directives:

```
<%@ page [language="java"]
[extends="package.class"]
[import="{package.class|package.*},….."
[session="true/false"]
[buffer="none|8kb|sizekb"]
[autoFlush="true|false"]
[isThreadSafe="true/false"]
[info="text"]
[errorpage="relativeURL"]
[contentType="MIME[;charset=charset]"  |   "text/html";
Charset=ISO 8859-1"]
[isErrorPage="true|false"]%>
```

Example:

```
<%@page import="java.util.*;" %>
<html>
   <head>

     <title> Page Directive Example </title>
   </head>
   <body>
     <%
     Date d1=new Date();
```

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```
     out.println("curent date is=");
     out.println(d1);
     %>
   </body>
</html>
```

(2) Include Directive:

Include directive is used to include the static page and dynamic pages with the other jsp pages. For example if we want to Set same header and footer for all the pages we can create header.html and can include it with necessary jsp pages.

In short it is used to insert a part of the code that is common to multiple pages.

Syntax:<%@include file="relative path"%>
The file attribute is used to specify the name of the file to be included.

First.html

```
<html>
  <head><title>Include example</title></head>
  <body>
   Username : <input type="text" name="txtnm" value="">
   Password : <input type="text" name="txtps" value="">
     <input type="submit" name="submit" value="submit">
  </body>
</html>
```

IncludeDemo.jsp

```
<%@include file="First.html" %>
<html>
   <head>
     <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
     <title>JSP Page<./title>
   </head>
   <body>
     <h1>welcome to include directive example</h1>
   </body>
</html>
```

(3)Taglib Directive:

It declares that the JSP file uses custom tags, names the tag library that defines them, and specifies their tag prefix. Syntax:

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<%@ Taglib uri="URItoTagLibrary" prefix="tagPrefix" %>
Example:

<%@ taglib uri="/tlds/Fancy/TableGenerator.tld" prefix="fancytable" %>
< fancytable: table>
………..
</fancytable:table>

1 Word Question Answer		
Sr.No.	Question	Answer
1.	_____Directive is uses to specify attributes for the whole JSP page	Page
2.	_____ directive is used to include the static page and dynamic pages with the other jsp pages.	Include
3.	_____Directive declares that the JSP file uses custom tags	Taglib

2. Scripting Elements

Scripting Elements are used to write java code with the jsp file. As you know in jsp java code is embedded within HTML code. You need to write some java language statements or use java features within the JSP page.

There are 3 types of scripting elements which are as follows:

- **Scriptlets**
- **Declaration**
- **Expression**

1. Scriptlets:
Scriptlets are block of java code with the jsp page. Scriptlets starts with <% tag and end with %>closing tag.

Syntax:
```
<%
    Statement 1;
    Statement 2;
    …………………….
    Statement n;
%>
```

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Example:

We can write any valid java statements with the scriptlets declaring variable, writing processing and output part.

2. Declaration:

Declaration tags are used to declare the variables, methods and instance of the classes with the jsp page. Declaration starts with <%! tag and end with %>closing tag.

```
<%!
    Statement 1;
    Statement 2;
    …………………….
    Statement n;
%>
```

3. Expression:

Expression element is used to print value of any variable or any valid expression when the jsp page is requested. All the expressions are printed automatically by converting values into string values.

Syntax:
<%= expressions %>
Example:
Current Time :< %= java.util.Calendar.getInstance().getTime() %>

1 word Question Answer		
Sr.No.	**Question**	**Answer**
1.	_____ Elements are used to write java code with the jsp file.	Scripting Elements
2.	_____ are block of java code with the jsp page.	Scriptlets
3.	Scriptlets starts with____ tag and end with ____closing tag.	<%,%>
4.	Declaration starts with ___ tag and end with ___closing tag.	<%!,%>
5.	_____ is used to print value of any variable or any valid expression when the jsp page is requested.	Expression element
6.	An expression starts with _____ and ends with ____.	<%=,%>

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4. Action Elements:

Action elements are high level jsp elements which are used to create, modify and use other objects.Syntax of action element's tags just like XML syntax.

- **<jsp:param>**
- **<jsp:include>**
- **<jsp:forward>**
- **<jsp:plugin>**

1. <jsp:param>

This element Is used to provide the tag/value pair of information, by including these as sub attribute of the <jsp:include>,<jsp:forward> and the <jsp:plugin> actions.

Syntax:

```
<jsp:param name="pname" value="pvalue"/>
OR
<jsp:param name="pname" value="pvalue">
</jsp: param>
```

2. <jsp: include>

This element is used to include static and dynamic resource of the current JSP page. This object is just used to include resource on the current JSP page. It can not be used to send response.

Syntax:

```
<jsp: include page="jsp page"   flush="true/false"/>
<jsp: param name="pname" value="pvalue">
</jsp: include>
```

Example:

```
<jsp:include page="login.jsp"    flush="true"/>
<jsp: param name="username"    value="java">
</jsp:include>
```

Here <jsp: include>   has two attribute which are:

Page: Specifies the resource (JSP/HTML) file which will be included.

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Flush: An optional parameter used to flush buffer. Specified true/false.

Note: Once the buffer is flushed, the value can not be recalled as it is flushed from the memory directly.

3. <jsp:forward>:

This control is used to transfer control from current JSP page to another source which may be any valid source of application.It is obvious to understand that whenever this action elements is called,execution of current JSP page is stopped and control is transfered to another specified URL into <jsp:forward>:

Note:<jsp:forward> action element is same as forward() of request dispatcher of servlet programming.

Syntax:
<jsp:forward page="destinationpage"/>

Example
<jsp:forward page="abc.jsp"/>

Above example will transfer control from current page to abc.jsp

4. <jsp:plugin>

This element is used to embed an applet and java beans with the jsp page.the tag automatically detects the bowser type and inserts the appropriate HTML tag either<embed> or <object> in the output.

Syntax:

<jsp:plugin type="plugintype" code="classfilename" codebase="url">
</jsp:plugin>

Example:

<jsp:plugin type="applet " code="AppletDemo.class" >
</jsp:plugin>

1 Word Question Answer		
Sr. No.	**Question**	**Answer**
1.	_____ Element is used to include static and dynamic resource of the current JSP page.	<jsp: include>

2.	_____ Control is used to transfer control from current JSP page to another source which may be any valid source of application.	<jsp:forward>
3.	_____ element is used to embed an applet and java beans with the jsp page	<jsp:plugin>

Students Outcomes:- students can get the knowledge of basic component or tags or elements of jsp by which the pages are created.

Topic:- COMMENTS AND TEMPALATE   DATA

Trailer:- (Only For Understanding)

In jsp page the data instead of elements are known as template data.

Details:- (For Exam)

We can use two type of comment with JSP page one is for HTML and another for JSP.

HTML comment :<! --this comment will appear in the client's browser -->
JSP comment: <% -- this comment will not appear in the client's browser --%>

JSP comment will not appear in the page output to the client.

Template Data:

In JSP page everything that is not JSP elements or JSP comments is termed as Template Data. Usually all the HTML and text in the page.

SCOPE OF THE JSP OBJCTS

Objects that are created as part of the JSP page have a certain lifetime and may or may not be accessible to other components or objects in the web application.

The lifetime and accessibility of an object is known as scope.
There are four valid scope.

- Page Scope
- Request Scope
- Session Scope
- Application Scope
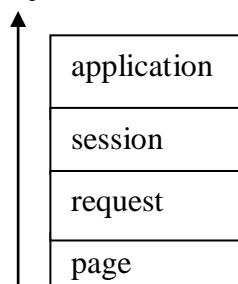
application
session
request
page

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1. Page scope:

This scope is most restrictive. With page scope, the object is accessible only within the current jsp page in which it is defined.
Jsp implicit objects out, exception, response, config, pageContext and page have'page scope'.

2. Request scope:

Jsp object created using the 'request' scope can be accessesd from any pages that serve that request. This means that the object is available within the page in which it is created and within pages to which the request is forwarded or included
Implicit object request has 'request scope'

3. session scope:

Objects with session scope are available to all application component that participate in the client's session. JSP object that is created using the session scope is bound to the session object.
Implicit object session has the 'session scope'.

4. Application Scope:

Objects with application scope are available to the entire application for the life of the application. Implicit object application has the 'application scope'.

1 Word Question Answer		
Sr.No.	Question	Answer
1.	_____ Template data is ignored by the JSP translator.	Template
2.	The lifetime and accessibility of an object is known as_____	Scope
3.	Jsp object created using the _____ scope can be accessesd from any pages that serve that request	request
4.	Implicit object request has _____scope	Request
5.	Objects with_____ scope is available to all application components that participate in the client's session.	session
6.	Objects with application scope are available to the entire _____for the life of the application	application

Students Outcomes:- students can get the knowledge of different scope of jsp objects.

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Topic:- IMPLICIT OBJECT OF JSP

Trailer:- (Only For Understanding)

Jsp objects which are inbuilt or implicit.

Details:- (For Exam)

Implicit objects means the object which is already created by JSP itself.
Implicit objects are automatically created in JSP pages and can be used without declaring their object.

The reason behind that implicit object is, jsp page is also converted into servlet at last, so some of objects should be provided by JSP also for programming similar to sevlet. Implicit object are used within scriptlet and expression elements.

- **request**
- **response**
- **out**
- **session**
- **config**
- **exception**
- **application**

1. request:

This is the most important object which is used in JSP programming. The entire request coming from the client can be obtained from this object.

The request object has request scope. That means that the implicit request object can is in scope until the response to the client is complete.

Example:

```
<%
String u=request.getParameter("txt_username");
String p=request.getParameter("txt_password");
Out.println("welcome,"+u);
%>
```

The above example is used to retrieve username and password from request object and then print it.

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2. response:

This is another most important object which is used in JSP programming. If you want to generate any output for client,the you can generate it using response object.
As similar to sevlet programming ,response object in jsp is belongs to javax.servlet.HttpServletResponse class.

This object allow us to set content type using setContentType (), set headser using addHeader (String name, String value), to set cookie using addCookie (Cookie cookie) for the client and send a redirect response to the client using sendRedirect () of response.

3. session:

This object is used for session tracking .this belongs to javax.servlet.http.HttpSession class.
session object is for requesting the client is created under sessionimplicit object.

We can use session method like getAttribute(), setAttribute(), getValue(), putValue(), removeAttribute(), removeValue(), isNew(), getId(), getCreationTime().

4. application

This object is used for set values and attributes at application level.
Application object of JSP is similar to ServletContext object of servlet programming.
As it is similar servletContext object of application object.

You can use all methods available under ServletContext object like getAttribute(), setAttribute(), removeAttribute(),getServletInfo(), getInitParameter(), getInitParameterNames().

5. out:

This object is used to write output to the output stream of the client.The scope of out is current page.
out obect is created using javax.sevlet.jsp.JspWriter class.
Methods of out object is print(),println(),clear(),clearBuffer(),close(),flush().

6. config:

This object is similiar to ServeltConfig object of servlet class.config object is created using javax.Servlet.ServletConfig class.
This is mainly used to read some initial parameters which are passed to particular page.
Method available inside config object are getInitParameter(), getInitParameterNames(), getServletContext(), getServletName().

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7. page:

As you know JSP page is converted into servlet class at last. Then the servlet instance is created of that particuar sevlet class.

As page is the instance of the current jsp sevlet class; it contains method of object class along with all the methods created inside jsp page.

Implicit objects	Super class	Description
Request	HttpServletRequest	Provides HTTP request information
Response	HttpServletResponse	Send back data to the client
Out	JspWriter	Write data to the response stream
Session	HttpSession	Track information about a user from one request to another.
Application	ServletContext	Data shared by all JSP and servlets in the application.
pageContext	Pagecontext	Contains data associated with the whole page.
Config	ServletConfig	Provides servlet configuration data.
Page	Objects	Similar with "this" object in java
Exception	Throwable	Exception not caught by appliacation code

1 Word Question Answer		
Sr.No.	Question	Answer
1.	_____ objects means the object which is created already created by JSP itself.	Implicit
2.	Request object in JSP also belongs to _____class.	javax.servlet.httpServletRequest
3.	If you want to generate any output for client,the you can generate it using _____object	Response
4.	_____ object is used for session tracking	Session
5.	_____ object is used for set values and attributes at application level.	Application
6.	_____object is used to write output to the output stream of the client	Out

Students Outcomes:- students can get the knowledge of how the objects use and which methods are executed?

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Topic:- Handling and Errors and Exception with JSP Page

Trailer:- (Only For Understanding)

Error handling or Exception handling techniques.

Details:- (For Exam)

Exception referred to the error occurred at run time. In java exception handled through the exception object. In jsp exception is implicit object with page scope.

It is an instance of java.lang.throwable as you know that Throwable class is the super class of all the exception and error classes in the java.

Here with the jsp we can handle exception with Scriptlets, by creating an errorpage and with deployment descriptor.

(1) Exception handling using Scriptlets:

Exception can be handled in a scriptlet in the same way as in java, by using the try and catch block.

(2) Exception handling using the page Directive:

This is the second way to handle exception by creating an error page. To create an error page with JSP we can use isErrorpage=true attribute of page directive.

After creating an error page we can handle the exception with any JSP page by invoking this error page with it using errorPage="URL of the error page" attribute of the page directive.

(3) Exception handling using Deployment Descriptor:

This is the third way to by which we can handle an exception with JSP page.
Deployment descriptor is a web.xml file which defines the classes, resources and configuration of the application and how the web server uses them to serve web requests.

It resides in the application under the WEB-INF/directory. If an error page is defined for handling an exception, the request is directed to the error page's URL.

The web application deployment descriptor uses the <error–page> tag.

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```
<error-page>
        <exception-type>java.lang.throwable</exception-type>
        <location>/errorpage.jsp</location>
<error-page>
<error-page>
        <exception-type>500</exception-type>
        <location>/errorpage.jsp</location>
<error-page>
```

