ADVANCED JAVA

JDBC * SERVLETS * JSP

SATYA KAVETI

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Table of Content

Change Table Content → Top → REFERENCES (5th Tab) →update content

1. SQL Basics

I.Introduction to SQL

SQL is a standard language for accessing and manipulating databases

RDBMS

- RDBMS stands for Relational Database Management System.
- RDBMS is the basis for SQL, and for all modern database systems such as MS SQL Server, IBM DB2, Oracle, MySQL, and Microsoft Access.
- The data in RDBMS is stored in database objects called tables.
- A table is a collection of related data entries and it consists of columns and rows

1. Database Tables: A database most often contains one or more tables. Each table is identified by a name (e.g. "Customers" or "Orders"). Tables contain records (rows) with data

2. SQL Statements Most of the actions you need to perform on a database are done with SQL statements. SQL keywords are **NOT case sensitive**: **select** is the same as **SELECT**

1.1 SQL Operations

Connecting MySQL with XAMPP commndline

```
cd C:\xampp\mysql\bin
c:
mysql.exe -u root -p
root
```

MariaDB [(none)]> **show databases;**

```
+--------------------+
| Database           |
+--------------------+
|  mysql              |
| student            |
| test               |
+--------------------+
8 rows in set (0.00 sec)
```

```
MariaDB [(none)]> use student
Database changed
```

MariaDB [student]> **show tables;**

```
+--------------------+
| Tables_in_student  |
+--------------------+
| student            |
| user               |
+--------------------+
```

Some of the Most Important SQL Commands

1. **CREATE DATABASE** - creates a new database

```
CREATE DATABASE `jdbc`
```

2. **DROP DATABASE** - modifies a database

```
DROP DATABASE `jdbc`
```

3. **CREATE TABLE** - creates a new table

```
CREATE TABLE `student` (
        `sno` INT NOT NULL,
        `name` VARCHAR(50) NULL,
        `address` VARCHAR(50) NULL,
PRIMARY KEY (`sno`)
);
```

4. **ALTER TABLE** - modifies a table

```
ALTER TABLE `student` ADD COLUMN `city` INT(11) NOT ;
```

5. **DROP TABLE** - deletes a table

```
DROP TABLE `student;
```

6. **CREATE INDEX** - creates an index (search key)

```
ALTER TABLE `student`  ADD UNIQUE INDEX `city` (`city`);
```

7. **DROP INDEX** - deletes an index

```
ALTER TABLE `student`  DELETE UNIQUE INDEX `city` (`city`);
```

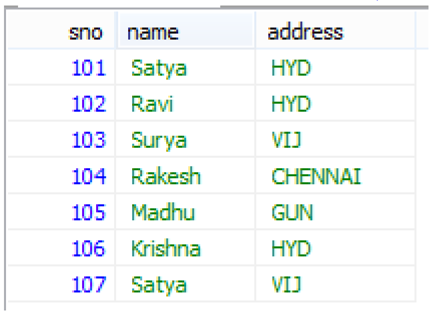
8. **INSERT INTO** - inserts new data into a database

```
INSERT INTO `student` (`name`, `address`) VALUES ('Ravi', 'HYD');
```

9. **SELECT** - extracts data from a database
10. **UPDATE** - updates data in a database
11. **DELETE** - deletes data from a database

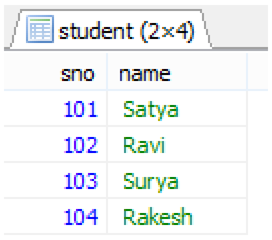
Select Operations

```
SELECT * FROM `student`;
```



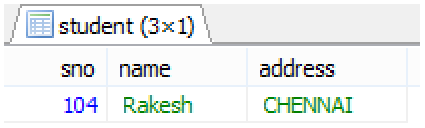
sno	name	address
101	Satya	HYD
102	Ravi	HYD
103	Surya	VIJ
104	Rakesh	CHENNAI
105	Madhu	GUN
106	Krishna	HYD
107	Satya	VIJ

```
SELECT s.sno, s.name FROM `student` s;
```



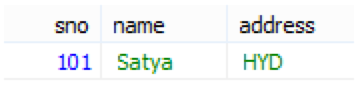
sno	name
101	Satya
102	Ravi
103	Surya
104	Rakesh

```sql
SELECT * FROM `student` s WHERE s.sno =104;
```



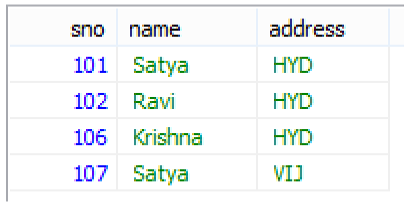
sno	name	address
104	Rakesh	CHENNAI

```sql
SELECT * FROM `student` s WHERE s.name="Satya" AND s.address="HYD";
```



sno	name	address
101	Satya	HYD

```sql
SELECT * FROM `student` s WHERE s.name="Satya" OR s.address="HYD";
```



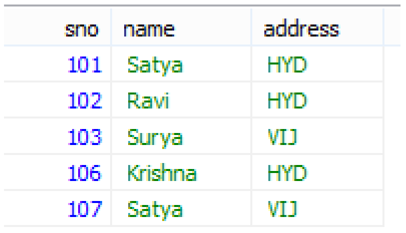
sno	name	address
101	Satya	HYD
102	Ravi	HYD
106	Krishna	HYD
107	Satya	VIJ

```sql
SELECT * FROM `student` s WHERE s.name like '%a';
```

- `like '%a'` ➔ **Ending with 'a'**
- `like 'a%'` ➔ **Starting with 'a'**
- `like '%a%'` ➔ **Contains with 'a'**
- `like '%'` ➔ **Contains any**

```sql
SELECT * FROM `student` s WHERE s.address IN ('HYD', 'VIJ');
```

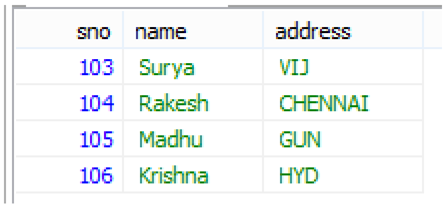
IN operator allows you to apply multiple where conditions



sno	name	address
101	Satya	HYD
102	Ravi	HYD
103	Surya	VIJ
106	Krishna	HYD
107	Satya	VIJ

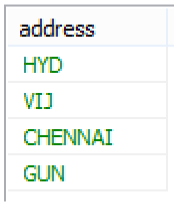
```sql
SELECT * FROM `student` s WHERE s.sno BETWEEN 103 AND 106
```

(Mostly used in date comparision)



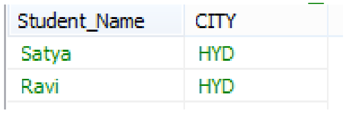
sno	name	address
103	Surya	VIJ
104	Rakesh	CHENNAI
105	Madhu	GUN
106	Krishna	HYD

```
SELECT DISTINCT s.address FROM `student` s;
```



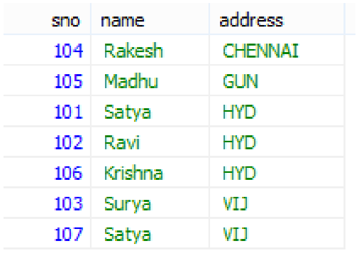
address
HYD
VIJ
CHENNAI
GUN

```
SELECT s.name AS 'Student_Name', s.address AS 'CITY' FROM `student` s
```



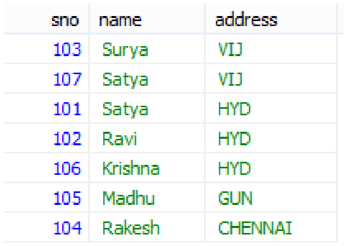
Student_Name	CITY
Satya	HYD
Ravi	HYD

```
SELECT * FROM `student` s ORDER BY s.address asc;     (default)
```



sno	name	address
104	Rakesh	CHENNAI
105	Madhu	GUN
101	Satya	HYD
102	Ravi	HYD
106	Krishna	HYD
103	Surya	VIJ
107	Satya	VIJ

```
SELECT * FROM `student` s ORDER BY s.address desc;
```



sno	name	address
103	Surya	VIJ
107	Satya	VIJ
101	Satya	HYD
102	Ravi	HYD
106	Krishna	HYD
105	Madhu	GUN
104	Rakesh	CHENNAI

```
UPDATE student` SET `name`='Vishnu' WHERE `sno`=107 AND `name`='Satya' AND
`address`='VIJ' LIMIT 1;
```

```
DELETE FROM `mydb`.`student` WHERE  `sno`=107 AND `name`='Vishnu' AND
`address`='VIJ' LIMIT 1;
```

1.2 JOINS

An SQL JOIN clause is used to combine rows from two or more tables, based on a common field between them.

Rules

1. At least on common column must be present beween two tables
2. PRIMARY_KEY of one table as FORIEN_KEY of another table is recommended.

PRIMARY KEY Constraint

- The PRIMARY KEY constraint uniquely identifies each record in a database table.
- Primary keys must contain UNIQUE values.
- A primary key column cannot contain NULL values.
- Table can have **only ONE primary key.**

FOREIGN KEY Constraint

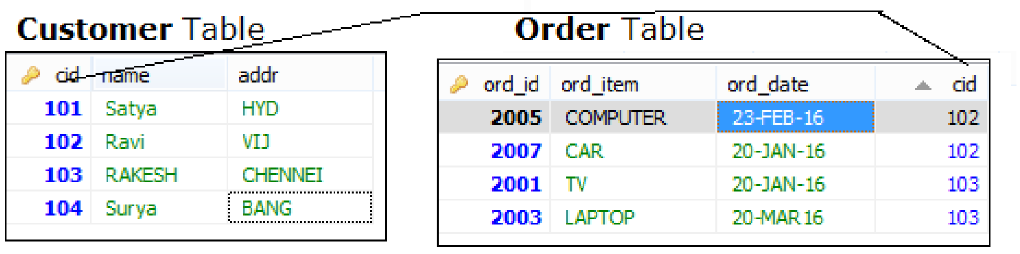
- A **FOREIGN KEY in one table points to a PRIMARY KEY in another table**.

CASCADE will propagate the change when the parent changes. (If you delete a row, rows in constrained tables that reference that row will also be deleted, etc.)

SET NULL sets the column value to NULL when a parent row goes away.

RESTRICT causes the attempted DELETE of a parent row to fail.

```
CREATE TABLE `customer` (
`cid` INT NOT NULL,
`name` VARCHAR(50) NULL,
`addr` VARCHAR(50) NULL,
PRIMARY KEY (`cid`)
) ;

CREATE TABLE `order` (
  `ord_id` INT NOT NULL,
  `ord_item` VARCHAR(50) NULL,
  `ord_date` VARCHAR(50) NULL,
  `cid` INT NULL,
  PRIMARY KEY (`ord_id`),
  CONSTRAINT `FK__customer` FOREIGN KEY (`cid`) REFERENCES `customer`
  (`cid`) ON UPDATE CASCADE ON DELETE CASCADE
)
COLLATE='utf8_general_ci'
ENGINE=InnoDB;
SELECT `DEFAULT_COLLATION_NAME` FROM `information_schema`.`SCHEMATA`
WHERE `SCHEMA_NAME`='mydb';
```

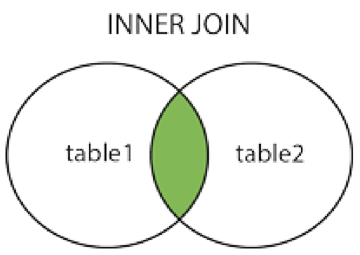


cid	name	addr
101	Satya	HYD
102	Ravi	VIJ
103	RAKESH	CHENNEI
104	Surya	BANG

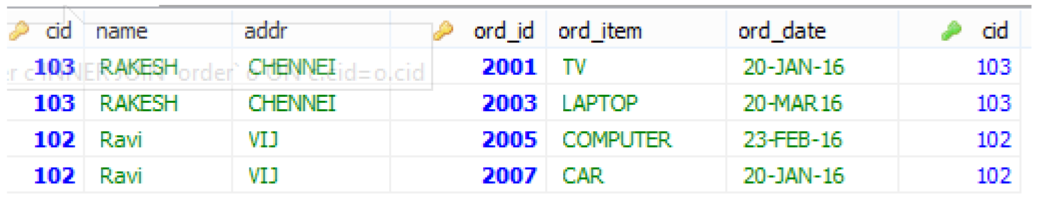
ord_id	ord_item	ord_date	cid
2005	COMPUTER	23-FEB-16	102
2007	CAR	20-JAN-16	102
2001	TV	20-JAN-16	103
2003	LAPTOP	20-MAR 16	103

We have 4 types of Joins

1. **INNER JOIN**:
   Returns all rows when there is at least one match in BOTH tables