1 Word Question Answer		
Sr.No.	Question	Answer
1.	_____ referred to the error occurred at run time.	Exception
2.	. In jsp exception is _____object with page scope.	Implicit
3.	_____class is the super class of all the exception and error classes in the java.	Throwable
4.	To create an error page with JSP we can use _____attribute of page directive.	isErrorpage=true
5.	The web application deployment descriptor uses the _____tag.	<error–page>

Students Outcomes:- students can get the knowledge of various techniques of how errors are handle with jsp?

Topic:- INCLUDING AND FORWARDING FROM JSP

Trailer:- (Only For Understanding)

it is very similar concept like servlet include and forward concept.

Details:- (For Exam)

JSP pages have the ability to include other jsp pages or servlet in the output that is sent to the client, or to forward the request to other jsp page or servlet for servicing. This thing is possible through the standard actions, <jsp: include> and <jsp: forward>.

Include Action

Including a jsp page or servlet through a standard differs from the include directive.

```
<%@ include file="/WEB-INF/footer.jsp">
<jsp:directive.include file="/WEB-INF/footer.jsp">
```

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When the jsp container translates the page, this directive causes the indicated file to be included in that place in the page and become part of the java source file that is compiled into the jsp page implementation class.

The included file is neither allowed to modify the headers of the response, not to set cookies in the response.

Syntax:

<jsp:include page="URL" flush="true/false">
<jsp:param name="paramname" value="paramvalue"/>
</jsp:include>

For the include element, the page attribute is required, and its value is the URL of the page whose output is included in the response.this URL is relative to the jsp page. The flush attribute is optional, and it indicates whether the output buffer should be flushed before the included file is called.the default value is false.

If the jsp needs to pass parameters to the included file, it does so with the <jsp:param>element. one element is used for each parameter .this element is optional. If it is included, both the name and value attributes are required. The included jsp page can access the parameters using the getParameter() and getParameterValues() methods of the request object.

Forward action

With   the forward action, the current page stops processing the request and forward the request to another web component. This other components complete the response.

Execution never returns to the calling page.

Syntax:
<jsp:forward page="URL">
<jsp:param name="paramname"   value="paramvalue"/>
</jsp:forward>

The meaning and use of the attributes and of the <jsp:param>element are the same as those for the include action.

1 Word Question Answer		
Sr.No.	Question	Answer
1.	When the jsp container translates the page, ____directive causes the indicated file to be included in that place in the page and become part of the java source file	Include

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2.	With the _____ standard action, the jsp file stops processing the current request and passing the request to the included file	Include
3.	For the include element, the _____attribute is required.	Page
4.	If the jsp needs to pass parameters to the included file, it does so with the _____element	<jsp:param>
5.	With the _____action, the current page stops processing the request and forward the request to another web component.	Forward
6.	If any output has occurred in calling jsp, an exception will be thrown when the _____action is encountered.	forward

Students Outcomes:- students can get the knowledge of include and forward pages.

JavaBeans Introduction:

A Java Bean is a Java class that is mainly responsible for holding onto some data without a large degree of functionality built into the class.

It is like a reusable software component. A bean encapsulates many objects into one object so that we can access this object from multiple places. Moreover, it provides easy maintenance.

The server and client tiers might also include components based on the Java-Beans component architecture (JavaBeans components) to manage the data flow from client, server and database.

JavaBeans components are not considered J2EE components by the J2EE specification.

JavaBeans components have properties and have get and set methods for accessing the properties. It should provide methods to set and get the values of the properties, known as getter and setter methods.
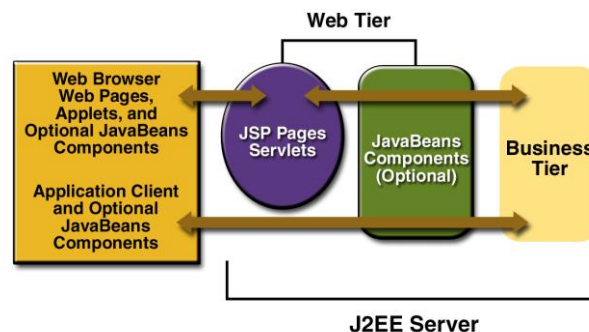
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As shown in above Figure, the web tier, like the client tier, might include a Java-Beans component to manage the user input and send that input to enterprise beans running in the business tier for processing.

JavaBean Properties and Methods

A JavaBean property is a named feature that can be accessed by the user of the object. The feature can be of any Java data type, containing the classes that you define.

A JavaBean property may be read, write, read-only, or write-only. JavaBean features are accessed through two methods in the JavaBean's implementation class:

getPropertyName ()
For example, if the property name is firstName, the method name would be getFirstName() to read that property. This method is called the accessor.

setPropertyName ()
For example, if the property name is firstName, the method name would be setFirstName() to write that property. This method is called the mutator.

The setProperty and getProperty action tags are used for developing web application with Java Bean. In web devlopment, bean class is mostly used because it is a reusable software component that represents data.

Indexed Properties
An indexed property is an array instead of a single value. In this case, the bean class provides a method for getting and setting the entire array.

Bound Properties
A bound property notifies listeners when its value changes. This has two implications:

1. The bean class includes addPropertyChangeListener() and removePropertyChangeListener() methods for managing the bean's listeners.

2. When a bound property is changed, the bean sends a PropertyChangeEvent to its registered listeners.
Bound properties can be tied directly to other bean properties using a builder tool like NetBeans. NetBeans allows you to do this without writing any code.

Constrained Properties
A *constrained* property is a special kind of bound property. For a constrained property, the bean keeps track of a set of *veto* listeners. When a constrained property is about to change, the listeners are consulted about the change.

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Advantages of JavaBean

- o The JavaBean properties and methods can be exposed to another application.

It provides an easiness to reuse the software components.

Disadvantages of JavaBean

- o JavaBeans are mutable. So, it can't take advantages of immutable objects.

- o Creating the setter and getter method for each property separately may lead to the boilerplate code.

1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	JavaBeans components have properties and have ____and_____ methods for accessing the properties.	Get,set
2.	To define a property in a bean class, supply public _____and ____methods.	Getter, setter
3.	An _____property is an array instead of a single value	*Indexed*
4.	When a bound property is changed, the bean sends a _____to its registered listeners.	PropertyChangeEvent
5.	PropertyChangeEvent and PropertyChangeListener live in the _____package.	java.beans
6.	_____properties can be tied directly to other bean properties using a builder tool like NetBeans.	Bound
7.	A _____property is a special kind of bound property.	*Constrained*
8.	For a constrained property, the bean keeps track of a set of _____listeners.	*Veto*
9.	Any public method that is not part of a property definition is a _____method.	Bean
10.	A _____class provides a complete custom GUI for customizing a target Java Bean.	customizer
11.	A "PropertyChange" event gets fired whenever a bean changes a _____ property.	Bound
12.	The ____class provides a standard way for tools to learn about the properties, events, and methods supported by a target Java Bean.	Introspector

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Topic:- Package java.beans Description

Trailer:- (Only For Understanding)

Simple introduction of package and its classes and interfaces.

Details:- (For Exam)

It contains classes related to developing *beans*. It provide classes for creating components based on the JavaBeansTM architecture.

A few of the classes are used by beans while they run in an application.

However, most of the classes in this package are meant to be used by a bean editor.

In particular, these classes help the bean editor to create a user interface that the user can use to customize the bean.

By using the PropertyEditor interface, a bean developer can provide an editor for this special type.

To minimize the resources used by a bean, the classes used by bean editors are loaded only when the bean is being edited.

They are not needed while the bean is running in an application and therefore not loaded.

Note:- To see classes and interfaces of this package please follow the below given link.

https://docs.oracle.com/javase/7/docs/api/java/beans/package-summary.html

Students Outcomes:- students can get the knowledge of package.

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Chapter-4 MVC Architecture,EJB, Hibernate

NO	CHAPTER NAME	CONTENT
4.	MVC Architecture, EJB, Hibernate	(1) Introduction to MVC (2) Implementation of MVC Architecture (3) Introduction (4) Benefits of EJB (5) Restriction on EJB (6) Types of EJB (7) Session Beans (8) Entity Beans (9) Message-driven beans (10) Timer service (11) Introduction to Hibernate (12) Need for hibernate (13) Features of hibernate (14) Disadvantages of Hibernate (15) Exploring Hibernate Architecture (16) Downloading and Configuring and necessary files to Hibernate in Eclipse (17) Jars files of hibernate. (18) Hibernate Configuration file (19) Hibernate Mapping file (20) Basic Example of Hibernate (21) Annotation (22) Hibernate Inheritance (23) Inheritance Annotations (24) Hibernate Sessions

Introduction to MVC:

Model **V**iew **C**ontroller or MVC as it is popularly called, is a software design pattern for developing web applications.

A Model View Controller pattern is made up of the following three parts:

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Model - The lowest level of the pattern which is responsible for maintaining data.

View - This is responsible for displaying all or a portion of the data to the user.

Controller - Software Code that controls the interactions between the Model and View.

M = database

V = client side view or client side output

C = server side logic
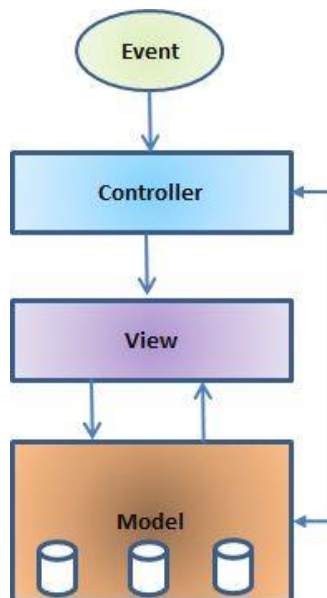
MVC is popular as it isolates the application logic from the user interface layer and supports separation of concerns.

Here the Controller receives all requests for the application and then works with the Model to prepare any data needed by the View.

The View then uses the data prepared by the Controller to generate a final presentable response. The MVC abstraction can be graphically represented as follows.

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1 Word Question Answer

Sr. No.	Question	Answer
1.	MVC Stands for?	Model View Controller
2.	Model View Controller or MVC as it is popularly called, is a software design pattern for developing _____.	web applications
3.	_____ is responsible for displaying all or a portion of the data to the user.	View
4.	_____is popular as it isolates the application logic from the user interface layer and supports separation of concern.	MVC

MVC architecture:

The **Model-View-Controller (MVC)** architecture is a widely used architectural approach for interactive applications that distributes functionality among application objects so as to minimize the degree of coupling between the objects.

To achieve this, it divides applications into three layers: model, view, and controller. Each layer handles specific tasks and has responsibilities to the other layers:

The Model
The model is responsible for managing the data of the application.

It responds to the request from the view &
it also responds to instructions from the controller to update itself.

The model represents business data, along with business logic or operations that govern access and modification of this business data.

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The view

A presentation of data in a particular format, triggered by a controller's decision to present the data.

They are script based templating systems like JSP, ASP, PHP and very easy to integrate with AJAX technology.

The view renders the contents of a model. It gets data from the model and specifies how that data should be presented.

It updates data presentation when the model changes. A view also forwards user input to a controller.

The controller

The controller is responsible for responding to user input and performs interactions on the data model objects.

The controller receives the input; it validates the input and then performs the business operation that modifies the state of the data model. The controller defines application behavior.

It dispatches user requests and selects views for presentation. It interprets user inputs and maps them into actions to be performed by the model.

In a web application, user inputs are HTTP GET and POST requests. A controller selects the next view to display based on the user interactions and the outcome of the model operations.

1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	_____ Architecture is a widely used architectural approach for interactive applications that distributes functionality among application objects so as to minimize the degree of coupling between the objects.	MVC

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2.	The _____is responsible for managing the data of the application.	Model
3.	The ____represents business data, along with business logic or operations that govern access and modification of this business data.	Model
4.	____presentation of data in a particular format, triggered by a controller's decision to present the data.	View
5.	The ____is responsible for responding to user input and performs interactions on the data model objects.	controller

Introduction of EJB:-

EJB stands for ==Enterprise Java Beans==. EJB is an essential part of a J2EE platform. J2EE platform have component based architecture to provide multi-tiered, distributed and highly transactional features to enterprise level applications.

EJB provides an architecture to develop and deploy component based enterprise applications considering robustness, high scalability and high performance.

An EJB application can be deployed on any of the application server with standard specification.

Enterprise beans run in the EJB container, a runtime environment within the Application Server. The EJB container provides system-level services such as transactions and security to its enterprise beans. These services enable you to quickly build and deploy enterprise beans.

What Is an Enterprise Bean?
An enterprise bean is a server-side component that encapsulates the business logic of an application. The business logic is the code that fulfills the purpose of the application.

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1 Word Question Answer		
Sr. No.	Question	Answer
1.	EJB stands for _____.	Enterprise Java Beans
2.	_____provides an architecture to develop and deploy component based enterprise applications considering robustness, high scalability and high performance.	EJB

Benefits of EJB:-

It simplified development of large scale enterprise level application.

Application Server/ EJB container provides most of the system level services like transaction handling, logging, load balancing, persistence mechanism, exception handling and so on. Developer has to focus only on business logic of the application.

EJB container manages life cycle of ejb instances thus developer needs not to worry about when to create/delete ejb objects.

For several reasons, enterprise beans simplify the development of large, distributed applications.

First, because the EJB container provides system-level services to enterprise beans, the bean developer can concentrate on solving business problems.

Second, because the beans contain the application's business logic, the client developer can focus on the presentation of the client.

Third, because enterprise beans are portable components, the application assembler can build new applications from existing beans. These applications can run on any compliant J2EE server provided that they use the standard APIs.

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1 Word Question Answer

Sr.No.	Question	Answer
1.	_____manages life cycle of ejb instances thus developer needs not to worry about when to create/delete ejb objects.	EJB container
2.	Enterprise beans are _____components.	portable

Where to use Enterprise Beans:

You should consider using enterprise beans if your application has any of the following
requirements:

• The application must be scalable. To accommodate a growing number of users, you may need to distribute an application's components across multiple machines.

• Transactions must ensure data integrity. Enterprise beans support transactions, the mechanisms that manage the concurrent access of shared objects.

• The application will have a variety of clients.With only a few lines of code, remote clients can easily locate enterprise beans.

Types of EJB:-

EJB are primarily of three types which are briefly described below:

Type	Description
Session Bean	**Session bean stores data of a particular user for a single session.** **It can be stateful or stateless.** **Session bean gets destroyed as soon as user session terminates.**

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Entity Bean	**Entity beans represent persistent data storage. User data can be saved to database via entity beans and later on can be retrieved from the database in the entity bean.**
Message Driven Bean	**Message driven beans are used in context of JMS (Java Messaging Service). Message Driven Beans can consumes JMS messages from external entities.**

Session Performs a task for a client; implements a web service.

Entity Represents a business entity object that exists in persistent storage.

Message-Driven Acts as a listener for the Java Message Service API, processing messages asynchronously.

1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	There are _____types of beans.	3
2.	_____ bean stores data of a particular user for a single session.	Session Bean
3.	_____represent persistent data storage.	Entity beans
4.	_____ beans are used in context of JMS.	Message Driven

What Is a Session Bean?

A session bean represents a single client inside the Application Server. To access an application that is deployed on the server, the client invokes the session bean's methods.

The session bean performs work for its client, shielding the client from complexity by executing business tasks inside the server. As its name suggests, a session bean is similar to an interactive session.

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A session bean is not shared; it can have only one client, in the same way that an interactive session can have only one user. Like an interactive session, a session bean is not persistent.

State Management Modes

There are two types of session beans**: stateless and stateful.**

Stateless Session Beans

A stateless session bean does not maintain a conversational state for the client.

When a client invokes the method of a stateless bean, the bean's instance variables may contain a state, but only for the duration of the invocation. When the method is finished, the state is no longer retained.

A stateless session bean can implement a web service, but other types of enterprise beans cannot.

Stateful Session Beans

A statefull session bean maintain a conversational state for the client.

In a stateful session bean, the instance variables represent the state of a unique client-bean session. Because the client interacts ("talks") with its bean, this state is often called the conversational state.

When to Use Session Beans

• At any given time, only one client has access to the bean instance.
• The state of the bean is not persistent, existing only for a short period (perhaps a few hours).
• The bean implements a web service.

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1 Wordd Question Answer

Sr.No.	Question	Answer
1.	A ____represents a single client inside the Application Server.	session bean
2.	When the client terminates, its ____appears to terminate and is no longer associated with the client.	session bean
3.	A ____session bean does not maintain a conversational state for the client.	Stateless
4.	In a _____session bean, the instance variables represent the state of a unique client-bean session.	stateful

What Is an Entity Bean?

An entity bean represents a business object in a persistent storage mechanism. Some examples of business objects are customers, orders, and products.

In the Application Server, the persistent storage mechanism is a relational database.

What Makes Entity Beans Different from Session Beans?
Entity beans differ from session beans in several ways. Entity beans are **persistent, allow shared access, have primary keys**, and can participate in **relationships** with other entity beans.

Persistence
Because the state of an entity bean is saved in a storage mechanism, it is persistent.
Persistence means that the entity bean's state exists beyond the lifetime of the application or the Application Server process.

There are two types of persistence for entity beans:
(1) bean-managed
(2) container managed

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With bean-managed persistence, the entity bean code that you write contains the calls that access the database.

With container-managed persistence, the EJB container automatically generates the necessary database access calls.

Shared Access
Entity beans can be shared by multiple clients.

Primary Key
Each entity bean has a unique object identifier. A customer entity bean. The unique identifier, or primary key, enables the client to locate a particular entity bean.

Relationships
Like a table in a relational database, an entity bean may be related to other entity beans. For example, in a college enrollment application, StudentBean and CourseBean would be related because students enroll in classes.

When to Use Entity Beans
• The bean represents a business entity and not a procedure. For example, CreditCardBean would be an entity bean, but CreditCardVerifierBean would be a session bean.

1 Word Question Answer		
Sr. No.	Question	Answer
	An _____bean represents a business object in a persistent storage mechanism	Entity
2.	____beans are persistent, allow shared access, have primary keys, and can participate in relationships with other entity beans.	Entity
3.	With ____persistence, the entity bean code that you write contains the calls that access the database.	bean-managed

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What Is a Message-Driven Bean?

A message-driven bean is an enterprise bean that allows J2EE applications to process messages asynchronously.

It normally acts as a JMS message listener, which is similar to an event listener except that it receives JMS messages instead of events.

The messages can be sent by any J2EE component—an application client, another enterprise bean, or a web component—or by a JMS application or system that does not use J2EE technology.

What Makes Message-Driven Beans Different from Session and Entity Beans?
The most visible difference between message-driven beans and session and entity beans is that clients do not access message-driven beans through interfaces.

In several respects, a message-driven bean resembles a stateless session bean.

• A message-driven bean's instances retain no data or conversational state for a specific client.

• All instances of a message-driven bean are equivalent, allowing the EJB container to assign a message to any message-driven bean instance.

When to Use Message-Driven Beans
Session beans and entity beans allow you to send JMS messages and to receive them.

1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	A _____bean is an enterprise bean that allows J2EE applications to process messages asynchronously.	message-driven

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2.	The most visible difference between message-driven beans and session and entity beans is that clients do not access ____beans through interfaces.	message-driven
3.	____execute upon receipt of a single client message.	message-driven bean
4.	When a message arrives, the container calls the message-driven bean's ____method to process the message.	onMessage

Timer Service

It is a service that include in application that model business work flows often used with timed notifications.

The timer service of the enterprise bean container enables you to schedule timed notifications for all types of enterprise beans except for stateful session beans.

You can schedule a timed notification to occur at a specific time, after duration of time, or at timed intervals. For example, you could set timers to go off at 10:30 AM on May 23, in 30 days, or every 12 hours.

When a timer expires (goes off), the container calls the ejbTimeout() method of the bean's implementation class. The ejbTimeout method contains the business logic that handles the timed event.

There are four interfaces in the javax.ejb package that are related to timers:

• TimedObject
• Timer
• TimerHandle
• TimerService (it provide createTimer()method)

Creating Timers

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To create a timer, the bean invokes one of the createTimer() methods of the TimerService Interface. When the bean invokes createTimer, the timer service begins to count down the timer duration.

Syntax:- TimerService ts = context.getTimerService();
Timer tm = ts.createTimer(intervalDuration,"created timer");

Timers are persistent. If the server is shut down (or even crashes), timers are saved and will become active again when the server is restarted.
If a timer expires while the server is down, the container will call ejbTimeout when the server is restarted.

A timer for an entity bean is associated with the bean's identity—that is, with a particular instance of the bean. If an entity bean sets a timer in ejbCreate, each bean instance will have its own timer.

The Date and long parameters of the createTimer methods represent time with the resolution of milliseconds.

The timer service is for business applications, which typically measure time in hours, days, or longer durations.

Canceling and Saving Timers
Timers can be canceled by the following events:
• When a single-event timer expires, the EJB container calls ejbTimeout and then cancels the timer.
• When an entity bean instance is removed, the container cancels the timers associated with the instance.
• When the bean invokes the cancel method of the Timer interface, the container cancels the timer.

To save a Timer object for future reference, invoke its getHandle method and store the TimerHandle object in a database.

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1 Word Question Answer

Sr.No.	Question	Answer
1.	The timer service of the enterprise bean container enables you to schedule timed notifications for all types of enterprise beans except for _____session beans	Stateful
2.	You can schedule a timed notification to occur at a specific time, after duration of time, or at timed intervals using_____.	Timer Service
3.	When a timer expires (goes off), the container calls the _____method.	ejbTimeout
4.	If a timer expires while the server is down, the container will call ___when the server is restarted.	ejbTimeout

Introduction of Hibernate:-

Hibernate is an Object-Relational Mapping(ORM) solution for JAVA and it raised as an open source persistent framework created by Gavin King in 2001.

It is a powerful, high performance Object-Relational Persistence and Query service for any Java Application.

Hibernate maps Java classes to database tables and from Java data types to SQL data types and relieve the developer from 95% of common data persistence related programming tasks.

Hibernate sits between traditional Java objects and database server to handle all the work in persisting those objects based on the appropriate O/R mechanisms and patterns.

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Java Objects — ORM/Hibernate — RDBMS

Needs of Hibernate:-

- Hibernate takes care of mapping Java classes to database tables using XML files and without writing any line of code.
- Provides simple APIs for storing and retrieving Java objects directly to and from the database.
- If there is change in Database or in any table then the only need to change XML file properties.
- It provides us to work around familiar Java Objects.
- Hibernate does not require an application server to operate.
- Manipulates Complex associations of objects of your database.
- Minimize database access with smart fetching strategies.
- Provides simple querying of data.

Hibernate Advantages:

- Hibernate supports Inheritance, Associations, Collections.
- hibernate support inheritance.
- Hibernate supports relationships like One-To-Many,One-To-One, Many-To-Many-to-Many, Many-To-One.
- It also supports collections like List,Set,Map (Only new collections).
- In jdbc all exceptions are checked exceptions, so we must write code in try, catch and throws, but in hibernate we only have Un-checked exceptions, so no need to write try, catch, or no need to write throws.
- Hibernate has capability to generate primary keys automatically while we are storing the records into database.