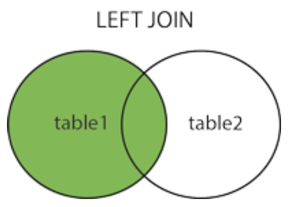


```
SELECT * FROM customer c INNER JOIN `order` o ON c.cid=o.cid
```

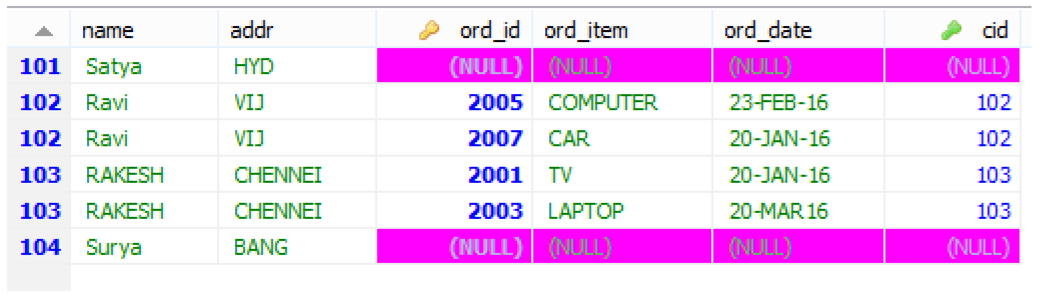


cid	name	addr	ord_id	ord_item	ord_date	cid
103	RAKESH	CHENNEI	2001	TV	20-JAN-16	103
103	RAKESH	CHENNEI	2003	LAPTOP	20-MAR16	103
102	Ravi	VIJ	2005	COMPUTER	23-FEB-16	102
102	Ravi	VIJ	2007	CAR	20-JAN-16	102

2. LEFT JOIN:
Return **all rows from the left table, and the matched rows from the right table.** It will fill rows with **NULL** for unmatched rows on **right**

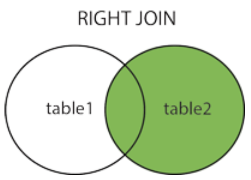


```
SELECT * FROM customer c LEFT JOIN `order` o ON c.cid=o.cid
```



	name	addr	ord_id	ord_item	ord_date	cid
101	Satya	HYD	(NULL)	(NULL)	(NULL)	(NULL)
102	Ravi	VIJ	2005	COMPUTER	23-FEB-16	102
102	Ravi	VIJ	2007	CAR	20-JAN-16	102
103	RAKESH	CHENNEI	2001	TV	20-JAN-16	103
103	RAKESH	CHENNEI	2003	LAPTOP	20-MAR16	103
104	Surya	BANG	(NULL)	(NULL)	(NULL)	(NULL)

3. RIGHT JOIN:
Return all rows from the right table, and the matched rows from the left table. It will fill rows with **NULL** for unmatched rows on **left**.

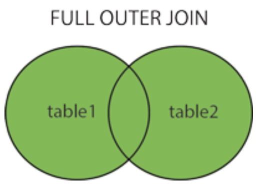


```
SELECT * FROM customer c RIGHT JOIN `order` o ON c.cid=o.cid
```

cid	name	addr	ord_id	ord_item	ord_date	cid
102	Ravi	VIJ	2005	COMPUTER	23-FEB-16	102
102	Ravi	VIJ	2007	CAR	20-JAN-16	102
103	RAKESH	CHENNEI	2001	TV	20-JAN-16	103
103	RAKESH	CHENNEI	2003	LAPTOP	20-MAR-16	103

4. FULL JOIN:

Return **all rows when there is a match in ONE of the tables**



```
SELECT * FROM customer c FULL OUTER JOIN `order` o ON c.cid=o.cid
```

In MySQL we don't have Full Outer Join, for this we have to use Unions

UNION Operator

SQL UNION operator **combines the result of two or more SELECT statements**

```
SELECT * FROM customer c WHERE c.cid>102
UNION
SELECT * FROM customer c
```

cid	name	addr
103	RAKESH	CHENNEI
104	Surya	BANG
101	Satya	HYD
102	Ravi	VIJ

- The UNION operator selects only distinct values by default.
- To allow duplicate values, to get duplicates also use `UNION ALL`
- Column name must be equal in TWO tables

SELECT INTO

SELECT INTO statement **copies data from one table** and inserts it into a **new table**.

```
SELECT * INTO old_customer FROM customer;          (mysql not supporting)
```

INSERT INTO SELECT

It selects data from one table and inserts it into an **existing table**

Constraints

- NOT NULL - Indicates that a column cannot store NULL value
- UNIQUE - Ensures that each row for a column must have a unique value
- PRIMARY KEY - A combination of a NOT NULL and UNIQUE
- FOREIGN KEY - Ensure the referential integrity of the data in one table to match values in another table
- CHECK - Ensures that the value in a column meets a specific condition
- DEFAULT - Specifies a default value for a column

Views

View is a **virtual table based on the result-set of an SQL statement.**

- A view contains rows and columns, just like a real table.
- The fields in a view are fields from one or more real tables in the database

```
CREATE OR REPLACE VIEW view_name AS
SELECT column_name(s)
FROM table_name
WHERE condition
```

```
CREATE OR REPLACE VIEW [Current Product List] AS
SELECT ProductID,ProductName,Category
FROM Products
WHERE Discontinued=No
```

We can perform INSERT, DELETE, UPDATE Opetations as normal as Table operations

Date Functions

The following table lists the most important built-in date functions in MySQL:

Function	Description
NOW()	Returns the current date and time
CURDATE()	Returns the current date
CURTIME()	Returns the current time
DATE()	Extracts the date part of a date or date/time expression
EXTRACT()	Returns a single part of a date/time
DATE_ADD()	Adds a specified time interval to a date
DATE_SUB()	Subtracts a specified time interval from a date

DATEDIFF()	**Returns the number of days between two dates**
DATE_FORMAT()	**Displays date/time data in different formats**

1.3 Sql Functions

Number functions

- **AVG()** - Returns the average value
- **COUNT()** - Returns the number of rows
- **FIRST()** - Returns the first value
- **LAST()** - Returns the last value
- **MAX()** - Returns the largest value
- **MIN()** - Returns the smallest value
- **SUM()** - Returns the sum

String functions

- **UCASE()** - Converts a field to upper case
- **LCASE()** - Converts a field to lower case
- **MID()** - Extract characters from a text field
- **LEN()** - Returns the length of a text field
- **ROUND()** - Rounds a numeric field to the number of decimals specified
- **NOW()** - Returns the current system date and time
- **FORMAT()** - Formats how a field is to be displayed

1.4 PL/SQL

PL/SQL stands for (Procedural Language/Structure Query Language). It is extension of SQL

2.1 Bascis

1. **Datatpye**

Below are supported Datatypes in PL/SQL which are supported in SQL.

	Data type	**Syntax**
1	**Integer**	**INTEGER**
2	**Smallint**	**SMALLINT**
3	**Numeric**	**NUMERIC(P,S)**
4	**Real**	**REAL**

5	**Decimal**	**DECIMAL(P,S)**
6	**Float**	**FLOAT(P)**
7	**Character**	**CHAR(X)**
8	**Character varying**	**VARCHAR2(X)**
9	**Date**	**Date**
10	**Time**	**TIME**

2. **Variables**

Variable Declaration

```
Variable_name datatype;
a number;
```

Variable Initialization

```
Variable_name datatype:=value;
a number=10;
```

3. Input Statement : to provide input value at run time by using operator (&).

4. Output Statement:

```
dbms_output.put_line ('Message' || variable);

dbms_output.put_line ('Sum: ' || c);
```

Basic Syntax

```
begin
        dbms_output.put_line("Hello word");
end;
```

Very simple, in the place of { }, we use **begin … end;**

Procedure

A pl-sql Procedure does not return any value. Procedure has two sections;

- **Declaration of the procedure:** Declaration of procedure always start with a keyword create ends with last **variable parameters**.
- **Body of the procedure:** Body of procedure starts with a keyword called **is or as** and ends with end statement.

Example

```
create or replace procedure p1(a in number, b out number, c out number, d out number)
```

```
is
          begin;
             select ename, sal, deptno, into b, c, d from emp where empno=a;
          end;
```

Function

A PL/SQL Function is a self control block which is used to perform some specific task. **function must always return a value**, but a procedure may or may not return a value.

```
create or replace function add(a number, b number)
return number
is
number;
          begin;
                    a:=10;
                    b:=20;
                    c=a+b;
          return c;
          end;
```

Package is a collection of sub-programs that means function or procedure

```
          create package package_name AS
            procedure procedure_name(parameter);
          end package_name;
```

Cursors

A Cursors is a temporary work area created in the system memory when a SQL statement is executed. It is a temporary memory which is used to fetch more than one record at a time from existing table.

Implicit cursor cursor is perform by the system internally

Explicit cursor This type of cursor is performed by the user manually or programatically

Steps to perform cursor

Steps	**Syntax**
Declare the cursor	**open cursor_name;**
Open the cursor	**open cursor_name;**
Fetch the record from the cursor	**fetch cursor_name into variables;**

Close the cursor	**close cursor_name;**

Declare the cursor

```
declare
a emp %rowtype;
cursor c is select * from emp where depno=&deptno;
begin
open c;
loop fetch c into a;
if c % found then
dbms_output.put_line(a.empno || ' ' a.ename || ' ' || a.sal);
else
exit;
end if;
end loop;
close c;
end;
```

Trigger

Trigger is a pl/sql block structure which is fired when a DML statements like Insert, Delete, Update is executed on a database table. A trigger is triggered automatically when an associated DML statement is executed

Purpose of Triggers

Triggers can be written for the following purposes:

- Generating some derived column values automatically
- Enforcing referential integrity
- **Event logging and storing information on table access Auditing**
- Synchronous replication of tables
- **Imposing security authorizations**
- To avoid invalid transactions
- To generate the resulting data automatically.

Part of Trigger

A database trigger has 5 parts.

- Trigger timing
- Trigger event or statement
- Trigger level
- Trigger restriction

- Trigger body

```
CREATE [OR REPLACE ] TRIGGER trigger_name
{BEFORE | AFTER | INSTEAD OF }
{INSERT [OR] | UPDATE [OR] | DELETE}
[OF col_name]
ON table_name
[REFERENCING OLD AS o NEW AS n]
[FOR EACH ROW]
WHEN (condition)
BEGIN
  --- sql statements
END;
```

Write a trigger to stop delete operation on emp table

```
create or replace trigger mytrigger
before
delete
on emp
begin
raise_application_error(-20000, 'sorry we can not delete any record from this table');
end;
```

References

- http://www.w3schools.com/sql/
- http://www.sitesbay.com/plsql/

2. MongoDB

MongoDB is an open-source **NoSQL, Document Database** Written in **C++** that provides high performance, high availability, and automatic scaling.