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- Hibernate has its own query language, i.e hibernate query language (HQL) which is database independent.
- So if we change the database, then also our application will works as HQL is database independent.
- HQL contains database independent commands.
- While we are inserting any record, if we don't have any particular table in the database, if it not found any table in the database this will create the table for us.
- Hibernate supports caching mechanism so an application performance will be increased automatically.
- Hibernate supports annotations, apart from XML.
- Hibernate provided Dialect classes, so we no need to write sql queries in hibernate, instead we use the methods provided by that API.
- Getting pagination in hibernate is quite simple.

Hibernate Disadvantages:-

- You know some thing, Its saying hibernate is little slower than pure JDBC, actually the reason being hibernate used to generate many SQL statements in run time, but i guess this is not the disadvantage.
- But there is one major disadvantage, which was boilerplate code issue, actually we need to write same code in several files in the same application, but spring eliminated this.

Supported Databases:

Hibernate supports almost all the major RDBMS. Following is list of few of the database engines supported by Hibernate.

HSQL Database Engine,   DB2/NT
MySQL,   PostgreSQL
FrontBase,   Oracle
Microsoft SQL Server Database
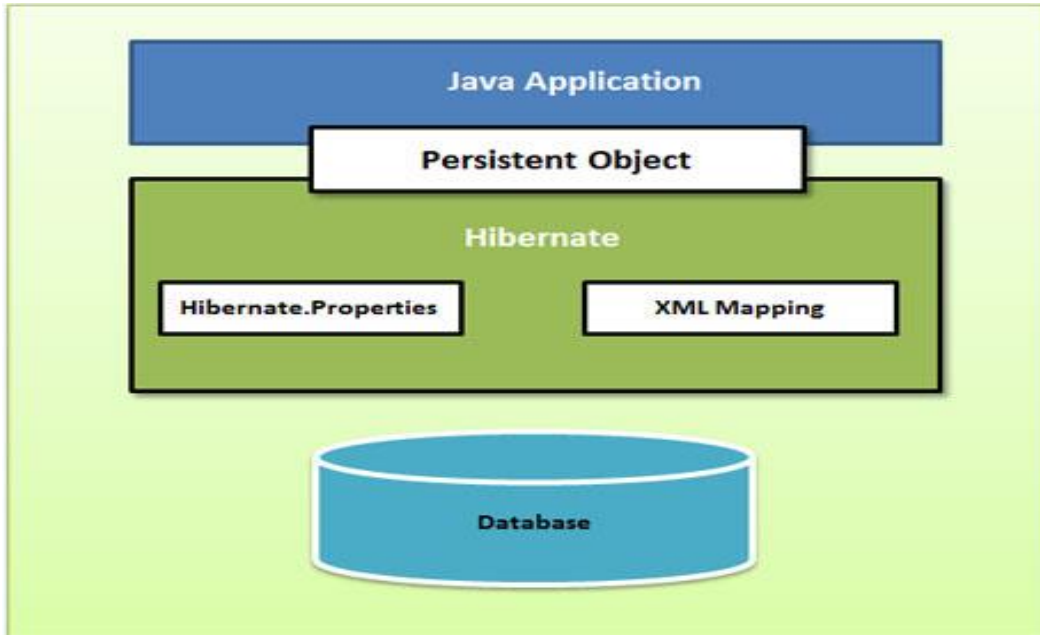Sybase SQL Server, Informix Dynamic Server

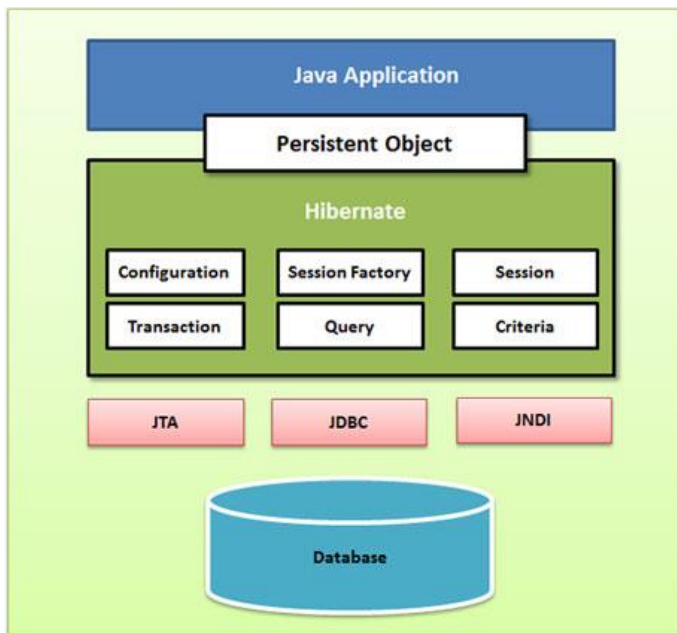SHREE H.N.SHUKLA GROUP OF COLLEGES

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1 Word Question Answer

Sr.No.	Question	Answer
1.	_____powerful, high performance Object-Relational Persistence and Query service for any Java Application.	Hibernate
2.	____takes care of mapping Java classes to database tables using XML files and without writing any line of code.	Hibernate
3.	Hibernalte is supporting inheritance.	True
4.	Hibetnate creates primary key automatically,	True
5.	Hibernate has its own query language, i.e ____.	Hibernate query language

(1) Hibernate Architecture:

The Hibernate architecture is layered type. Hibernate makes use of the database and configuration data to provide persistence services (and persistent objects) to the application.

Following is a very high level view of the Hibernate Application Architecture.

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Following is a detailed view of the Hibernate Application Architecture with few important core classes.

Hibernate uses various existing Java APIs, like JDBC, Java Transaction API (JTA), and Java Naming and Directory Interface (JNDI).

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JDBC is common to relational databases, allowing almost any database with a JDBC driver to be supported by Hibernate.

JNDI and JTA allow Hibernate to be integrated with J2EE application servers.

1 Word Question Answer		
Sr. No.	**Question**	**Answer**
1.	JTA stands for?	Java Transaction API
2.	JNDI stands for?	Java Naming and Directory Interface

Configuration Object:

The Configuration object is the first Hibernate object you create in any Hibernate application and usually created only once during application initialization. It represents a configuration or properties file required by the Hibernate. The Configuration object provides two keys components:

Database Connection: This is handled through one or more configuration files supported by Hibernate. These files are **hibernate.properties** and **hibernate.cfg.xml**.

Class Mapping Setup: This component creates the connection between the Java classes and database tables.

SessionFactory Object:

The SessionFactory is heavyweight object so usually it is created during application start up and kept for later use. You would need one SessionFactory object per database using a separate configuration file. So if you are using

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multiple databases then you would have to create multiple SessionFactory objects.

Session Object:

A Session is used to get a physical connection with a database. The Session object is lightweight and designed to be instantiated each time an interaction is needed with the database. Persistent objects are saved and retrieved through a Session object.

The session objects should not be kept open for a long time so they should be created and destroyed them as needed.

Transaction Object:

A Transaction represents a unit of work with the database and most of the RDBMS supports transaction functionality. Transactions in Hibernate are handled by an underlying transaction manager and transaction (from JDBC or JTA).

This is an optional object and Hibernate applications may choose not to use this interface, instead managing transactions in their own application code.

Query Object:

Query objects use SQL or Hibernate Query Language (HQL) string to retrieve data from the database and create objects. A Query instance is used to bind query parameters, limit the number of results returned by the query, and finally to execute the query.

Criteria Object:

Criteria object are used to create and execute object oriented criteria queries to retrieve objects.

1 Word Question Answer

Sr.No.	Question	Answer

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1.	The _____object is the first Hibernate object you create in any Hibernate application.	Configuration
2.	_____ Component creates the connection between the Java classes and database tables.	Class Mapping Setup
3.	_____ Object is used to create a SessionFactory object.	Configuration
4.	The SessionFactory is a _____object and used by all the threads of an application.	thread safe
5.	The _____is heavyweight object.	SessionFactory
6.	_____in Hibernate are handled by an underlying transaction manager and transaction.	Transactions
7.	HQL stands for?	Hibernate Query Language

Downloading Hibernate:

It is assumed that you already have latest version of Java is installed on your machine. Following are the simple steps to download and install Hibernate on your machine.

Make a choice whether you want to install Hibernate on Windows, or UNIX and then proceed to the next step to download .zip file for windows and .tz file for UNIX.

Download the latest version of Hibernate
from http://www.hibernate.org/downloads.

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Here in this tutorial I downloaded **hibernate-distribution-3.6.4.Final** and when you unzip the downloaded file it will give you directory structure as follows.

Name	Date modified	Type	Size
documentation	04/05/2011 15:16	File folder	
lib	04/05/2011 15:15	File folder	
project	04/05/2011 14:44	File folder	
changelog.txt	04/05/2011 14:44	Text Document	224 KB
hibernate_logo.gif	04/05/2011 14:44	GIF image	2 KB
hibernate3.jar	04/05/2011 15:15	Executable Jar File	4,037 KB
hibernate-testing.jar	04/05/2011 15:03	Executable Jar File	44 KB
lgpl.txt	04/05/2011 14:44	Text Document	26 KB

Installing Hibernate:

(1) Make sure you are setting your CLASSPATH variable properly otherwise you will face problem while compiling your application.

(2) Copy all the library files from **/lib** into your CLASSPATH, and change your classpath variable to include all the JARs:

(3) Finally copy **hibernate3.jar** file into your CLASSPATH. This file lies in the root directory of the installation and is the primary JAR that Hibernate needs to do its work.

Hibernate Prerequisites:

Following is the list of the packages/libraries required by Hibernate and you should install them before starting with Hibernate. To install these packages you would have to copy library files from **/lib** into your CLASSPATH, and change your CLASSPATH variable.

S.N.	Packages/Libraries
1	**dom4j** - XML parsing www.dom4j.org/
2	**Xalan** - XSLT Processor http://xml.apache.org/xalan-j/
3	**Xerces** - The Xerces Java Parser http://xml.apache.org/xerces-j/

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4	**cglib** - Appropriate changes to Java classes at runtime http://cglib.sourceforge.net/
5	**log4j** - Logging Faremwork http://logging.apache.org/log4j
6	**Commons** - Logging, Email etc. http://jakarta.apache.org/commons
7	**SLF4J** - Logging Facade for Java http://www.slf4j.org

Jar files of Hibernate :

Let us see what are the jar files we need to download to work with hibernate framework, and how to install.

Working with the framework software is nothing but, adding the .jar(s) files provided by that framework to our java application. Each framework software is not an installable software, it means we do not contain any setup.exe 😀

When we download any framework software, we will get a 'zip' file and we need to unzip it, to get the jar files required, actually all framework softwares will follow same common principles like…

Framework software will be in the form of a set of jar files, where one jar file acts as main **(**We can call this file as core**)** and remaining will acts as dependent jar files.

Each Framework software contain at least one configuration xml file, but multiple configuration files also allowed.

Where to download Hibernate .jar(s) files:
we can download jars related to hibernate at
http://sourceforge.net/projects/hibernate/files/hibernate3

From the above URL choose hibernate 3.2.2-ga.zip, as we are in initial stage this version will be better.

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Unzip it, and now you can find some jar files in the lib folder right..?, actually we doesn't require all the jar files, out of them just select the following jar files..
-Anttr-2.7.6.jar
-asm.jar
-asm-attrs.jar
-cglib-2.1.3.jar
-commons-collections-2.1.1.jar
-commons-logging-1.0.4.jar
-ehcash.jar
-dom4j-1.6.1.jar
-hibernate3.jar
-jta.jar
-log4j-1.2.3.jar

These are the main jar files to run hibernate related programming and among all the jars hibernate3.jar is the main file, but for annotation we need to add 4 – 6 other jar files, i will let you when time comes.
Remember: along with the hibernate jars we must include one more jar file, which is nothing but related to our database, this is depending on your database.

So finally we need total of 12 jar files to run the hibernate related program.

Hibernate Configuration

Hibernate requires to know in advance where to find the mapping information that defines how your Java classes relate to the database tables.

Hibernate also requires a set of configuration settings related to database and other related parameters. All such information is usually supplied as a standard Java properties file called **hibernate.properties**, or as an XML file named **hibernate.cfg.xml**.

Hibernate Properties:

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Following is the list of important properties you would require to configure for a databases in a standalone situation:

S.N.	Properties and Description
1	**hibernate.dialect** This property makes Hibernate generate the appropriate SQL for the chosen database.
2	**hibernate.connection.driver_class** The JDBC driver class.
3	**hibernate.connection.url** The JDBC URL to the database instance.
4	**hibernate.connection.username** The database username.
5	**hibernate.connection.password** The database password.
6	**hibernate.connection.pool_size** Limits the number of connections waiting in the Hibernate database connection pool.
7	**hibernate.connection.autocommit** Allows autocommit mode to be used for the JDBC connection.

If you are using a database along with an application server and JNDI then you would have to configure the following properties:

S.N.	Properties and Description
1	**hibernate.connection.datasource** The JNDI name defined in the application server context you are using for the application.
2	**hibernate.jndi.class** The InitialContext class for JNDI.
3	**hibernate.jndi.<JNDIpropertyname>**

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	Passes any JNDI property you like to the JNDI *InitialContext*.
4	**hibernate.jndi.url** Provides the URL for JNDI.
5	**hibernate.connection.username** The database username.
6	**hibernate.connection.password** The database password.

Hibernate with MySQL Database:

MySQL is one of the most popular open-source database systems available today. Let us create **hibernate.cfg.xml** configuration file and place it in the root of your application's classpath. You would have to make sure that you have **testdb** database available in your MySQL database and you have a user **test** available to access the database.

The XML configuration file must conform to the Hibernate 3 Configuration DTD, which is available from http://www.hibernate.org/dtd/hibernate-configuration-3.0.dtd.

```xml
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE hibernate-configuration SYSTEM
"http://www.hibernate.org/dtd/hibernate-configuration-3.0.dtd">

<hibernate-configuration>
  <session-factory>
  <property name="hibernate.dialect">
    org.hibernate.dialect.MySQLDialect
  </property>
  <property name="hibernate.connection.driver_class">
    com.mysql.jdbc.Driver
  </property>

  <!-- Assume test is the database name -->
```

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```xml
<property name="hibernate.connection.url">
   jdbc:mysql://localhost/test
</property>
<property name="hibernate.connection.username">
   root
</property>
<property name="hibernate.connection.password">
   root123
</property>

<!-- List of XML mapping files -->
<mapping resource="Employee.hbm.xml"/>

</session-factory>
</hibernate-configuration>
```

The above configuration file includes **<mapping>** tags which are related to hibernate-mapping file.

Hibernate Examples

Let us try an example of using Hibernate to provide Java persistence in a standalone application. We will go through different steps involved in creating Java Application using Hibernate technology.

Create POJO Classes:

The first step in creating an application is to build the Java POJO class or classes, depending on the application that will be persisted to the database. Let us consider our **Employee** class with **getXXX** and **setXXX** methods to make it JavaBeans compliant class.

A POJO (Plain Old Java Object) is a Java object that doesn't extend or implement some specialized classes and interfaces respectively required by the EJB framework. All normal Java objects are POJO.

```java
public class Employee {
```

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```java
   private int id;
   private String firstName;
   private String lastName;
   private int salary;

   public Employee() {}
   public Employee(String fname, String lname, int salary) {
     this.firstName = fname;
     this.lastName = lname;
     this.salary = salary;
   }
   public int getId() {
     return id;
   }
   public void setId( int id ) {
     this.id = id;
   }
   public String getFirstName() {
     return firstName;
   }
   public void setFirstName( String first_name ) {
     this.firstName = first_name;
   }
   public String getLastName() {
     return lastName;
   }
   public void setLastName( String last_name ) {
     this.lastName = last_name;
   }
   public int getSalary() {
     return salary;
   }
   public void setSalary( int salary ) {
     this.salary = salary;
   }
}
```

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Create Database Tables:

Second step would be creating tables in your database.

Consider above objects need to be stored and retrieved into the following RDBMS table:

```
create table EMPLOYEE (
  id INT NOT NULL auto_increment,
  first_name VARCHAR(20) default NULL,
  last_name  VARCHAR(20) default NULL,
  salary    INT  default NULL,
  PRIMARY KEY (id)
);
```

Create Mapping Configuration File:

This step is to create a mapping file that instructs Hibernate how to map the defined class or classes to the database tables.

```xml
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE hibernate-mapping PUBLIC
 "-//Hibernate/Hibernate Mapping DTD//EN"
 "http://www.hibernate.org/dtd/hibernate-mapping-3.0.dtd">

<hibernate-mapping>
  <class name="Employee" table="EMPLOYEE">
    <meta attribute="class-description">
      This class contains the employee detail.
    </meta>
    <id name="id" type="int" column="id">
      <generator class="native"/>
    </id>
    <property name="firstName" column="first_name" type="string"/>
    <property name="lastName" column="last_name" type="string"/>
```

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```
  <property name="salary" column="salary" type="int"/>
  </class>
</hibernate-mapping>
```

You should save the mapping document in a file with the format <classname>.hbm.xml. We saved our mapping document in the file Employee.hbm.xml. Let us see little detail about the mapping document:

- The mapping document is an XML document having <hibernate-mapping> as the root element which contains all the <class> elements.

- The **<class>** elements are used to define specific mappings from a Java classes to the database tables. The Java class name is specified using the **name** attribute of the class element and the database table name is specified using the **table** attribute.

- The **<meta>** element is optional element and can be used to create the class description.

- The **<id>** element maps the unique ID attribute in class to the primary key of the database table. The **name** attribute of the id element refers to the property in the class and the **column** attribute refers to the column in the database table. The **type** attribute holds the hibernate mapping type, this mapping types will convert from Java to SQL data type.

- The **<generator>** element within the id element is used to automatically generate the primary key values. Set the **class** attribute of the generator element is set to **native** to let hibernate pick up either **identity, sequence** or **hilo** algorithm to create primary key depending upon the capabilities of the underlying database.

- The **<property>** element is used to map a Java class property to a column in the database table. The **name** attribute of the element refers to the property in the class and the **column** attribute refers to the column in the database table. The **type** attribute holds the hibernate mapping type, this mapping types will convert from Java to SQL data type.

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There are other attributes and elements available which will be used in a mapping document and I would try to cover as many as possible while discussing other Hibernate related topics.

Create Application Class:

Finally, we will create our application class with the main () method to run the application. We will use this application to save few Employees' records and then we will apply CRUD operations on those records.

Compilation and Execution:

Here are the steps to compile and run the above mentioned application. Make sure you have set PATH and CLASSPATH appropriately before proceeding for the compilation and execution.

- Create hibernate.cfg.xml configuration file as explained in configuration chapter.
- Create Employee.hbm.xml mapping file as shown above.
- Create Employee.java source file as shown above and compile it.
- Create ManageEmployee.java source file as shown above and compile it.
- Execute ManageEmployee binary to run the program.

You would get following result, and records would be created in EMPLOYEE table.

```
$java ManageEmployee
.......VARIOUS LOG MESSAGES WILL DISPLAY HERE........

First Name: Zara  Last Name: Ali  Salary: 1000
First Name: Daisy  Last Name: Das  Salary: 5000
First Name: John  Last Name: Paul  Salary: 10000
First Name: Zara  Last Name: Ali  Salary: 5000
First Name: John  Last Name: Paul  Salary: 10000
```

If you check your EMPLOYEE table, it should have following records:

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```
mysql> select * from EMPLOYEE;
+----+------------+-----------+--------+
| id | first_name | last_name | salary |
+----+------------+-----------+--------+
| 29 | Zara       | Ali       |   5000 |
| 31 | John       | Paul      |  10000 |
+----+------------+-----------+--------+
2 rows in set (0.00 sec

mysql>
```

Hibernate Mapping Files

An Object/relational mappings are usually defined in an XML document. This mapping file instructs Hibernate how to map the defined class or classes to the database tables.

Though many Hibernate users choose to write the XML by hand, a number of tools exist to generate the mapping document.

Let us consider our previously defined POJO class whose objects will persist in the table defined in next section.

```
public class Employee {
private int id;
private String firstName;
private String lastName;
private int salary;
public Employee() {}
public Employee(String fname, String lname, int salary) {
this.firstName = fname;
this.lastName = lname;
this.salary = salary;
}
public int getId() {
return id;
```

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```
        }
        public void setId( int id ) {
        this.id = id;
        }
        public String getFirstName() {
        return firstName;
        }
        public void setFirstName( String first_name ) {
        this.firstName = first_name;
        }
        public String getLastName() {
        return lastName;
        }
        public void setLastName( String last_name ) {
        this.lastName = last_name;
        }
        public int getSalary() {
        return salary;
        }

        public void setSalary( int salary ) {
        this.salary = salary;
        }
        }
```

There would be one table corresponding to each object you are willing to provide persistence. Consider above objects need to be stored and retrieved into the following RDBMS table:

```
create table EMPLOYEE (
id INT NOT NULL auto_increment,
first_name VARCHAR(20) default NULL,
last_name VARCHAR(20) default NULL,
salary INT default NULL,
PRIMARY KEY (id)
);
```

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Based on the two above entities we can define following mapping file which instructs Hibernate how to map the defined class or classes to the database tables.

```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE hibernate-mapping PUBLIC
"-//Hibernate/Hibernate Mapping DTD//EN"
"http://www.hibernate.org/dtd/hibernate-mapping-3.0.dtd">
<hibernate-mapping>
<class name="Employee" table="EMPLOYEE">
<meta attribute="class-description">
This class contains the employee detail.
</meta>
<id name="id" type="int" column="id">
<generator class="native"/>
</id>
<property name="firstName" column="first_name" type="string"/>
<property name="lastName" column="last_name" type="string"/>
<property name="salary" column="salary" type="int"/>
</class>
</hibernate-mapping>
```

You should save the mapping document in a file with the format <classname>.hbm.xml. We saved our mapping document in the file Employee.hbm.xml. Let us see little detail about the mapping elements used in the mapping file:

- The mapping document is an XML document having **<hibernate-mapping>** as the root element which contains all the <class> elements.

- The **<class>** elements are used to define specific mappings from a Java classes to the database tables. The Java class name is specified using the **name** attribute of the class element and the database table name is specified using the **table** attribute.

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- The **<meta>** element is optional element and can be used to create the class description.

- The **<id>** element maps the unique ID attribute in class to the primary key of the database table. The **name** attribute of the id element refers to the property in the class and the **column** attribute refers to the column in the database table. The **type** attribute holds the hibernate mapping type, this mapping types will convert from Java to SQL data type.

There are other attributes and elements available which will be used in a mapping document and I would try to cover as many as possible while discussing other Hibernate related topics.

Annotation

Hibernate annotations is the newest way to define mappings without a use of XML file.

You can use annotations in addition to or as a replacement of XML mapping metadata.

Hibernate Annotations is the powerful way to provide the metadata for the Object and Relational Table mapping.

Environment Setup for Hibernate Annotation
First of all you would have to make sure that you are using JDK 5.0 otherwise you need to upgrade your JDK to JDK 5.0 to take advantage of the native support for annotations.

Second, you will need to install the Hibernate 3.x annotations distribution package, available from the sourceforge: (Download Hibernate Annotation) and copy hibernate-annotations.jar, lib/hibernate-comons-annotations.jar and lib/ejb3-persistence.jar from the Hibernate Annotations distribution to your CLASSPATH.

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Annotated Class Example

While working with Hibernate Annotation all the metadata is clubbed into the POJO java file along with the code this helps the user to understand the table structure and POJO simultaneously during the development.

Consider we are going to use following EMPLOYEE table to store our objects:

```
create table EMPLOYEE (
id INT NOT NULL auto_increment,
first_name VARCHAR(20) default NULL,
last_name VARCHAR(20) default NULL,
salary INT default NULL,
PRIMARY KEY (id)
);
```

Following is the mapping of Employee class with annotations to map objects with the defined EMPLOYEE table:

```
import javax.persistence.*;
@Entity
@Table(name = "EMPLOYEE")
public class Employee {
@Id @GeneratedValue
@Column(name = "id")
private int id;
@Column(name = "first_name")
private String firstName;
@Column(name = "last_name")
private String lastName;
@Column(name = "salary")
private int salary;
public Employee() {}
public int getId() {
return id;
}

public void setId( int id ) {
this.id = id;
```

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```
        }
        public String getFirstName() {
        return firstName;
        }
        public void setFirstName( String first_name ) {
        this.firstName = first_name;
        }
        public String getLastName() {
        return lastName;
        }
        public void setLastName( String last_name ) {
        this.lastName = last_name;
        }
        public int getSalary() {
        return salary;
        }
        public void setSalary( int salary ) {
        this.salary = salary;
        }
        }
```

@Entity Annotation

The EJB 3 standard annotations are contained in the javax.persistence package, so we import this package as the first step. Second we used the @Entity annotation to the Employee class which marks this class as an entity bean.

@Table Annotation

The @Table annotation allows you to specify the details of the table that will be used to persist the entity in the database.

The @Table annotation provides four attributes, allowing you to override the name of the table, its catalogue, and its schema, and enforce unique constraints on columns in the table. For now we are using just table name which is EMPLOYEE.