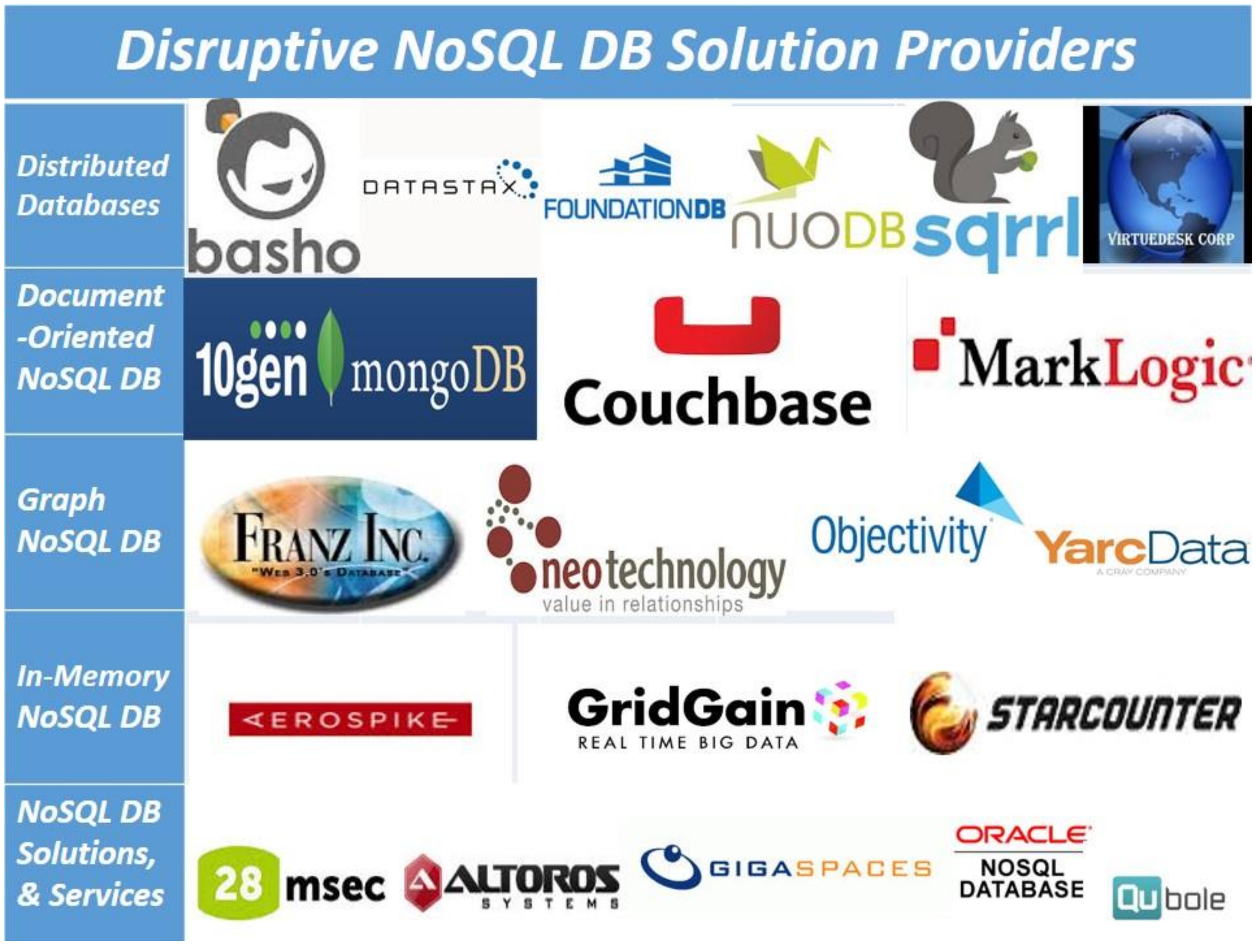
1.Introduction

1.1 NoSQL (Not Only SQL)

It provides a mechanism for storage and retrieval of data other than tabular relations model used in relational databases. NoSQL database doesn't use tables for storing data. It is generally used to store big data and real-time web applications.

NoSQL Database Types

- **Document databases:** Documents can contain many different key-value pairs, or key-array pairs.
- **Graph stores:** are used to store networks of data, such as social connections.
- **Key-value stores:** simplest NoSQL databases. Every single item in the database is stored as an attribute name (or 'key'), together with its value.
- **Wide-column** stores such as Cassandra and HBase are optimized for queries over large datasets, and store columns of data together, instead of rows.


Disruptive NoSQL DB Solution Providers
Distributed Databases
basho
DATASTAX
FOUNDATIONDB
NUODB
sqrrl
VIRTUEDESK CORP
Document -Oriented NoSQL DB
10gen mongoDB
Couchbase
MarkLogic
Graph NoSQL DB
FRANZ INC.
neotechnology value in relationships
Objectivity
YarcData
In-Memory NoSQL DB
AEROSPIKE
GridGain REAL TIME BIG DATA
STARCOUNTER
NoSQL DB Solutions, & Services
28 msec
ALTOROS SYSTEMS
GIGASPACES
ORACLE NOSQL DATABASE
Qubole

1.2 MongoDB Features & Advantages

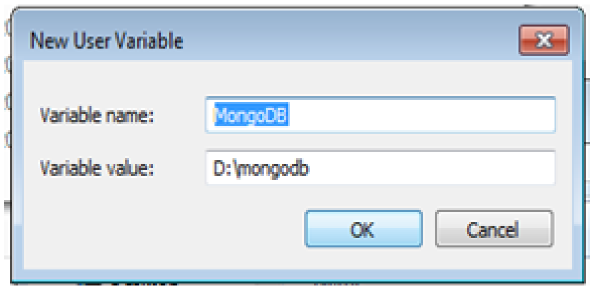
- **High Performance** : Indexes support faster queries
- **Rich Query Language**: supports CRUD Operation, Data Aggregation, Text Search &Geospatial Queries.
- **High Availability**: MongoDB’s replication facility, called replica set provide atomatic failover and Data redundancy.
- **Horizontal Scalability**: Sharding (partitioning) distributes data across a cluster of machines.

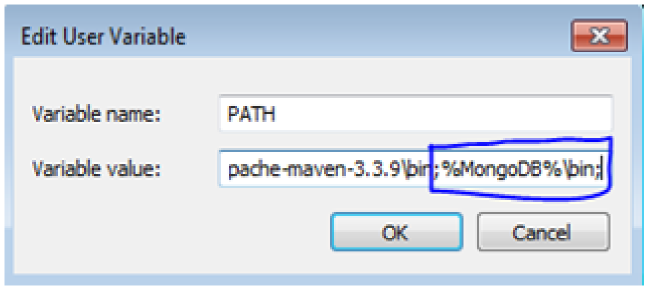
1.3 MongDB Installation & Configuration

The MongoDB does not require installation, just download and extracts the zip file, configure the data directory and start it with command "mongod".

- **Download** MongoDB and extract into some folder, ex: **d:/mongodb**

- Create following directories inside **d:/mongodb**
  - **D:\mongodb\data**
  - **D:\mongodb\log**
- Configure Environmnet variables `MongoDB = D:\mongodb  PATH=%MongoDB%\bin`



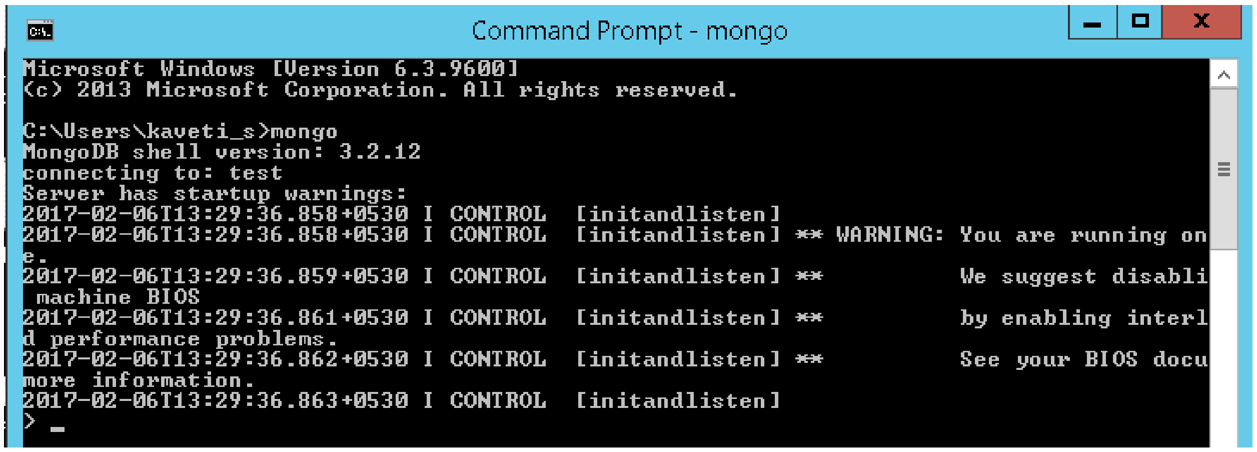


- Create a mongodb config file under : `d:\mongodb\mongo.config`

```
##store data here
dbpath=D:\mongodb\data

##all output go here
logpath=D:\mongodb\log\mongo.log

##log read and write operations
diaglog=3
```

- Start MongoDB using any of below commands
  - ➔ **D:\mongodb\bin>mongod –dbpath=D:/mongodb**
  - ➔ **d:\mongodb\bin>mongod.exe --config="D:\mongodb\mongo.config"**

- Connect to MongoDB using **mongo** command



```
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All rights reserved.

C:\Users\kaveti_s>mongo
MongoDB shell version: 3.2.12
connecting to: test
Server has startup warnings:
2017-02-06T13:29:36.858+0530 I CONTROL  [initandlisten]
2017-02-06T13:29:36.858+0530 I CONTROL  [initandlisten] ** WARNING: You are running on
e.
2017-02-06T13:29:36.859+0530 I CONTROL  [initandlisten] **          We suggest disabli
 machine BIOS
2017-02-06T13:29:36.861+0530 I CONTROL  [initandlisten] **          by enabling interl
d performance problems.
2017-02-06T13:29:36.862+0530 I CONTROL  [initandlisten] **          See your BIOS docu
more information.
2017-02-06T13:29:36.863+0530 I CONTROL  [initandlisten]
> _
```

To start MongoDB Service

```
net start MongoDB
```

To stop MongoDB Service

```
net stop MongoDB
```

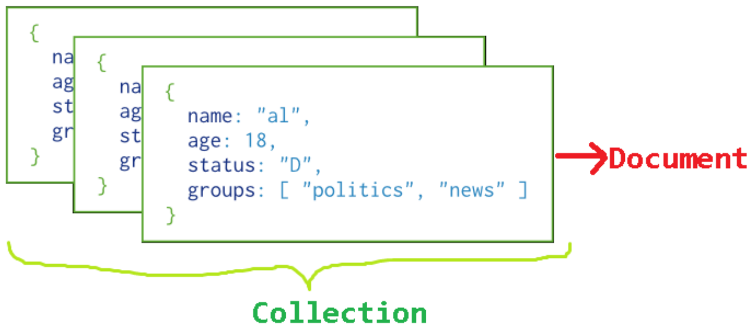
To remove MongoDB Service

```
c:\mongodb\bin>mongod --remove
```

2. MongoDB Operations

2.1 Database – Collection – Documents

- **Document**: is a single entry / record. i.e., **single row** in a table
- **Collection**: Group of Documents are known as Collection. i.e., **Table**
- **Database**: Group of Collections are known as **Database**



2.2 Database Operations

1. Show all Databases

Syntax: >show dbs

```
> show dbs
local      0.000GB
SatyaCodes  0.000GB
```

2. Create / Use Database

Syntax: use <database_name>

```
> use SatyaCodes
switched to db SatyaCodes
```

Here, your created database "SatyaCodes" is not present in the list, insert at least one document into it to display database

2. Check the currently selected database

Syntax: >db

```
> db
SatyaCodes
```

4. Drop Database

Syntax: >db.dropDatabase()

```
> db.dropDatabase()
{ "dropped" : "SatyaCodes", "ok" : 1 }
```

2.3 Collection Operations

Usually we don't need to create collection. MongoDB creates collection automatically when you insert some documents.

Example: Insert a document named "admin" into a collection named "users". The operation will create the collection if the collection does not currently exist

```
> db.users.insert({"username":"admin", "password":"Admin@123"})
WriteResult({ "nInserted" : 1 })
> show collections
users
```

We can also create collection by using **db.createCollection(name, options)**

1. Create Collection

Syntax: **db.createCollection(name, options)**

- **Name**: is a string type, specifies the name of the collection to be created.
- **Options**: is a document type, specifies the memory size and indexing of the collection. (optional)

```
> db.createCollection("books")
{ "ok" : 1 }
```

2.check the collections in the database

Syntax: **show collections()**

```
> show collections
books
users
```

3. Drop Collection

Syntax: db.<COLLECTION_NAME>.drop()

```
> db.books.drop();
true
> show collections
users
```

The drop command returns true if it successfully drops a collection. It returns false when there is no existing collection to drop.

2.4 Document Operations

Data Types	Description
String	String is the most commonly used datatype. It is used to store data
Integer	Integer is used to store the numeric value. It can be 32 bit or 64 bit depends on server
Boolean	This datatype is used to store boolean values. It just shows YES/NO values.
Double	Double datatype stores floating point values.
Min/Max Keys	This datatype compare a value against the lowest and highest bson elements.
Arrays	This datatype is used to store a list or multiple values into a single key.
Object	Object datatype is used for embedded documents.
Null	It is used to store null values.
Symbol	It is generally used for languages that use a specific type.
Date	This datatype stores the current date or time in unix time format

2.4.1 Insert Documents

MongoDB provides the following methods for inserting documents into a collection:

1. **db.collection.insert()**
2. **db.collection.insertOne()**
3. **db.collection.insertMany()**

If the collection does not currently exist, insert operations will create the collection.

_id Field: In MongoDB, each document stored in a collection requires a **unique _id field that acts as a primary key.** If an inserted document omits the _id field, the MongoDB driver automatically generates an ObjectId for the _id field.

1.db.collection.insert():

Inserts a single document or multiple documents into a collection. To insert a single document, pass a document to the method; to insert multiple documents, pass an array of documents to the method

```
db.users.insert(
   {
      username: "Satya",
      password: "Satya@134",
      age:27,
      status:"active"
   }
)
 WriteResult({ "nInserted" : 1 })
```

2.db.collection.insertOne()

Inserts a **single document** into a collection

```
> db.users.insertOne(
   {
      username: "SatyaCodes",
      password: "SatyaCodes@134",
      age:27,
      status:"active"
   }
)
{
        "acknowledged" : true,
        "insertedId" : ObjectId("58986791fb8a774546289da0")
}
```

3.db.collection.insertMany()

Inserts multiple documents into a collection.

```
db.users.insertMany(
   [
     { username:"Surya", password:"Password@1345", age: 42, status: "inactive", },
     { username:"Ravi",  password:"Password@1345", age: 22, status: "inactive", },
     { username:"Rakesh", password:"Password@1345", age: 34, status: "active", }
   ]
)
----
... )
{
        "acknowledged" : true,
        "insertedIds" : [
                ObjectId("589868c4fb8a774546289da1"),
                ObjectId("589868c4fb8a774546289da2"),
                ObjectId("589868c4fb8a774546289da3")
        ]
}
```

2.4.2 Query Documents (find Operations)

MongoDB provides the **db.collection.find()** method to read documents from a collection. The **db.collection.find()** method returns **a cursor** to the matching documents.

Syntax **> db.collection.find(<query filter>, <projection>)**

- **<query filter>:** a query filter to specify which documents to return.
- **< projection>:** which fields from the matching documents to return

1.Select All Documents in a Collection

An empty query filter document ({}) selects all documents in the collection

Syntax **> db.users.find({}) or db.users.find()**

```
> db.users.find({})
{ "_id" : ObjectId("58986156fb8a774546289d9e"), "username" : "admin", "password" : "Admin@123" }
{ "_id" : ObjectId("58986716fb8a774546289d9f"), "username" : "Satya", "password" : "Satya@134", "age" :
27, "status" : "active" }
{ "_id" : ObjectId("58986791fb8a774546289da0"), "username" : "SatyaCodes", "password" : "SatyaCodes@134",
"age" : 27, "status" : "active" }
{ "_id" : ObjectId("589868c4fb8a774546289da1"), "username" : "Surya", "password" : "Password@1345",
"age" : 42, "status" : "inactive" }
```

2.Select All Documents with Condition

```
> db.users.find( { status: "active" } )
{ "_id" : ObjectId("58986716fb8a774546289d9f"), "username" : "Satya", "password" : "Satya@134", "age" :
27, "status" : "active" }
{ "_id" : ObjectId("58986791fb8a774546289da0"), "username" : "SatyaCodes", "password" : "SatyaCodes@134",
"age" : 27, "status" : "active" }
{ "_id" : ObjectId("589868c4fb8a774546289da3"), "username" : "Rakesh", "password" : "Password@1345",
"age" : 34, "status" : "active" }
```

3.Select All Documents with AND Condition

We can specify the the no. of conditions by using **comma (,)** operator

Retrieves all documents where **status equals "active" and age is less than ($lt) 30:**

```
> db.users.find( { status: "active", age: { $lt: 30 } } )
{ "_id" : ObjectId("58986716fb8a774546289d9f"), "username" : "Satya", "password" : "Satya@134", "age" :
27, "status" : "active" }
{ "_id" : ObjectId("58986791fb8a774546289da0"), "username" : "SatyaCodes", "password" : "SatyaCodes@134",
"age" : 27, "status" : "active" }
```

4.Select All Documents with OR Condition

Using the **$or** operator, you can specify a compound query that joins each clause with a logical OR conjunction so that the query selects the documents in the collection that match at least one condition.

Retrieves all documents where the **status equals "inactive" or age is less than ($lt) 30:**

```
db.users.find(
   {
     $or: [ { status: "inactive" }, { age: { $lt: 30 } } ]
   }
)
-------
{ "_id" : ObjectId("58986716fb8a774546289d9f"), "username" : "Satya", "password" : "Satya@134", "age" :
27, "status" : "active" }
{ "_id" : ObjectId("589868c4fb8a774546289da1"), "username" : "Surya", "password" : "Password@1345",
"age" : 42, "status" : "inactive" }
```

For more related Query Documents visit **MongoDB Offcial website**

2.4.3 Update Documents

MongoDB provides the following methods for updating documents in a collection

1. **db.collection.update()**
2. **db.collection.updateOne()**
3. **db.collection.updateMany()**
4. **db.collection.replaceOne()**

Once set, you cannot update the value of the _id field nor can you replace an existing document with a replacement document that has a different _id field value.

1.db.collection.update()

Either updates or replaces a **single document** that match a specified filter **or updates all documents** that match a specified filter.

```
db.users.update(
   { "status": "inactive" },
   {
     $set: { "Level": 2}
   }
)
------
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
```

2.db.collection.updateOne()

Updates at most a single document that match a specified filter even though multiple documents may match the specified filter.

```
db.users.updateOne(
   { "username": "Surya" },
   {
     $set: { "password": "901290190", age: 20 }
   }
)
------
{ "acknowledged" : true, "matchedCount" : 1, "modifiedCount" : 1 }
```

3.db.collection.updateMany()

Update all documents that match a specified filter.

```
db.users.updateMany(
   { "status": "active" },
   {
     $set: { "Level": 1}
   }
)
----------
{ "acknowledged" : true, "matchedCount" : 6, "modifiedCount" : 6 }
```

4.db.collection.replaceOne()

Replaces at most a single document that match a specified filter even though multiple documents may match the specified filter.

2.4.4 Delete Documents

MongoDB provides the following methods to delete documents of a collection:

1. **db.collection.remove()**
2. **db.collection.deleteOne()**
3. **db.collection.deleteMany()**

Delete operations do not drop indexes, even if deleting all documents from a collection

1.db.collection.remove()

To remove all documents from the collection based on condition

```
> db.users.remove( { age: 27 } )
WriteResult({ "nRemoved" : 2 })
```

2.db.collection.deleteOne()

Delete at most a single document that match a specified filter,even though multiple documents may match

```
> db.users.deleteOne( { status: "active" } )
"acknowledged" : true, "deletedCount" : 1 }
```

3.db.collection.deleteMany()

To remove all documents from the collection based on condition

```
> db.users.deleteMany({ status : "inactive" })
 "acknowledged" : true, "deletedCount" : 5 }
```

The following methods can also delete documents from a collection:

- **db.collection.findOneAndDelete().**
- **findOneAndDelete()** provides a sort option. The option allows for the deletion of the first document sorted by the specified order.
- **db.collection.findOneAndModify().**
- **db.collection.findOneAndModify()** provides a sort option. The option allows for the deletion of the first document sorted by the specified order.
- **db.collection.bulkWrite().**

2.4.5 Advanced Operations

limit() To limit the records in MongoDB, you need to use **limit()** method

```
>db.COLLECTION_NAME.find().limit(NUMBER)
```

Skip() used to skip the number of documents.

```
>db.COLLECTION_NAME.find().limit(NUMBER).skip(NUMBER)
```

sort() specify sorting order. 1 is used for ascending order while -1 is used for descending order.

```
>db.COLLECTION_NAME.find().sort({KEY:1})
```

aggregate() aggregation in MongoDB, you should use aggregate() method.

```
>db.COLLECTION_NAME.aggregate(AGGREGATE_OPERATION)
AGGREGATE_OPERATION = $sum, $avg, $min, $max, $push, $addToSet, $first, $last
```

db.collection.save()

Updates an existing document or inserts a new document, depending on its document parameter.

```
db.products.save( { item: "book", qty: 40 } )
```

help() uses to guide you how to do things in MongoDB.

```
 db.help()                    help on db methods
 db.mycoll.help()             help on collection methods
 sh.help()                    sharding helpers
 rs.help()                    replica set helpers
 help admin                   administrative help
 help connect                 connecting to a db help
 help keys                    key shortcuts
 help misc                    misc things to know
 help mr                      mapreduce

 show dbs                     show database names
 show collections             show collections in current database
 show users                   show users in current database
 show profile                 show most recent system.profile entries time >= 1ms
 show logs                    show the accessible logger names
 show log [name]              prints out the last segment of log in memory,
 use <db_name>                set current database
 db.foo.find()                list objects in collection foo
 db.foo.find( { a : 1 } )     list objects in foo where a == 1
 it                           result of the last line evaluated; use to further iterate
 DBQuery.shellBatchSize = x   set default number of items to display on shell
 exit                         quit the mongo shell
```

3. MongoDB with Java

To use MongoDB in our Java programs, we need MongoDB JDBC driver. Follow the below steps to do so.

Steps to Connect with MongoDB Using Java

1.Create Java Project using Elipse Convet that into Maven Project

2. Download mongo-java driver from github. Or declare mongo-java driver in pom.xml

```
        <dependencies>
                <dependency>
                        <groupId>org.mongodb</groupId>
                        <artifactId>mongo-java-driver</artifactId>
                        <version>2.10.1</version>
                </dependency>
        </dependencies>
```

3. Write a Java class to connect with MongoDB & perform operations

```
package core;
import java.net.UnknownHostException;
import com.mongodb.DB;
import com.mongodb.DBCollection;
import com.mongodb.MongoClient;
import com.mongodb.MongoException;

public class MongoDBConnect {
        public static void main(String[] args) {
                try {
                        /**** Connect to MongoDB ****/
                        // Since 2.10.0, uses MongoClient
                        MongoClient mongo = new MongoClient("localhost", 27017);

                        /**** Get database ****/
                        // if database doesn't exists, MongoDB will create it for you
                        DB db = mongo.getDB("SatyaCodes");

                        /**** Get collection / table from 'testdb' ****/
                        // if collection doesn't exists, MongoDB will create it for you
                        DBCollection table = db.getCollection("user");

                        if (mongo != null) {
                System.out.println("============\n MongoDB Connected!!! \n===========");
                                System.out.println("Database Name : " + db.getName());
                                System.out.println("Collection : " + table.getName());
                        }

                } catch (UnknownHostException e) {
                        e.printStackTrace();
                } catch (MongoException e) {
                        e.printStackTrace();
                }
        }
}
```

```
Output
 MongoDB Connected!!!
===========
Database Name : SatyaCodes
Collection : user
```

3.1 MongoDB with Java

1.Mongo Connection

Connect to MongoDB server. For MongoDB version >= 2.10.0, uses MongoClient.

```
// Old version, uses Mongo
Mongo mongo = new Mongo("localhost", 27017);

// Since 2.10.0, uses MongoClient
MongoClient mongo = new MongoClient( "localhost" , 27017 );
```

2.Mongo Database

Get database. If the database doesn't exist, MongoDB will create it for you.

```
DB db = mongo.getDB("database name");
```

If MongoDB in secure mode, authentication is required

```
boolean auth = db.authenticate("username", "password".toCharArray());
```

Display all databases.

```
List<String> dbs = mongo.getDatabaseNames();
for(String db : dbs){
        System.out.println(db);
}
```

3.Mongo Collection

Get collection / table.

```
DB db = mongo.getDB("testdb");
DBCollection table = db.getCollection("user");
```

Display all collections from selected database.

```
DB db = mongo.getDB("testdb");
Set<String> tables = db.getCollectionNames();

for(String coll : tables){
        System.out.println(coll);
}
```

Steps to develop any MongoDB Application

1.Connect with MongoDB Server

```
MongoClient mongoClient = new MongoClient("localhost", 27017);
```

2.Connect with Database

```
DB db = mongoClient.getDB("SatyaCodes");
```

3.Get the Collection , on which collection you want to work

```
DBCollection collection = db.getCollection("users");
```

4.Get Document Object to perform CURD operaions on Document

```
BasicDBObject document = new BasicDBObject();
```

1. MongoDB Authenetication Example

Add user to SatyaCodes Collection for testing purpose

```
db.createUser(
                 {
                   user: "admin",
                   pwd: "admin",
                   roles: [
                      {role: "readWrite", db: "SatyaCodes"}
                           ]
                   }
            )
```

Example

```
import com.mongodb.DB;
import com.mongodb.MongoClient;

public class MongoDB_Authentication {
        public static void main(String args[]) {
                try {
                        // To connect to mongodb server
                        MongoClient mongoClient = new MongoClient("localhost", 27017);

                        // Now connect to your databases
                        DB db = mongoClient.getDB("SatyaCodes");
                        System.out.println("Connect to database successfully");
                        boolean auth = db.authenticate("admin", "admin".toCharArray());
                        System.out.println("Authentication: " + auth);

                } catch (Exception e) {
                        System.err.println(e.getClass().getName() + ": " + e.getMessage());
                }
        }
}
```