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Ph.No–(0281)2440478, 2472590	Ph. No–(0281)2471645

@Id and @GeneratedValue Annotations

Each entity bean will have a primary key, which you annotate on the class with the @Id annotation. The primary key can be a single field or a combination of multiple fields depending on your table structure.

By default, the @Id annotation will automatically determine the most appropriate primary key generation strategy to be used but you can override this by applying the @GeneratedValue annotation it is helpful generator type to use makes your code portable between different databases.

@Column Annotation

The @Column annotation is used to specify the details of the column to which a field or property will be mapped. You can use column annotation with the following most commonly used attributes:

- name attribute permits the name of the column to be explicitly specified.

- length attribute permits the size of the column used to map a value particularly for a String value.

- nullable attribute permits the column to be marked NOT NULL when the schema is generated.

- unique attribute permits the column to be marked as containing only unique values.

1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	Hibernate _____is the newest way to define mappings without a use of XML file.	Annotations
2.	Hibernate _____is the powerful way to provide the metadata for the Object and Relational Table mapping.	Annotations

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3.	while working with Hibernate Annotation all the metadata is clubbed into the _____java file	POJO
4.	The _____annotation allows you to specify the details of the table that will be used to persist the entity in the database.	@Table
5.	The _____annotation is used to specify the details of the column.	@Column

Hibernate Inheritance:-

Compared to JDBC we have one main advantage in hibernate, which is hibernate inheritance. Suppose if we have base and derived classes, now if we save derived(sub) class object, base class object will also be stored into the database.

For Example:

```
class Payment
{
  // content will goes here
}
-------------------------------------------------------------------------------------------------
class Payment
{
  // content will goes here
}
      class     CreditCard     extends
      Payment
      {
        // content will goes here
      }
```

See if you save CreditCard class object, then payment class object will also be saved into the database.

Note: We can also called this **Hibernate Inheritance Mapping** as Hibernate Hierarchy

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Hibernate supports 3 types of Inheritance Mappings:

Table per Hierarchy

In table per hierarchy mapping, single table is required to map the whole hierarchy, an extra column (known as discriminator column) is added to identify the class. But nullable values are stored in the table.

Table per Hierarchy using xml file
Table per Hierarchy using Annotation

Table per Concrete class

In case of table per concrete class, tables are created as per class. But duplicate column is added in subclass tables.

Table per Concrete class using xml file
Table per Concrete class using Annotation

Table per Subclass

In this strategy, tables are created as per class but related by foreign key. So there are no duplicate columns.

Table per Subclass using xml file
Table per Subclass using Annotation

1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	In table per hierarchy mapping, how many table is required to map the whole hierarchy?	one
2.	In case of_____, tables are created as per class.	table per concrete class
3.	In table per sub class tables are created as per class but related by ____.	foreign key

Hibernate Sessions

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A Session is used to get a physical connection with a database. The Session object is lightweight and designed to be instantiated each time an interaction is needed with the database. Persistent objects are saved and retrieved through a Session object.

The session objects should not be kept open for a long time. they should be created and destroyed them as needed.

The main function of the Session is to offer create, read and delete operations for instances of mapped entity classes.

Instances may exist in one of the following three states at a given point in time:

- **transient:** A new instance of a a persistent class which is not associated with a Session and has no representation in the database and no identifier value is considered transient by Hibernate.

- **persistent:** You can make a transient instance persistent by associating it with a Session. A persistent instance has a representation in the database, an identifier value and is associated with a Session.

- **detached:** Once we close the Hibernate Session, the persistent instance will become a detached instance.

1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	____is used to get a physical connection with a database.	Session
2.	_____objects are saved and retrieved through a Session object.	Persistent
3.	The main function of the ____is to offer create, read and delete operations for instances of mapped entity classes.	Session
4.	Once we close the Hibernate Session, the persistent instance will become a ____instance.	detached

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Session Interface Methods

There are number of methods provided by the **Session** interface some of few important methods are as under.

No	Session Methods and Description
1	**Transaction beginTransaction()** Begin a unit of work and return the associated Transaction object.
2	**void cancelQuery()** Cancel the execution of the current query.
3	**void clear()** Completely clear the session.
4	**Connection close()** End the session by releasing the JDBC connection and cleaning up.
5	**Criteria createCriteria(String entityName)** Create a new Criteria instance, for the given entity name.
6	**Query createQuery(String queryString)** Create a new instance of Query for the given HQL query string.
7	**SQLQuery createSQLQuery(String queryString)** Create a new instance of SQLQuery for the given SQL query string.
8	**void delete(Object object)** Remove a persistent instance from the datastore.
9	**void refresh(Object object)** Re-read the state of the given instance from the underlying database.
10	**boolean isConnected()** Check if the session is currently connected.
11	**boolean isOpen()** Check if the session is still open.
12	**void saveOrUpdate(Object object)** Either save(Object) or update(Object) the given instance.
13	**void update(Object object)** Update the persistent instance with the identifier of the given detached instance.

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Chapter – 5 Spring, Struts

| 5 | Spring, Struts | • Introduction of Spring Framework
• Spring Architecture
• Spring Framework definition
• Spring & MVC
• Spring Context definition
• Inversion of Control (IoC) in Spring
• Aspect Oriented programming in Spring (AOP)
• Understanding Struts Framework
• Comparision with MVC using RequestDispatcher and the EL
• Struts Flow of Control
• Processing Requests with Action Objects
• Handling Request Parameters with FormBeans
• Prepopulating and Redisplaying Input Forms
• Using Properties Files | 20 | 12 |

(1) Introduction to Spring & Spring Framework:-

Spring is the most popular application development framework for enterprise Java. Millions of developers around the world use Spring Framework to create high performing, easily testable, reusable code.

Spring framework is an open source Java platform and it was initially written by Rod Johnson and was first released under the Apache 2.0 license in June 2003.

Spring is lightweight when it comes to size and transparency. The basic version of spring framework is around 2MB.

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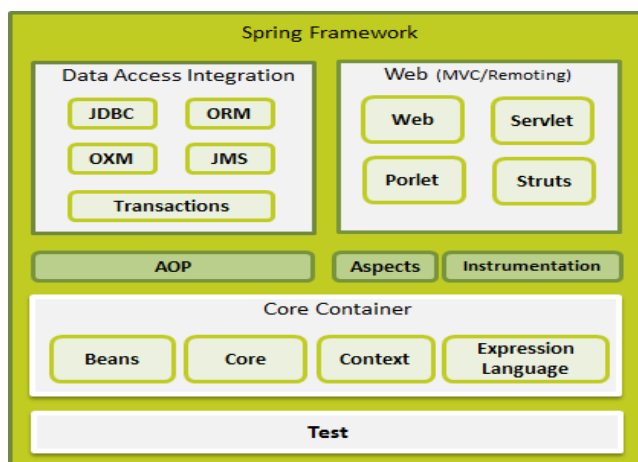|	
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The core features of the Spring Framework can be used in developing any Java application. Spring framework targets to make J2EE development easier to use and promote good programming practice by enabling a POJO-based programming model.

Spring Framework advantages:

Following is the list of few of the great benefits of using Spring Framework:

- Spring enables developers to develop enterprise-class applications using POJOs.

- Spring is organized in a modular fashion. Even though the number of packages and classes are substantial, you have to worry only about ones you need and ignore the rest.

- Spring does not reinvent the wheel instead; it truly makes use of some of the existing technologies.

- Testing an application written with spring is simple because environment-dependent code is moved into this framework. Furthermore, by using JavaBean-style POJOs, it becomes easier to use dependency injection for injecting test data.

- Spring's web framework is a well-designed web MVC framework, which provides a great alternative to web frameworks such as Struts or other web frameworks.

- Spring provides a convenient API to translate technology-specific exceptions (thrown by JDBC, Hibernate, or JDO, for example) into consistent, unchecked exceptions.

- Lightweight IOC containers tend to be lightweight, especially when compared to EJB containers, for example. This is beneficial for developing and deploying applications on computers with limited memory and CPU resources.

- Spring provides a consistent transaction management interface that can scale down to a local transaction (using a single database, for example) and scale up to global transactions (using JTA, for example).

1 Word Question Answer

Sr.No.	Question	Answer
1.	____Framework is used to create high	Spring

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	performing, easily testable, reusable code.	
2.	• Spring's web framework is a well-designed web MVC framework, which provides a great alternative to web frameworks such as _____or other over engineered or less popular web frameworks.	Struts

(2) Spring Architecture

- Spring could potentially be a one-stop shop for all your enterprise applications; however, spring is modular, allowing you to pick and choose which modules are applicable to you, without having to bring in the rest. Following section gives detail about all the modules available in Spring Framework.

- The Spring Framework provides about 20 modules which can be used based on an application requirement.

-

Spring and MVC:-

The spring web MVC framework provides model-view-controller architecture and ready components that can be used to develop flexible and loosely coupled web applications. The MVC pattern results in separating the different aspects of the application (input

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logic, business logic, and UI logic), while providing a loose coupling between these elements.

- The **Model** encapsulates the application data and in general they will consist of POJO.
- The **View** is responsible for rendering the model data and in general it generates HTML output that the client's browser can interpret.
- The **Controller** is responsible for processing user requests and building appropriate model and passes it to the view for rendering.

The DispatcherServlet

The Spring Web model-view-controller (MVC) framework is designed around a DispatcherServlet that handles all the HTTP requests and responses. The request processing workflow of the Spring Web MVC DispatcherServlet is illustrated in the following diagram:
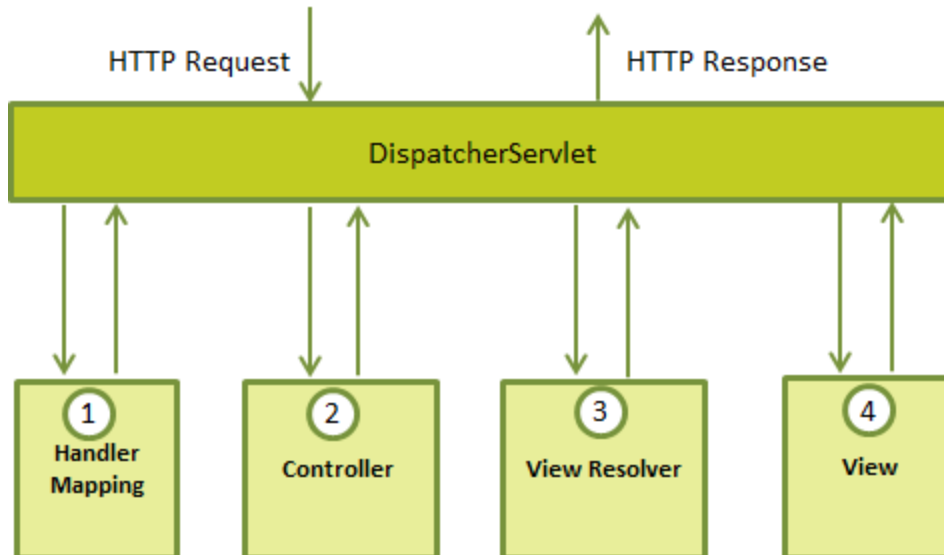
Following is the sequence of events corresponding to an incoming HTTP request to DispatcherServlet:

1. After receiving an HTTP request, *DispatcherServlet* consults the *HandlerMapping* to call the appropriate *Controller*.
2. The *Controller* takes the request and calls the appropriate service methods based on used GET or POST method. The service method will set model data based on defined business logic and returns view name to the *DispatcherServlet*.

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3. The *DispatcherServlet* will take help from *ViewResolver* to pickup the defined view for the request.
4. Once view is finalized, The *DispatcherServlet* passes the model data to the view which is finally rendered on the browser.

All the above mentioned components ie. HandlerMapping, Controller and ViewResolver are parts of *WebApplicationContext* which is an extension of the plain *ApplicationContext* with some extra features necessary for web applications.

1 Word Question Answer		
Sr.No.	Question	Answer
1.	Spring enables developers to develop enterprise-class applications using _____.	POJO
2.	The spring provides ____architecture.	MVC
3.	The *DispatcherServlet* will take help from _____to pickup the defined view for the request.	ViewResolver
4.	Once view is finalized, The ____passes the model data to the view which is finally rendered on the browser.	DispatcherServlet

(3)   Spring Application Context Definition:-

The Application Context is spring's more advanced container. Similar to BeanFactory it can load bean definitions, wire beans together and dispense beans upon request.