3.1.2 MongoDB Java Complete Example

```
package core;
import java.net.UnknownHostException;
import java.util.HashMap;
import java.util.Map;
import com.mongodb.BasicDBObject;
import com.mongodb.BasicDBObjectBuilder;
import com.mongodb.DB;
import com.mongodb.DBCollection;
import com.mongodb.DBCursor;
import com.mongodb.DBObject;
import com.mongodb.Mongo;
import com.mongodb.MongoException;
import com.mongodb.util.JSON;
public class MongoDB_Insert {
        public static void main(String[] args) {

                try {

                        Mongo mongo = new Mongo("localhost", 27017);
                        DB db = mongo.getDB("SatyaCodes");

                        DBCollection collection = db.getCollection("users");
                        collection.remove(new BasicDBObject());

                        // 1. BasicDBObject example
                        System.out.println("1.BasicDBObject example...");
                        System.out.println("===========================");
                        BasicDBObject document = new BasicDBObject();
                        document.put("username", "satyajohnny");
                        document.put("password", "password254");

                        BasicDBObject documentDetail = new BasicDBObject();
                        documentDetail.put("street", "RAMALAYAM");
                        documentDetail.put("city", "VIJAYAWADA");
                        documentDetail.put("state", "ANDHRA PRADESH");
                        document.put("address", documentDetail);
                        collection.insert(document);

                        DBCursor cursorDoc = collection.find();
                        while (cursorDoc.hasNext()) {
                                System.out.println(cursorDoc.next());
                        }
                        collection.remove(new BasicDBObject());

                        // 2. BasicDBObjectBuilder example
                        System.out.println("\n\n 2.BasicDBObjectBuilder Insert");
                        System.out.println("===========================");
                        BasicDBObjectBuilder documentBuilder = BasicDBObjectBuilder.start()
                                         .add("username", "Anil")
                                         .add("password",       "Anigirekula123");

                        BasicDBObjectBuilder documentBuilderDetail = BasicDBObjectBuilder.start()
                                .add("street", "NTR STREET")
                                        .add("city", "HYDERABAD").add("state", "TN");
                        documentBuilder.add("detail", documentBuilderDetail.get());
                        collection.insert(documentBuilder.get());

                        DBCursor cursorDocBuilder = collection.find();
                        while (cursorDocBuilder.hasNext()) {
                                System.out.println(cursorDocBuilder.next());
                        }
                        collection.remove(new BasicDBObject());

                        // 3. Map example
                        System.out.println("\n\n 3.MAP Insert");
                        System.out.println("===========================");
                        Map<String, Object> documentMap = new HashMap<String, Object>();
                        documentMap.put("username", "mapuser");
                        documentMap.put("password", "mapassword");

                        Map<String, Object> documentMapDetail = new HashMap<String, Object>();
                        documentMapDetail.put("street", "JAMES STREET");
                        documentMapDetail.put("city", "GEORGIO");
                        documentMapDetail.put("state", "U.S");
                        documentMap.put("detail", documentMapDetail);
                        collection.insert(new BasicDBObject(documentMap));

                        DBCursor cursorDocMap = collection.find();
                        while (cursorDocMap.hasNext()) {
                                System.out.println(cursorDocMap.next());
                        }
                        collection.remove(new BasicDBObject());

                        // 4. JSON parse example
                        System.out.println("\n\n 4.JSON Insert");
                        System.out.println("===========================");

        String json = "{'username' : 'jsonuser','password' : 'JsonPass',"
        + "'detail' : {'street' : 'FIGHTCLUB STREET', 'city' : 'MELBORN', 'state' : 'AUS'}}}";

                        DBObject dbObject = (DBObject) JSON.parse(json);
                        collection.insert(dbObject);

                        DBCursor cursorDocJSON = collection.find();
                        while (cursorDocJSON.hasNext()) {
                                System.out.println(cursorDocJSON.next());
                        }
                        collection.remove(new BasicDBObject());

                } catch (UnknownHostException e) {
                        e.printStackTrace();
                } catch (MongoException e) {
                        e.printStackTrace();
                }

        }
```

```
}
```

```
//Output
1.BasicDBObject example...
===========================
{ "_id" : { "$oid" : "589b07a32989f6de61c17c09"} , "username" : "satyajohnny" , "password" :
"password254" , "address" : { "street" : "RAMALAYAM" , "city" : "VIJAYAWADA" , "state" : "ANDHRA
PRADESH"}}


 2.BasicDBObjectBuilder Insert
===========================
{ "_id" : { "$oid" : "589b07a32989f6de61c17c0a"} , "username" : "Anil" , "password" :
"Anigirekula123" , "detail" : { "street" : "NTR STREET" , "city" : "HYDERABAD" , "state" : "TN"}}


 3.MAP Insert
===========================
{ "_id" : { "$oid" : "589b07a32989f6de61c17c0b"} , "password" : "mapassword" , "detail" : { "city"
: "GEORGIO" , "street" : "JAMES STREET" , "state" : "U.S"} , "username" : "mapuser"}


 4.JSON Insert
===========================
{ "_id" : { "$oid" : "589b07a32989f6de61c17c0c"} , "username" : "jsonuser" , "password" :
"JsonPass" , "detail" : { "street" : "FIGHTCLUB STREET" , "city" : "MELBORN" , "state" : "AUS"}}
```

In above we are removing inserted Object for display purpose only

```
collection.remove(new BasicDBObject());
```

Similarly we can perform CURD operations using below methods in the same way

Update Operation

Update a document where "username"="satya" to SatyaKaveti.

```
DBCollection table = db.getCollection("user");

BasicDBObject query = new BasicDBObject();
query.put("username", "satya");

BasicDBObject newDocument = new BasicDBObject();
newDocument.put("username", "SatyaKaveti");

BasicDBObject updateObj = new BasicDBObject();
updateObj.put("$set", newDocument);

table.update(query, updateObj);
```

Find/Query/Search Operation

Find document where "username =satya", and display it with DBCursor

```
DBCollection table = db.getCollection("user");

BasicDBObject searchQuery = new BasicDBObject();
searchQuery.put("username ", " satya ");

DBCursor cursor = table.find(searchQuery);
```

```java
while (cursor.hasNext()) {
       System.out.println(cursor.next());
}
```

Delete Operation

Find document where "username =satya", and delete it.

```java
DBCollection table = db.getCollection("user");

BasicDBObject searchQuery = new BasicDBObject();
searchQuery.put("username ", " satya ");

table.remove(searchQuery);
```

References

http://www.javatpoint.com/mongodb-tutorial

https://docs.mongodb.com/v3.2/tutorial/

http://www.mkyong.com/tutorials/java-mongodb-tutorials/

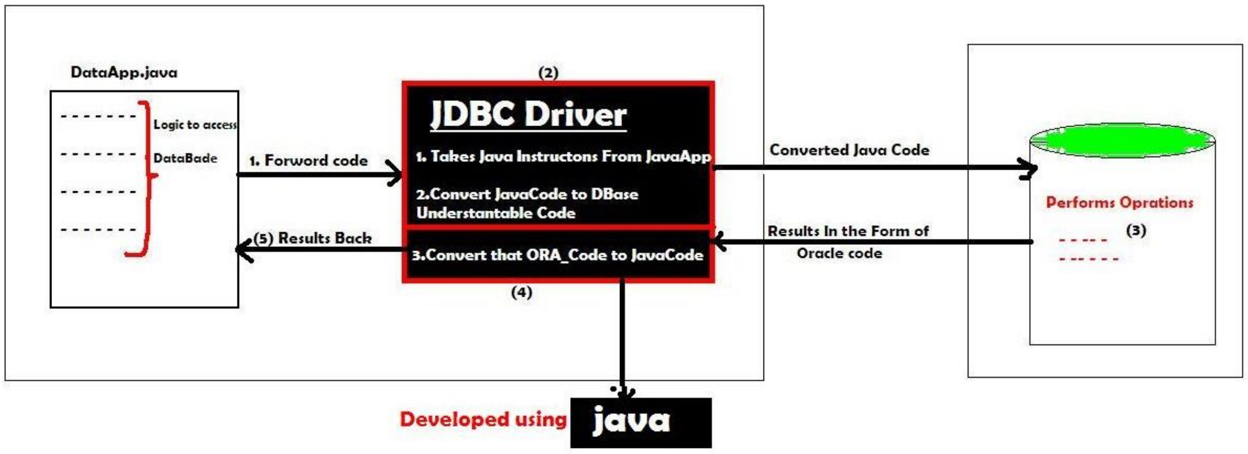
https://www.tutorialspoint.com/mongodb/mongodb_environment.htm

2. JDBC

2.1 Introduction

Before JDBC, ODBC API was the database API to connect and execute query with the database. But, ODBC API uses ODBC driver which is written in C language (i.e. platform dependent and unsecured).

That is why Java has defined its own API (JDBC API) that uses JDBC drivers (writtn in Java).

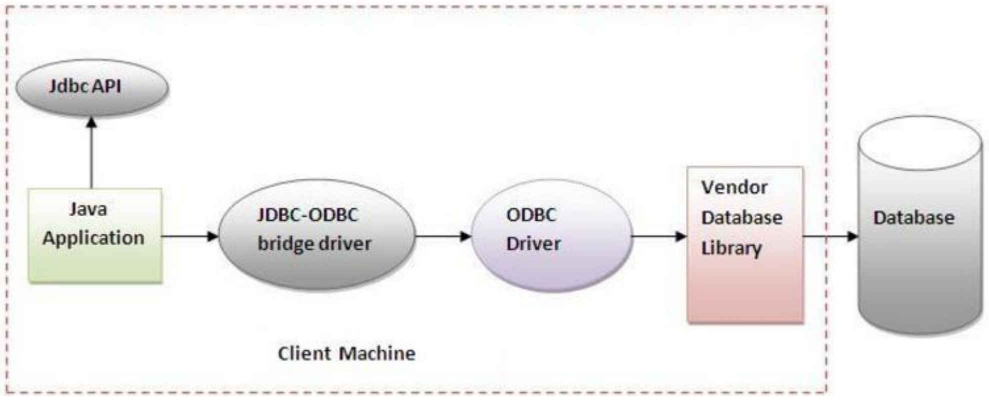

DataApp.java
Logic to access DataBade
(2)
JDBC Driver
1. Forword code
1. Takes Java Instructons From JavaApp
2.Convert JavaCode to DBase Understantable Code
3.Convert that ORA_Code to JavaCode
(5) Results Back
(4)
Converted Java Code
Results In the Form of Oracle code
Performs Oprations
(3)
Developed using java

There are 4 types of JDBC drivers:

1.	**JDBC-ODBC bridge driver**	
2.	**Native-API driver**	**(partially java driver)**
3.	**Network Protocol driver**	**(fully java driver)**
4.	**Thin driver**	**(fully java driver)**

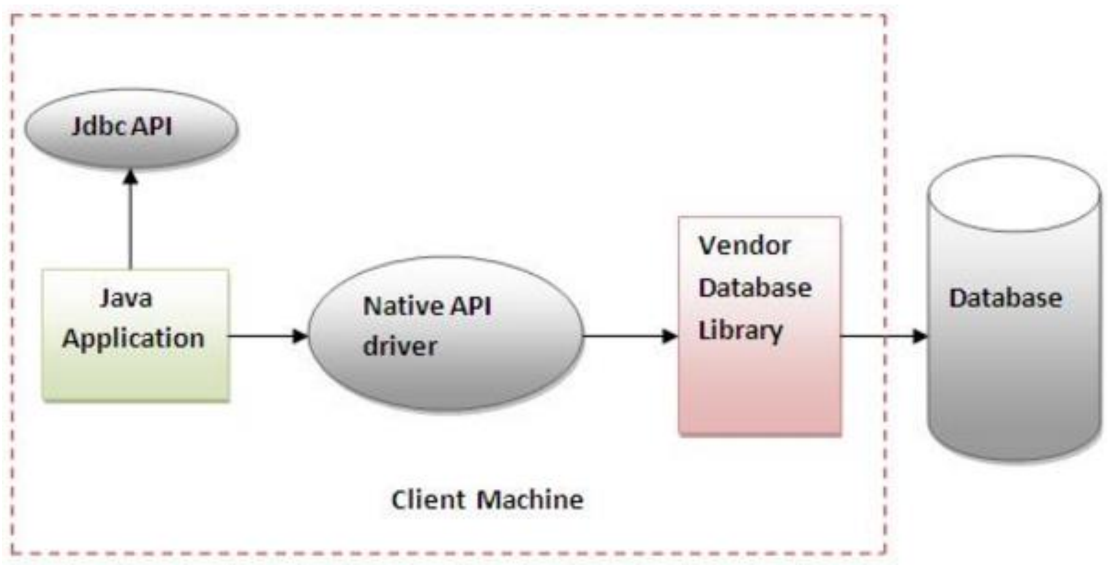
<u>1. JDBC-ODBC bridge driver (Type-1)</u>

- The JDBC-ODBC bridge driver uses **ODBC driver to connect to the database.**
- The JDBC-ODBC bridge driver converts JDBC method calls into the ODBC function calls.
- Can be easily connected to **ANY database.**
- Performance degraded because **JDBC method call is converted into the ODBC calls**
- **ODBC driver needs** to be installed on the **client machine**
- Sun provided ODBC driver name : **sun.jdbc.odbc.JdbcOdbcDriver**



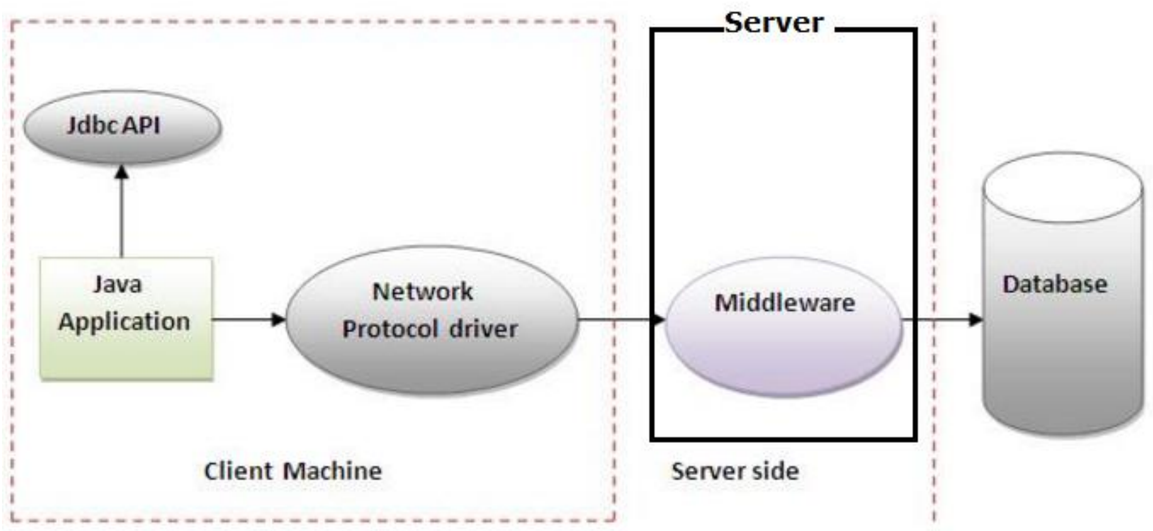
<u>2. Native API driver (Type-1)</u>

- The Native API driver uses the client-side libraries of the database.
- For **MySQL they have own Native API Driver, similarly for ORACLE, Postgres etc,**
- The driver converts JDBC (Java) method calls into native calls (MySQL, Oracle) of the database API.
- It is **NOT FULLY written entirely in java**
- The Native driver needs to be installed on the each client machine.



3. Network Protocol driver (Type-3)

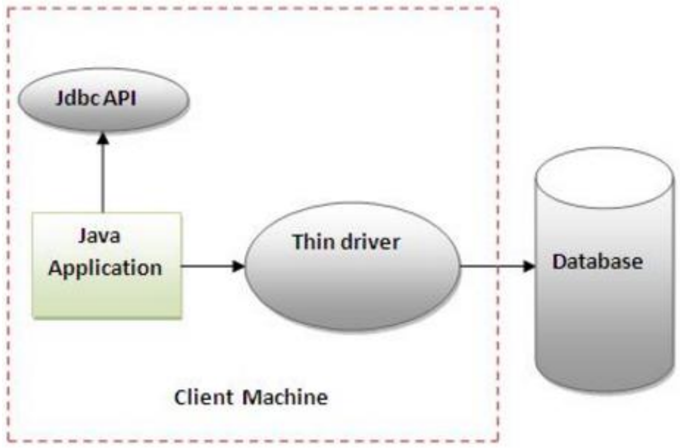
- The Network Protocol driver uses middleware (application server) that converts JDBC calls directly or indirectly into the vendor-specific database protocol.
- It is fully written in java.
- Used in **Connection Pooling**
- **Network support is required on client machine.**
- Maintenance of Network Protocol driver becomes costly because it requires database-specific coding to be done in the middle tier.



4. Thin driver (Type -4)

- The thin driver converts JDBC calls directly into the vendor-specific database protocol.
- It is **fully written in Java language**
- Better performance than all other drivers.
- **No software is required at client side or server side**.

- **com.mysql.jdbc.Driver** (MySQL), **oracle.jdbc.driver.OracleDriver**(ORACLE)



Steps to connect to the database

There are 5 steps to connect...

1. **Register the driver class**

   Class.forName ("oracle.jdbc.driver.OracleDriver");

2. **Creating connection**

   Connection con=DriverManager.getConnection ("url","system","password");

   Connection con=DriverManager.getConnection ("url "); //2nd Way

3. **Creating statement**

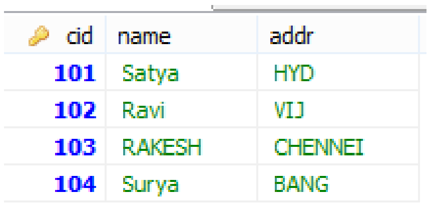
   Statement stmt=con.createStatement ();

4. **Executing queries**

   ResultSet rs=stmt.executeQuery("select * from emp");

5. **Closing connection**

   con.close();



cid	name	addr
101	Satya	HYD
102	Ravi	VIJ
103	RAKESH	CHENNEI
104	Surya	BANG

Table Data

```
101   Satya          HYD
102   Ravi           VIJ
103   RAKESH         CHENNEI
104   Surya          BANG
```

Output Data

```
public class JDBC {
     public static void main(String[] args) throws Exception {
            Class.forName("com.mysql.jdbc.Driver");
            Connection con = DriverManager.getConnection
                    ("jdbc:mysql://localhost:3306/mydb", "root", "123456");

            Statement stmt = con.createStatement();
            ResultSet rs = stmt.executeQuery("SELECT * FROM customer");
            while (rs.next())
System.out.println(rs.getInt(1)+":"+rs.getString(2)+ "   " +
rs.getString(3));
            con.close();
     }
   }
```

In above Example we use getConnection("URL","UNAME","PWD") to connect with database.we can use directly without giving username/pwd also

There are two ways to connect java application with the access database.

- **Without DSN (Data Source Name) → above**
- **With DSN** → jdbc:odbc:mydsn (mydsn is DSN)

Creating DSN

Start > Administrative Tools > Data Sources (ODBC). →Add → (.mdb)

2.2 DriverManager class

- The DriverManager class acts as an interface between user and drivers
- It keeps track of the drivers that are available and handles establishing a connection between a database and the appropriate driver.
- The DriverManager class maintains a list of Driver classes that have registered themselves by calling the method **DriverManager.registerDriver().**

Methods

1) **public static void registerDriver(Driver driver):**
2) **public static void deregisterDriver(Driver driver):**
3) **public static Connection getConnection(String url):**
4) **public static Connection getConnection(String url,String uname,String pwd)**

2.3 Connection interface

A Connection is the session between java application and database. The Connection interface is a factory of Statement, PreparedStatement, and DatabaseMetaData i.e.

- **Statement createStatement()**
- **PreparedStatement prepareStatement(String sql)**
- **CallableStatement prepareCall(String sql)**
- **Blob createBlob()**
- **Clob createClob()**
- **String getSchema()**
- **DatabaseMetaData getMetaData()**

- **void close()**
- **void commit()**
- **void rollback()**
- **void setAutoCommit(boolean autoCommit)**
- **boolean getAutoCommit()**

All above statement related methods can have

- **ResultSet.TYPE_SCROLL_SENSITIVE**→ used to move ResultSet Both Directions
- **ResultSet.CONCUR_UPDATABLE** → used to perform DML operations on ResultSet

2.4 Statement interface

- The Statement interface provides methods to execute queries with the database.
- The statement interface is a factory of ResultSet
- it provides factory method to get the object of ResultSet

- **public ResultSet executeQuery(String sql):**
  Is used to execute **SELECT query**. It returns the object of ResultSet.
- **public int executeUpdate(String sql):**
  Is used to execute DML, **CREATE, DROP, INSERT, UPDATE, DELETE** etc.
- **public boolean execute(String sql):**
  Is used to execute queries that may return multiple results. **>1** if success, **0** on fail
- **public int[] executeBatch():**
  Is used to execute batch of commands.

2.5 ResultSet interface

- The object of ResultSet maintains a cursor pointing to a row of a table.
- Initially, cursor points to before the first row.
- By default, ResultSet object can be **moved forward only** and it **is not updatable**.
  - **public XXX getXXX(int rowIndex):**
  - **public XXX getXXX(String rowName):**
  - public boolean next()
  - public boolean previous()
  - public boolean first()
  - public boolean last()

executeQuery (String sql) example

We use this method to execute SELECT queries

```
public class JDBC {
	public static void main(String[] args) throws Exception {
		Class.forName("com.mysql.jdbc.Driver");
		Connection con = DriverManager.getConnection
("jdbc:mysql://localhost:3306/mydb", "root", "123456");

		Statement stmt = con.createStatement();
		ResultSet rs = stmt.executeQuery("SELECT * FROM customer");
		while (rs.next()) {
System.out.println(rs.getInt(1)+""+rs.getString(2)+" "+ rs.getString(3));
		}
		con.close();
	}
}
```

```
101  Satya  HYD
102  Ravi  VIJ
103  RAKESH  CHENNEI
104  Surya  BANG
```

executeUpdate (String sql) example

We use this method to **NON-SELECT** Queries like UPDATE, DELETE, etc

Returns 1 if → success

Returns 0 if → Failure

```
public class JDBC {
	public static void main(String[] args) throws Exception {
		String url = "jdbc:mysql://localhost:3306/mydb";
		Class.forName("com.mysql.jdbc.Driver");
	Connection con = DriverManager.getConnection(url, "root", "123456");
		Statement stmt = con.createStatement();

	String qry = "UPDATE `customer` SET `name`='Ram' WHERE  `cid`=102";
		int res = stmt.executeUpdate(qry);
		if (res > 0)
			System.out.println("Success is :" + res);
		else
			System.out.println("Failure is :" + res);
		con.close();
	}
}
```

```
Success is :1
Failure is :0
```

Boolean execute example

We can use **execute()** method in **both SELECT & NON-SELECT queries.**

1. SELECT

It returns TRUE on SELECT queres we can get ResultSet by calling below method

ResultSet rs = statement.getResultSet ()

2. NON-SELECT

It returns FALSE on NON-SELECT queres. we can get **Int** value by calling below method

int i = statement.getUpdateCount();

```
public class JDBC {
	public static void main(String[] args) throws Exception {
	String url = "jdbc:mysql://localhost:3306/mydb";
	Class.forName("com.mysql.jdbc.Driver");
	Connection con = DriverManager.getConnection(url, "root", "123456");
	Statement stmt = con.createStatement();

	// String qry = "SELECT * FROM customer";
	String qry = "UPDATE `customer` SET `name`='Ram' WHERE `cid`=102";

		boolean flag = stmt.execute(qry);
		if (flag == true) {
			System.out.println("SELECT QUERY\n --------");
			ResultSet rs = stmt.getResultSet();
			while (rs.next()) {
		System.out.println(rs.getString(1) + ":" + rs.getString(2));
			}
		}
		else {
			System.out.println("NON-SELECT QUERY\n --------");
			int i = stmt.getUpdateCount();
			System.out.println("Result is : " + i);
		}
	}
}
```

```
SELECT QUERY
 --------
101:Satya
102:Ram
103:RAKESH
104:Surya

NON-SELECT QUERY
 --------
Result is : 1
```

executeBatch(String sql) example

```
public class BatchDemo {
	public static void main(String[] args) throws Exception {
```

```
          String url = "jdbc:mysql://localhost:3306/mydb";
          Class.forName("com.mysql.jdbc.Driver");
      Connection con = DriverManager.getConnection(url, "root", "123456");

          Statement st = con.createStatement();
          st.addBatch("insert into  student   values(81, 'Syam', 'mtm')");
          st.addBatch("insert into  student   values(11, 'ram', 'mum')");
          st.addBatch("insert into  student   values(14, 'bam', 'kuk')");
          st.addBatch("insert into  student   values(44, 'pram', 'secu')");

          int rs[] = st.executeBatch();
          int sum = 0;
          for (int i = 0; i < rs.length; i++) {
                sum = sum + i;
          }
          System.out.println(sum + "Record are UPDATED using BATCH");
      }
}
```

Scrollabe Resultset(String sql) example

By Default ResultSet Object is not SCROLLABLE & NOT UPDATABLE.to make ResultSet Object to move both Directions we need to configure TYPE & MODE Values

Possible TYPE Values

▪ **ResultSet.TYPE_SCROLL_SENSITIVE**	→ **(Update Possible)**
▪ **ResultSet.TYPE_SCROLL_INSENSITIVE**	→ **(Default)**

Possible MODE Values

▪ **ResultSet.CONCUR_READ_ONLY**	→ **(Update Possible)**
▪ **ResultSet.CONCUR_UPDATABLE**	→ **(Default)**