Additionally it adds more enterprise-specific functionality such as the ability to resolve textual messages from a properties file and the ability to publish application events to interested event listeners.

This container is defined by the *org.springframework.context.ApplicationContext* interface.

The *ApplicationContext* includes all functionality of the *BeanFactory*, it is generally recommended over the *BeanFactory*. BeanFactory can still be used for light weight applications like mobile devices or applet based applications.

The most commonly used ApplicationContext implementations are:

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- **FileSystemXmlApplicationContext**: This container loads the definitions of the beans from an XML file. Here you need to provide the full path of the XML bean configuration file to the constructor.
- **ClassPathXmlApplicationContext** This container loads the definitions of the beans from an XML file. Here you do not need to provide the full path of the XML file but you need to set CLASSPATH properly because this container will look bean configuration XML file in CLASSPATH.
- **WebXmlApplicationContext:** This container loads the XML file with definitions of all beans from within a web application.

1 Word Question Answer		
Sr.No.	**Question**	**Answer**
1.	The _____is spring's more advanced container.	Application Context
2.	The *ApplicationContext* includes all functionality of the *Bean_____*.	BeanFactory
3.	_____ Container loads the definitions of the beans from an XML file.	FileSystemXmlApplicationContext

(4) Spring IoC Containers (Inversion of Control)

The spring container is at the core of the Spring Framework. The container will create the objects, wire them together, configure them, and manage their complete lifecycle from creation till destruction.

The spring container uses dependency injection (DI) to manage the components that make up an application. These objects are called Spring Beans.

The container gets its instructions on what objects to instantiate, configure, and assemble by reading configuration metadata provided. The configuration metadata can be represented either by XML, Java annotations, or Java code.

The following diagram is a high-level view of how spring works. The Spring IoC container makes use of Java POJO classes and configuration metadata to produce a fully configured and executable system or application.
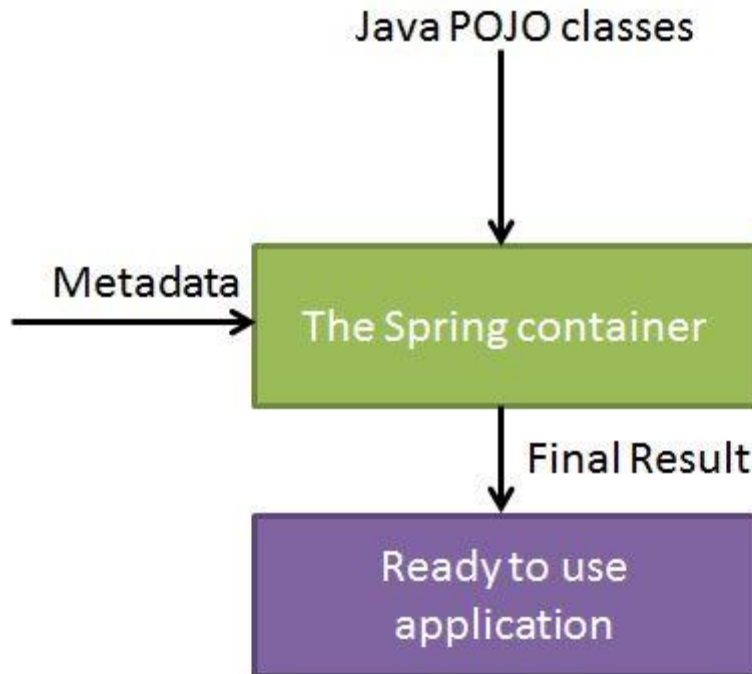
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Spring provides following two distinct types of containers.

S.N.	Container & Description
1	Spring BeanFactory Container This is the simplest container providing basic support for DI and defined by the *org.springframework.beans.factory.BeanFactory* interface. The BeanFactory and related interfaces, such as BeanFactoryAware, InitializingBean, DisposableBean, are still present in Spring for the purposes of backward compatibility with the large number of third-party frameworks that integrate with Spring.
2	Spring ApplicationContext Container This container adds more enterprise-specific functionality such as the ability to resolve textual messages from a properties file and the ability to publish application events to interested event listeners. This container is defined by the *org.springframework.context.ApplicationContext* interface.

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The *ApplicationContext* container includes all functionality of the *BeanFactory* container, so it is generally recommended over the *BeanFactory*.

BeanFactory can still be used for light weight applications like mobile devices or applet based applications where data volume and speed is significant.

1 Word Question Answer		
Sr.No.	Question	Answer
1.	IoC stands for?	Inversion of Conrol
2.	DI stands for?	Dependency Injection

(5) AOP with Spring Framework:

One of the key components of Spring Framework is the **Aspect oriented programming (AOP)** framework.

Aspect Oriented Programming entails breaking down program logic into distinct parts called so-called concerns.

The functions that span multiple points of an application are called **cross-cutting concerns** and these cross-cutting concerns are conceptually separate from the application's business logic.

There are various common good examples of aspects like logging, auditing, declarative transactions, security, and caching etc.

The key unit of modularity in OOP is the class, whereas in AOP the unit of modularity is the aspect. Dependency Injection helps you decouple your application objects from each other and AOP helps you decouple cross-cutting concerns from the objects that they affect.

AOP is like triggers in programming languages such as Perl, .NET, Java and others.

Spring AOP module provides interceptors to intercept an application, for example, when a method is executed, you can add extra functionality before or after the method execution.

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AOP Terminologies:

Before we start working with AOP, let us become familiar with the AOP concepts and terminology. These terms are not specific to spring; rather they are related to AOP.

Terms	Description
Aspect	A module which has a set of APIs providing cross-cutting requirements. For example, a logging module would be called AOP aspect for logging. An application can have any number of aspects depending on the equirement.
Join point	This represents a point in your application where you can plug-in AOP aspect. You can also say, it is the actual place in the application where an action will be taken using Spring AOP framework.
Advice	This is the actual action to be taken either before or after the method execution. This is actual piece of code that is invoked during program execution by Spring AOP framework.
Pointcut	This is a set of one or more joinpoints where an advice should be executed. You can specify pointcuts using expressions or patterns as we will see in our AOP examples.
Introduction	An introduction allows you to add new methods or attributes to existing classes.
Target object	The object being advised by one or more aspects, this object will always be a proxied object. Also referred to as the advised object.
Weaving	Weaving is the process of linking aspects with other application types or objects to create an advised object. This can be done at compile time, load time, or at runtime.

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Types of Advice

Spring aspects can work with five kinds of advice mentioned below:

Advice	Description
before	Run advice before the method execution.
after	Run advice after the method execution regardless of its outcome.
after-returning	Run advice after the method execution only if method completes successfully.
after-throwing	Run advice after the method execution only if method exits by throwing an exception.
around	Run advice before and after the advised method is invoked.

Spring JDBC Framework Overview

While working with database using plain old JDBC, it becomes cumbersome to write unnecessary code to handle exceptions, opening and closing database connections etc. But Spring JDBC Framework takes care of all the low-level details starting from opening the connection, prepare and execute the SQL statement, process exceptions, handle transactions and finally close the connection.

So what you have done is just define connection parameters and specify the SQL statement to be executed and do the required work for each iteration while fetching data from the database.

Spring JDBC provides several approaches and correspondingly different classes to interface with the database. I'm going to take classic and the most popular approach which makes use of **JdbcTemplate**class of the framework. This is the central framework class that manages all the database communication and exception handling.

Let us create a database table **Student** in our database **TEST**.

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```
CREATE TABLE Student(
  ID  INT NOT NULL AUTO_INCREMENT,
  NAME VARCHAR(20) NOT NULL,
  AGE  INT NOT NULL,
  PRIMARY KEY (ID)
);
```

Now we need to supply a DataSource to the JdbcTemplate so it can configure itself to get database access. You can configure the DataSource in the XML file with a piece of code as shown below:

```
<bean id="dataSource"
class="org.springframework.jdbc.datasource.DriverManagerDataSource">
  <property name="driverClassName" value="com.mysql.jdbc.Driver"/>
  <property name="url" value="jdbc:mysql://localhost:3306/TEST"/>
  <property name="username" value="root"/>
  <property name="password" value="password"/>
</bean>
```

1 Word Question Answer

Sr.No.	Question	Answer
1.	AOP stands for?	Aspect oriented programming
2.	_____represents a point in your application where you can plug-in AOP aspect.	Join point
3.	_____is a set of one or more joinpoints where an advice should be executed.	Pointcut
4.	_____is the process of linking aspects with other application types or objects to create an advised object.	Weaving
5.	The ____class executes SQL queries, updates statements and stored procedure calls, performs iteration over ResultSets and extraction of returned parameter values.	JdbcTemplate

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(6)   Introduction and Framework of struts:-

Struts2 is popular and mature web application framework based on the MVC design pattern. Struts2 is not just the next version of Struts 1, but it is a complete rewrite of the Struts architecture.

The WebWork framework started off with Struts framework as the basis and its goal was to offer an enhanced and improved framework built on Struts **to make web development easier for the developers**.

After some time, the Webwork framework and the Struts community joined hands to create the famous Struts2 framework.

Struts 2 framework features:

Here are some of the great features that may force you to consider Struts2:

- **POJO forms and POJO actions** - Struts2 has done away with the Action Forms that were an integral part of the Struts framework. With Struts2, you can use any POJO to receive the form input. Similarly, you can now see any POJO as an Action class.
- **Tag support** - Struts2 has improved the form tags and the new tags allow the developers to write less code.
- **AJAX support** - Struts2 has recognised the take over by Web2.0 technologies, and has integrated AJAX support into the product by creating AJAX tags, that function very similar to the standard Struts2 tags.
- **Easy Integration** - Integration with other frameworks like spring, Tiles and SiteMesh is now easier with a variety of integration available with Struts2.
- **Template Support** - Support for generating views using templates.
- **Plugin Support** - The core Struts2 behaviour can be enhanced and augmented by the use of plugins. A number of plugins are available for Struts2.
- **Profiling** - Struts2 offers integrated profiling to debug and profile the application. In addition to this, Struts also offers integrated debugging with the help of built in debugging tools.
- **Easy to modify tags** - Tag markups in Struts2 can be tweaked using Freemarker templates. This does not require JSP or java knowledge. Basic HTML, XML and CSS knowledge is enough to modify the tags.

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- **Promote less configuration** - Struts2 promotes less configuration with the help of using default values for various settings. You don't have to configure something unless it deviates from the default settings set by Struts2.

1 word Question Answer		
Sr.No.	Question	Answer
1.	_____is popular and mature web application framework based on the MVC design pattern.	Struts2
2.	With Struts2, you can use any ____to receive the form input.	POJO
3.	Struts2 promotes less configuration with the help of using ____for various settings	default values

(7)   Struts 2 Architecture:

From a high level, Struts2 framework is MVC2 framework. The Model-View-Controller pattern in Struts2 is realized with following five core components:

- **Actions**
- **Interceptors**
- **Value Stack / OGNL**
- **Results / Result types**
- **View technologies**

Struts2 is slightly different from a traditional MVC framework.

The following diagram depicts the **M**odel, **V**iew and **C**ontroller to the Struts2 high level architecture.

The controller is implemented with a Struts2 dispatch servlet filter as well as interceptors,
the model is implemented with actions, and
the view as a combination of result types and results.
The value stack and OGNL(Object Graph Navigation Language) provide common thread, linking and enabling integration between the components.

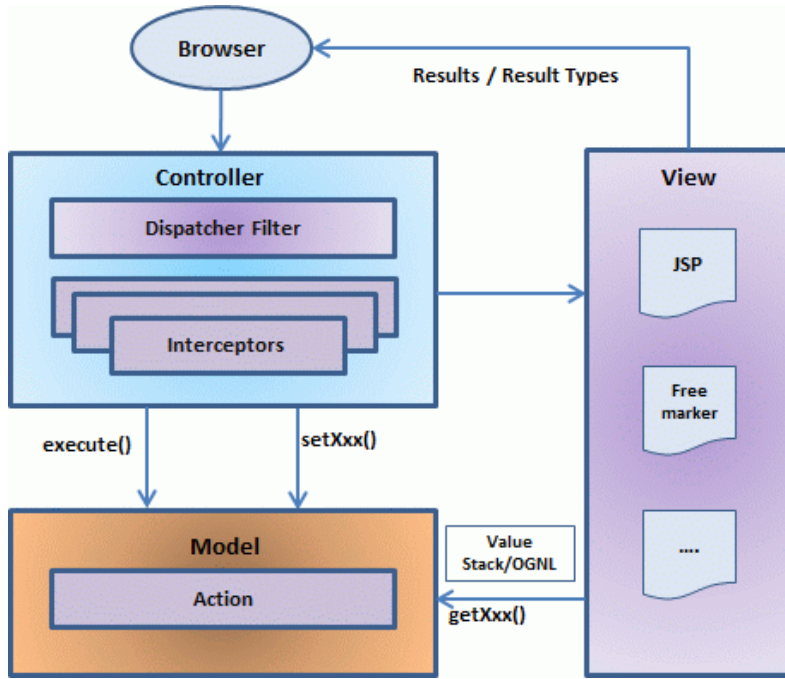This is the architectural overview of the Struts 2 MVC pattern.

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Request life cycle:

Based on the above digram, one can explain the user's request life cycle in Struts 2 as follows:

- User sends a request to the server for requesting for some resource (i.e pages).
- The FilterDispatcher looks at the request and then determines the appropriate Action.
- Configured interceptors functionalities apply such as validation, file upload etc.
- Selected action is executed to perform the requested operation.
- Again, configured interceptors are applied to do any post-processing if required.
- Finally the result is prepared by the view and returns the result to the user.

1 Word Question Answer

Sr.No.	Question	Answer
1.	The value stack and ____provide common thread, linking and enabling integration between the other components.	OGNL
2.	The ____looks at the request and then determines the appropriate Action.	FilterDispatcher

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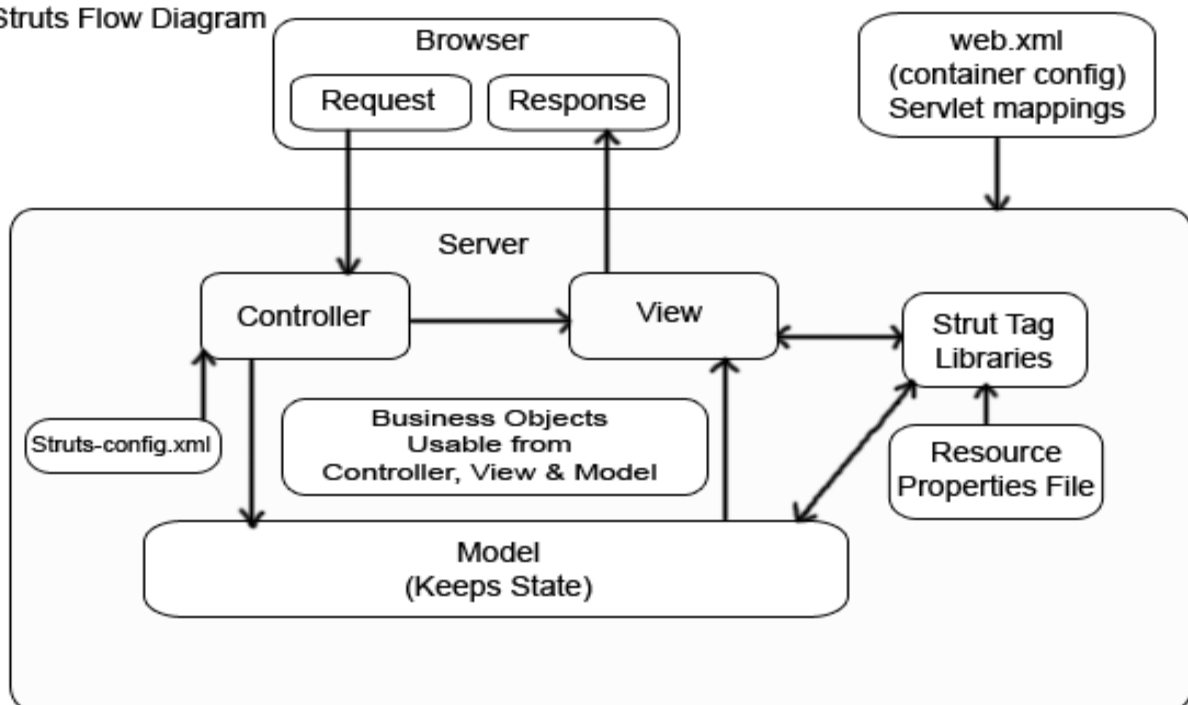**Raiya Road, Rajkot – 360001**
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3.	Configured ____are applied to do any post-processing if required.	interceptors

(8)   Struts MVC v/s Spring MVC:-

Struts forces Actions and Form object into concrete inheritance.	Spring's MVC is very versatile and flexible based on interfaces.
Struts can not handle many requests.	Spring provides both interceptors and controllers, thus helps to factor out common behavior to the handling of many requests.
Struts web tier is hard to test than Spring MVC.	Web tier of Spring MVC is easy to test than Struts web tier.
In Struts framework you need to implement your business objects	Spring web layer built on top of a business object layer which is considered a good practice.
Struts force your Controllers to extend a Struts class	Spring doesn't, there are many convenience Controller implementations that you can choose to extend.
In struts a variety of Struts specific tags are used to assure that request parameters are bound to ActionForm fields and show binding/validation errors.	In SpringMVC, there is one simple bind tag that handles all of this. Your JSP's remain smaller and have more pure HTML content.
In Struts, Actions are coupled to the view by defining ActionForwards within a ActionMapping or globally.	SpringMVC has HandlerMapping interface to support this functionality.
With Struts, validation is usually performed (implemented) in the validate method of an ActionForm.	In SpringMVC, validators are business objects that are NOT dependent on the Servlet API which makes these validators to be reused in your business logic before persisting a domain object to a database.

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1 Word Question Answer

| Sr.No.	Question	Answer
1.	_____can not handle many requests.	Struts
2.	Spring provides both _____and_____, thus helps to factor out common behavior to the handling of many requests	Interceptors, controllers
3.	In ____a variety of Struts specific tags are used to assure that request parameters are bound to ActionForm fields and show binding/validation errors.	struts

(9) Struts Flow Diagram:-

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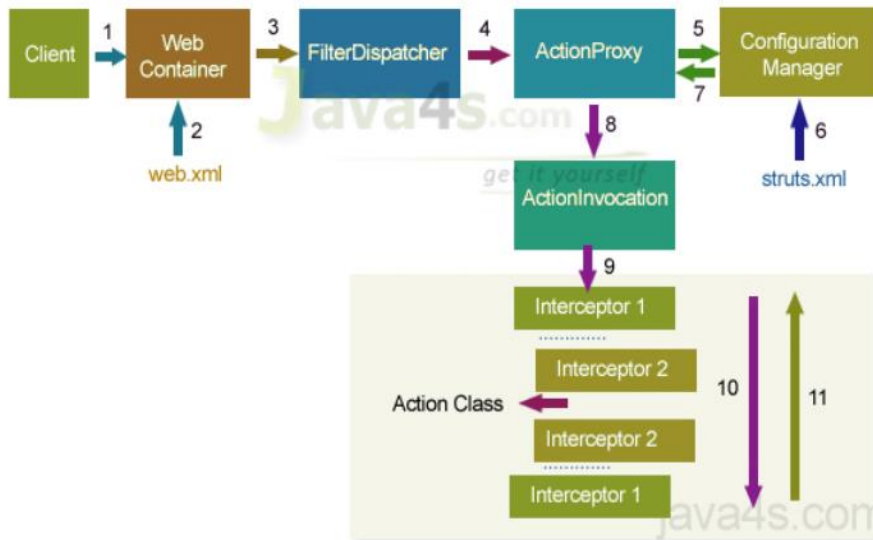
Execution flow of struts

- When a client request is given, a web container will receive request
- Web container loads web.xml and verifies whether the url-patterns are verified or not, if matches web-container transfer the request to FilterDispatcher
- FilterDispatcher hand overs the request to ActionProxy, it is a proxy class which is responsible to apply before and after services to original business logic
- ActionProxy contacts ConfiguraionManager class, to know the suitable Action for the request and the needed services for the request
- ConfigurationManager class loads struts.xml and provides the required information back to ActionProxy
- ActionProxy delegates the request along with its information to ActionInvocation
- ActionInvocation executes the interceptors added to an Action from 1 – N, after that it will calls the business logic implemented from N – 1 in reverse order
- ActionInvocation receives finally result produced by an Action class
- ActionProxy transfers the result back to FilterDispatcher
- FilterDispatcher selects an appropriate view, basing on the result
- Finally FilterDispatcher uses RequestDispatchers forwarding mechanism and forward a view as a response back to the client.

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2- Vaishali Nagar	3 – Vaishali Nagar
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Raiya Road, Rajkot – 360001	Raiya Road, Rajkot - 360001
Ph.No–(0281)2440478, 2472590	Ph. No–(0281)2471645

1 Word Question Answer		
Sr.No.	Question	Answer
1.	Web container loads web.xml and verifies whether the url-patterns are verified or not, if matches web-container transfer the request to _____.	FilterDispatcher
2.	____contacts ConfiguraionManager class, to know the suitable Action for the request and the needed services for the request.	ActionProxy
3.	ConfigurationManager class loads ____and provides the required information back to ActionProxy.	structs.xml
4.	All the field labels and messages can be retrieved from a _____.	message resource
5.	The Struts framework includes _____that can automatically populate fields from a JavaBean.	custom tags

(10) Processing requests with ActionObjects

Create an Action object to handle requests.

In general, your Action subclass should: <u>Be in a package.</u> In this case, we have

package coreservlets; This means that the class file should go in *your_web_app*/WEB-INF/classes/coreservlets/.

<u>Add Struts-specific import statements to whatever imports are otherwise needed.</u> In this case, we have

import javax.servlet.http.*;

import org.apache.struts.action.*;

<u>Extend the Action class.</u> In this case, we have

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public class RegisterAction1 **extends Action** {...}

Override the execute method. This method is defined as follows.

 public ActionForward execute(ActionMapping mapping,

ActionForm form, HttpServletRequest request, HttpServletResponse response)

  throws Exception

{

 ...

  }

The execute method should have one or more return values. These values will then be mapped to specific JSP pages by forward entries in struts-config.xml. In this case, we simply return "success" in all situations.

```
  public ActionForward execute(ActionMapping mapping,
                ActionForm form,
                HttpServletRequest request,
                HttpServletResponse response)
     throws Exception
{
   return(mapping.findForward("success"));
       }
```

For this simple example, the Action will do nothing but return "success". Here is the code (download the source code here).

RegisterAction1.java

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2- Vaishali Nagar
Nr. Amrapali Under Bridge
Raiya Road, Rajkot – 360001
Ph.No–(0281)2440478, 2472590

3 – Vaishali Nagar
Nr. Amrapali Under Bridge
Raiya Road, Rajkot - 360001
Ph. No–(0281)2471645

```
package coreservlets;

import javax.servlet.http.*;
import org.apache.struts.action.*;

public class RegisterAction1 extends Action
{
  public ActionForward execute(ActionMapping mapping,
                ActionForm form,
                HttpServletRequest request,
                HttpServletResponse response)
    throws Exception
        {
   return(mapping.findForward("success"));
 }
}
```

Prepopulating and Redisplaying Input Forms

In this section, we show how to associate form beans with the input page using the Struts html: tags.

Associating form beans with input forms provides three advantages:

It guarantees that the request parameter names and the bean property names stay in sync. if you use the wrong name, you get an immediate error message.

It lets you prepopulate text fields with initial values. By associating a bean with the input page, the initial text field values can come from your application.

It lets you redisplay values in the text fields. If you send the user back to the original form, the originally entered values are automatically filled in. That's because the form is already associated with a bean, but now the bean is the one that was just created from the request.

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Raiya Road, Rajkot – 360001	**Raiya Road, Rajkot - 360001**
Ph.No–(0281)2440478, 2472590	**Ph. No–(0281)2471645**

USING PROPERTY FILES:-

1.Create a properties file in WEB-INF/classes
– E.g., WEB-INF/classes/MessageResources.properties

2. Define strings in the properties file
some.key1=first message
some.key2=second message
some.key3=some parameterized message: {0}

3. Load the properties file in struts-config.xml
– <message-resources parameter="MessageResources"/>

4. Output the messages in JSP pages
– Load the tag library
• <%@ taglib uri="http://struts.apache.org/tags-bean" prefix="bean" %>
– Output the messages using bean:message
• First message is <bean:message key="some.key1"/>
• Second: <bean:message key="some.key2"/>
• Third: <bean:message key="some.key3" arg0="replacement"/>

Advantages of Properties Files
• **Centralized updates**
– If a message is used in several places, it can be updated with a single change.
– This is consistent with the Struts philosophy of making as many changes as possible in config files, not in Java or JSP code.