Methods applicable on Scrolable ResultSet Object

- **int getRow()** → Returns ROW INDEX
- **boolean first()** → Keep CURSOR at 1st Record
- **boolean last()** → Keep CURSOR at LAST Record
- **boolean next()** → Moves Cursor to Forward
- **boolean previous()** → Moves Cursor to Backword
- **boolean absolute(int +/-)**→ Moves Cursor to given Index on ResultSet
- **boolean relative**(int +/-)→ Moves Cursor to given Index, based on current Row

```
public class JDBC {
      public static void main(String[] args) throws Exception {
      String url = "jdbc:mysql://localhost:3306/mydb";
      Class.forName("com.mysql.jdbc.Driver");
```

```
	Connection con = DriverManager.getConnection(url, "root", "123456");
	Statement st = con.createStatement
	         (ResultSet.TYPE_SCROLL_SENSITIVE, ResultSet.CONCUR_READ_ONLY);

	ResultSet rs = st.executeQuery("select * from customer");
	                 System.out.println("From Using Next\n------");

		while (rs.next()) {
			System.out.println(rs.getString(1)+":"+rs.getString(2));
		}

		System.out.println("\nFrom Using Previous ");
		while (rs.previous()) {
			System.out.println(rs.getString(1)+":"+rs.getString(2));
		}

		System.out.println("randomly.................. ");

rs.first();
System.out.println(rs.getRow()+"First:"+rs.getString(1)+":"+rs.getString(2));


rs.last();
System.out.println(rs.getRow()+"Last: "+rs.getString(1)+":"+rs.getString(2));

rs.absolute(4);//from starting point to 4 records
System.out.println(rs.getRow()+"Absolute:"+rs.getString(1)+":"+rs.getString(2
));

rs.relative(-2); //from here to 2 points back
System.out.println(rs.getRow()+"relative:"+rs.getString(1)+":"+rs.getString(2
));
	}
}
```

```
From Using Next
------
101:Satya
102:Ram
103:RAKESH
104:Surya

From Using Previous
104:Surya
103:RAKESH
102:Ram
101:Satya
randomly..................
1First: 101:Satya
4Last: 104:Surya
4Absolute Record : 104:Surya
2relative Record : 102:Ram
```

In above example we used on for SCROLLING resultset on both ditections using `ResultSet.TYPE_SCROLL_SENSITIVE, ResultSet.CONCUR_READ_ONLY.`

If we want perform UPDATE operations & SCROLLING also, we have to use ResultSet.TYPE_`SCROLL_SENSITIVE, ResultSet.CONCUR_UPDATABLE`

Steps to Perform Insert/ UPDATE /Delete Operations on ResultSet

1. Select the Records

```
while (rs.next())
{
    System.out.println(rs.getRow()+””+rs.getString(1)+","+ rs.getString(2));
}
```

2. Perform INSERT Operation

```
            System.out.println("1.INSERT OPERATION\n-----");
            rs.moveToInsertRow(); // creates Empty Record
            rs.updateInt(1, 200);
            rs.updateString(2, "SACHIN");
            rs.updateString(3, "MUMBAI");
            rs.insertRow(); // Inserts Row
```

3. Perform UPDATE Operation

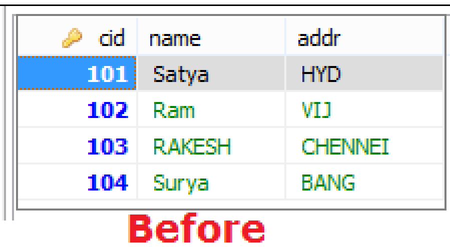
```
            System.out.println("\n2.UPDATE OPERATION\n-----");
            rs.absolute(2); // move to row to update
            rs.updateString(3, "KOLKATA");
            rs.updateRow();
```

4. Perform DELETE Operation

```
            System.out.println("\n3.DELTE OPERATION\n-----");
            rs.absolute(1); // move to row to DELETE
            rs.deleteRow();
```

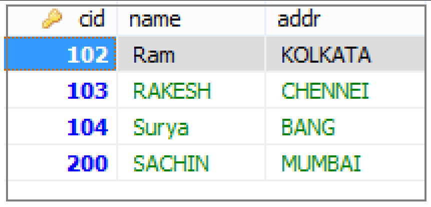
Example

```
public class JDBC {
      public static void main(String[] args) throws Exception {
            String url = "jdbc:mysql://localhost:3306/mydb";
            Class.forName("com.mysql.jdbc.Driver");
            Connection con = DriverManager.getConnection(url, "root",
"123456");
            Statement st = con.createStatement
            ResultSet.TYPE_SCROLL_SENSITIVE, ResultSet.CONCUR_UPDATABLE);
            ResultSet rs = st.executeQuery("select * from customer");

            while (rs.next()) {
            System.out.println(rs.getRow() + "->" + rs.getString(1) + "," +
rs.getString(2));
            }

            System.out.println("1.INSERT OPERATION\n-----");
            rs.moveToInsertRow(); // creates Empty Record
            rs.updateInt(1, 200);
            rs.updateString(2, "SACHIN");
            rs.updateString(3, "MUMBAI");
            rs.insertRow(); // Inserts Row

            System.out.println("\n2.UPDATE OPERATION\n-----");
            rs.absolute(2); // move to row to update
            rs.updateString(3, "KOLKATA");
            rs.updateRow();

            System.out.println("\n3.DELTE OPERATION\n-----");
            rs.absolute(1); // move to row to DELETE
            rs.deleteRow();
      }
}
```



cid	name	addr
101	Satya	HYD
102	Ram	VIJ
103	RAKESH	CHENNEI
104	Surya	BANG

Before



cid	name	addr
102	Ram	KOLKATA
103	RAKESH	CHENNEI
104	Surya	BANG
200	SACHIN	MUMBAI

After

200 - Inserted

102 - Updated

101 - Deleted

2.6 PreparedStatement

The PreparedStatement interface is a sub interface of Statement. It is used to execute parameterized query.The performance of the application will be faster if you use PreparedStatement interface because query is compiled only once.

```
String sql="insert into emp values(?,?,?)";
```

(?) values will be set by calling the setter methods of PreparedStatement.

Method	Description
public void setInt(int index,int value)	sets integer value to the given parameter index.
public void setString(int index, String val)	sets String value to the given parameter index.
public void setFloat(int index, float value)	sets float value to the given parameter index.
public void setDouble(int index, double val)	sets double value to the given parameter index.
public int executeUpdate()	Uses for create, drop, insert, update, delete queries
public ResultSet executeQuery()	Executes the select query.
Boolean execute()	It returns TRUE for SELECT queries, FALSE for update, delete Queries
void addBatch()	
ParameterMetaData getParameterMetaData()	Retrieves the number, types and properties of this PreparedStatement object's parameters
ResultSetMetaData getMetaData()	contains information about the columns of the ResultSet object
void setBlob(int index, Blob x) **void setBlob(int index,InputStream is)** **void setBinaryStream(int i,InputStream is)** **getBinarayStream("column");**	Inserts Binary Large Object Videos,Audios

void setClob(int index, Clob x) **void setClob(int index, Reader reader)** **getCharacterStream("column");**	Inserts character Large Object Files

java.sql.Statement	**java.sql.PreparedStatement**
Statement is used for executing a static SQL statement in java JDBC.	PreparedStatement is used for executing a precompiled SQL statement in java JDBC.
java.sql.Statement cannot accept parameters at runtime in java JDBC.	java.sql.PreparedStatement can be executed repeatedly, it can accept different parameters at runtime in java JDBC.
java.sql.Statement is slower as compared to PreparedStatement in java JDBC.	java.sql.PreparedStatement is faster because it is used for executing precompiled SQL statement in java JDBC.

```
public class JDBC {
      public static void main(String[] args) throws Exception {
            String url = "jdbc:mysql://localhost:3306/mydb";
            String u = "root";
            String p = "123456";
            PreparedStatement ps=null;
            Class.forName("com.mysql.jdbc.Driver");
            Connection con = DriverManager.getConnection(url, u, p);

        ps = con.prepareStatement("insert into customer values(?,?,?)");
            ps.setInt(1, 143);
            ps.setString(2, "sri");
            ps.setString(3, "mum");
            int res = ps.executeUpdate();
            System.out.println("Result     :     " + res);

        ps =con.prepareStatement("SELECT * FROM  customer c WHERE c.cid<? ");
            ps.setInt(1, 200);
            ResultSet rs = ps.executeQuery();
            while (rs.next()) {
                  System.out.println(rs.getString(2));
            }
      }
}
```

```
Result      :     1
Ram
RAKESH
Surya
sri
```

2.7 BLOB (BinaryLarge Obejects)

We use BLOB objects to store binary data like images, videos etc

We have following methods to Save & Retrive BLOB Objects

To Save

- **void setBinaryStream(int parameterIndex, InputStream x)**
- **void setBinaryStream(int parameterIndex, InputStream x, int length)**
- **void setBlob(int index, Blob x)**
- **void setBlob(int index,InputStream is)**

To Retrive

- **Blob getBlob(int columnIndex)**
- **Blob getBlob(String columnLabel)**
- **InputStream getBinaryStream(int columnIndex)**
- **InputStream getBinaryStream(String column)**

Steps:

1. **Read Image/ video data by using InputStream**

   FileInputStream fis=**new** FileInputStream("d:\\g.jpg");

2. **Create PreparedStatement Object to write insert image query**

   PreparedStatement ps=con.prepareStatement("insert into imgtable values(?,?)");

3. **Set parameter values**

   ps.setInt(1, 101);

   ps.setBinaryStream(2,fis);

4. **Execute Query**

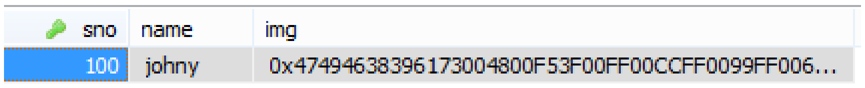
   int i=ps.executeUpdate();

5. To get image from table→ execute Select Quey , call on rs object

   FileInputSteam fs= rs.getBinarayStream("column");

6. Choose Location to Store new Image

   ```
   FileOutputStream fos = new FileOutputStream("res/newpict.gif");
   ```



sno	name	img
100	johny	0x47494638396173004800F53F00FF00CCFF0099FF006...

Example BlobInsert Operation

```
public class BlobInsert {
      public static void main(String[] args) throws Exception {
            String url = "jdbc:mysql://localhost:3306/mydb";
            String u = "root";
            String p = "123456";
            Class.forName("com.mysql.jdbc.Driver");
            Connection con = DriverManager.getConnection(url, u, p);
```

```
PreparedStatement ps = con.prepareStatement("insert into blobtest
values(?,?,?)");

            File f = new File("res/img.gif");
            FileInputStream fis = new FileInputStream(f);

            ps.setInt(1, 100);
            ps.setString(2, "johny");
            ps.setBinaryStream(3, fis, (int) f.length());
            ps.executeUpdate();
            System.out.println("Record is Inserted");
      }
}
```

Example BlobInsert Operation

```
public class BlobRetrive {
      public static void main(String[] args) throws Exception {
            String url = "jdbc:mysql://localhost:3306/mydb";
            String u = "root";
            String p = "123456";
            Class.forName("com.mysql.jdbc.Driver");
            Connection con = DriverManager.getConnection(url, u, p);
            Statement st = con.createStatement();
            ResultSet rs = st.executeQuery("select * from blobtest");

            if (rs.next()) {
                  InputStream in = rs.getBinaryStream("img");
            FileOutputStream fos = new FileOutputStream("res/newpict.gif");

                  int bytesRead = 0;
                  byte[] buffer = new byte[4096];
                  while ((bytesRead = in.read(buffer)) != -1) {
                        fos.write(buffer, 0, bytesRead);
                  }
                  System.out.println("photo is stored in newpict.gif");
                  fos.close();
                  in.close();
                  rs.close();
                  st.close();
                  con.close();
            } // if
      }// main
}// class
```

2.8 CLOB

We use CLOB objects to store character data like txt files,word files etc

We have following methods to Save & Retrive CLOB Objects

To Save

- **void setCharacterStream(int parameterIndex, InputStream x)**

- **void setCharacterStream(int parameterIndex, InputStream x, int length)**
- **void setClob(int index, Clob x)**
- **void setClob(int index,InputStream is)**

To Retrive

- **Blob getClob(int columnIndex)**
- **Blob getClob(String columnLabel)**
- **InputStream getCharacterStream (int columnIndex)**
- **InputStream getCharacterStream (String column)**

Steps:

1. **Read File data by using InputStream**

   FileInputStream fis=**new** FileInputStream("d:\\g.jpg");

2. **Create PreparedStatement Object to write insert image query**

   PreparedStatement ps=con.prepareStatement("insert into filetable values(?,?)");

3. **Set parameter values**

   ps.setInt(1, 101);

   ps.setCharacterStream (2,fis);

4. **Execute Query**

   int i=ps.executeUpdate();

5. To get image from table➔ execute Select Quey , call on rs object

   FileInputSteam fs= rs. getCharacterStream (“column”);

2.9 CallableStatement

CallableStatement interface is used to call the **stored procedures and functions**.

We can have business logic on the database by the use of stored procedures and functions that will make the performance better because these are precompiled.

Suppose you need the get the age of the employee based on the date of birth, you may create a function that receives date as the input and returns age of the employee as the output.

Stored Procedure	**Function**
is used to perform business logic.	is used to perform calculation.
must not have the return type.	must have the return type.
may return 0 or more values.	may return only one values.
We can call functions from the procedure.	Procedure cannot be called from function.
It supports input and output parameters.	Function supports only input parameter.
Exception handling using try/catch block can be used in stored procedures.	Exception handling using try/catch can't be used in user defined functions.

We use following method on Connection object to get CallableStatement Object

```
public CallableStatement prepareCall("{ call procedurename(?,?...?)}");

CallableStatement cs=con.prepareCall("{call myprocedure(?,?)}");
```

Example procedeure

```
create or replace function sum (n1 in number,n2 in number)
return number
is
temp number(8);
    begin
        temp :=n1+n2;
   return temp;
end;
/
```

In above example n1, n2 are Input Paramaters & temp is the Output parameter

To set Input Paramaters we use setXXX(int index, Value) methods

```
cs.setInt(1, 10);
cs.setInt(2, 20);
```

To set Output Paramaters we use registerOutParameter(int index, Type.TYPE) method

cs.registerOutParameter(1, Types.INTEGER);

int	Types.INTEGER
long	Types.LONG
String	Types.STRING
Date	Types.DATE
.....	Types.........

To excute CallableStatement we use **execute()** method

cs.execute();

To Get results we use **getXXX(int outputParamIndex)** method

cs.getInt(1);

```
public class FuncSum {
public static void main(String[] args) throws Exception{

Class.forName("oracle.jdbc.driver.OracleDriver");
Connection con=DriverManager.getConnection(
"jdbc:oracle:thin:@localhost:1521:xe","system","oracle");

CallableStatement stmt=con.prepareCall("{?= call sum4(?,?)}");
stmt.setInt(2,10);
stmt.setInt(3,43);
stmt.registerOutParameter(1,Types.INTEGER);
stmt.execute();

System.out.println(stmt.getInt(1));

}
}
```

```
Output: 53
```

2.10 Metadata

We have 3 types of metadata in jdbc

1) **DataBaseMetaData**
2) **ResultSetMetaData**
3) **ParameterMetaData**

1. DataBaseMetaData

We can get database meta like database details, driver name, name of total number of tables, no.of views etc. by using DataBaseMetaData class, we can get by using Connection Object

DatabaseMetaData getMetaData()
DatabaseMetaData dm = con.getMeteData()

String	**getDriverName()**
String	**getDriverVersion()**
String	**getURL()**
String	**getUserName()**
String	**getDatabaseProductName()**
String	**getDatabaseProductVersion()**
int	**getDatabaseMajorVersion()**
int	**getDatabaseMinorVersion()**

```
public class JDBC {
      public static void main(String[] args) throws Exception {
            String url = "jdbc:mysql://localhost:3306/mydb";
            String u = "root";
            String p = "123456";
            Class.forName("com.mysql.jdbc.Driver");

            Connection con = DriverManager.getConnection(url, u, p);
            DatabaseMetaData dm = con.getMetaData();
            System.out.println("Driver    :     "+dm.getDriverName());
            System.out.println("DriverVersion: "+dm.getDriverVersion());
            System.out.println("URL : "+dm.getURL());
            System.out.println("UserName : "+dm.getUserName());
            System.out.println("DatabseName : "+dm.getDatabaseProductName());
            System.out.println("DVersion : "+dm.getDatabaseProductVersion());
            System.out.println("Major : "+dm.getDatabaseMinorVersion());
            System.out.println("Minor : "+dm.getDatabaseMajorVersion());

      }
}
```

```
Driver  :       MySQL-AB JDBC Driver
DriverVersion: mysql-connector-java-5.1.18 ( Revision: tonci.grgin@oracle.com-20110930151701-
jfj14ddfq48ifkfq )
URL : jdbc:mysql://localhost:3306/mydb
UserName : root@localhost
DatabseName : MySQL
DVersion : 5.6.26
Major : 6
Minor : 5
```

2. ResultSetMetaData

- The metadata means data about data
- We can get ReselutSet meta information like no.of columns, column data,table name etc
    - **String getTableName(int column)**
    - **int getColumnCount()**
    - **String getColumnName(int column)**

- **int getColumnType(int column)**

```
public class JDBC {
	public static void main(String[] args) throws Exception {
		String url = "jdbc:mysql://localhost:3306/mydb";
		String u = "root";
		String p = "123456";
		Class.forName("com.mysql.jdbc.Driver");
		Connection con = DriverManager.getConnection(url, u, p);
		Statement st = con.createStatement();
		ResultSet rs = st.executeQuery("select * from customer");
		ResultSetMetaData rm = rs.getMetaData();
		System.out.println(rm.getTableName(1)); // customer
		System.out.println(rm.getColumnCount());// 3
		System.out.println(rm.getColumnName(2));// name
		System.out.println(rm.getColumnType(2));// 12
	}
}
```

3. ParameterMetaData

Used to get information about the types and properties for each parameter marker in a **PreparedStatement** object

- **int getParameterCount()**
- **int getParameterType(int param)**
- **String getParameterTypeName(int param)**

2.11 Batch Processing

Instead of executing a single query, we can execute a group of queries.The java.sql.Statement and java.sql.PreparedStatement interfaces provide methods for batch processing

- **void addBatch(String query)** ➔ It adds query into batch.
- **int[] executeBatch()** ➔ It executes the batch of queries.

```
Statement stmt=con.createStatement();
        stmt.addBatch("insert into user420 values(190,'abhi',40000)");
        stmt.addBatch("insert into user420 values(191,'umesh',50000)");
        stmt.executeBatch();//executing the batch
```

```
public class JDBC {
	public static void main(String[] args) throws Exception {
		String url = "jdbc:mysql://localhost:3306/mydb";
		String u = "root";
		String p = "123456";
		PreparedStatement ps = null;
		Class.forName("com.mysql.jdbc.Driver");
		Connection con = DriverManager.getConnection(url, u, p);
		Statement st = con.createStatement();
		st.addBatch("insert into student    values(81, 'Syam', 'mtm')");
		st.addBatch("insert into student    values(11, 'ram', 'mum')");
```

```
            st.addBatch("insert into  student    values(14, 'bam', 'kuk')");
            st.addBatch("insert into  student    values(44, 'pram', 'sec')");

            int rs[] = st.executeBatch();
            int sum = 0;
            for (int i = 0; i < rs.length; i++) {
                  sum = sum + i;
            }
            System.out.println(sum + "Record are UPDATED using BATCH");
      }
}
```

2.12 Transcations

In JDBC, **Connection interface** provides methods to manage transaction.

Method	Description
Void setAutoCommit(boolean status)	If it is true each transaction is committed bydefault.
void commit()	Commits the transaction.
void rollback()	Cancels the transaction.

```
class FetchRecords{
public static void main(String args[])throws Exception{
Class.forName("oracle.jdbc.driver.OracleDriver");
Connection con=DriverManager.getConnection("jdbc:oracle:thin:@localhost:1521:xe","u","p");
    con.setAutoCommit(false);
            Statement stmt=con.createStatement();
            stmt.executeUpdate("insert into user420 values(190,'abhi',40000)");
            stmt.executeUpdate("insert into user420 values(191,'umesh',50000)");
            con.commit();
            con.close(); }
            }
```

2.13 RowSet Interfcae

ResultSet Disdavantages

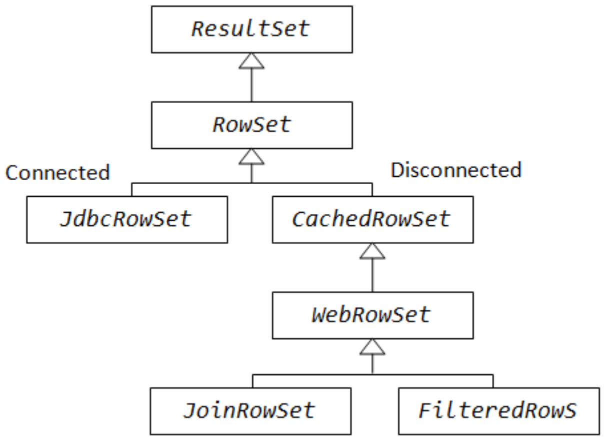
- ResultSet Object is not serilaizable , because it is always maintains a connection with DB
- We can't pass theResultset object from one class to other class across the network.

Rowset

- **RowSet extends the ResultSet interface** so it has all the methods of ResultSet
- RowSet **can be serialized** because it doesn't have a connection to any database
- RowSet **Object can be sent from one class to another across the network**.

We have following types of RowSets

1. **JdbcRowSet**
2. **CachedRowSet**
3. **WebRowSet**
4. **JoinRowSet**
5. **FilteredRowSet**



Features	JdbcRowSet	CacheRowSet	WebRowSet
Scrollable	✓	✓	✓
Updateable	✓	✓	✓
Connected	✓	✓	✓
Disconnected		✓	✓
Serializable		✓	✓
Generate XML			✓
Consume XML			✓

```
JdbcRowSet rowSet = RowSetProvider.newFactory().createJdbcRowSet();
rowSet.setUrl("jdbc:oracle:thin:@localhost:1521:xe");
rowSet.setUsername("system");
rowSet.setPassword("oracle");
rowSet.setCommand("select * from emp400");
rowSet.execute();
```

2.14 Notes

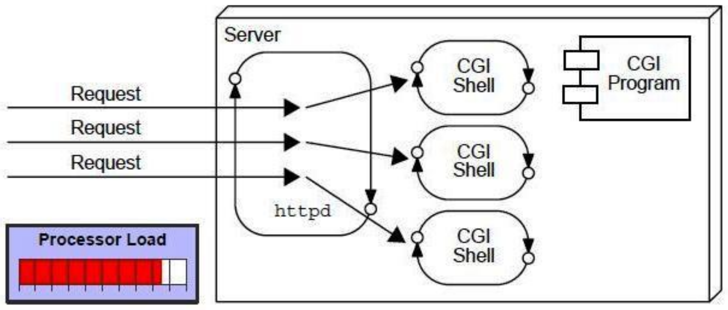
1. CGI

3. Servlets

A web application is an application accessible from the web. A web application is composed of web components like Servlet, JSP, Filter etc. and other components such as HTML. The web components typically execute in Web Server and respond to HTTP request.

1. CGI

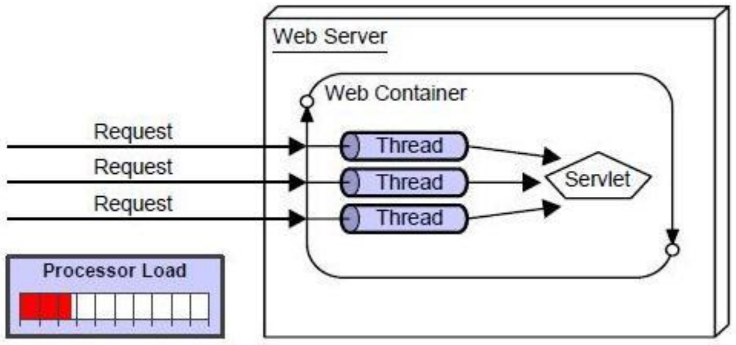
CGI technology enables the web server to call an external program and pass HTTP request information to the external program to process the request. For each request, it starts a new process.



Disadvantages of CGI

- If number of client's increases, it takes more time for sending response.
- For each request, it starts a process and Web server is limited to start processes.
- It uses platform dependent language e.g. C, C++, perl.

2. Servlet



The web container creates threads for handling the multiple requests to the servlet.

- **Better performance:** because it creates a thread for each request not process.
- **Portability:** because it uses java language.
- **Robust:** Servlets are managed by JVM so we don't need to worry about memory leak, garbage collection etc.
- **Secure:** because it uses java language..

3.1 Basics of Web Technologies

Static Website	**Dynamic Website**
Prebuilt content is same every time the page is loaded.	Content is generated quickly and changes regularly.
It uses the **HTML** code for developing a website.	It uses the server side languages such as **PHP,SERVLET, JSP, and ASP.NET** etc. for developing a website.

It sends exactly the same response for every request.	It may generate different HTML for each of the request.
The content is only changes when someone publishes and updates the file (sends it to the web server).	The page contains "**server-side**" code it allows the server to generate the unique content when the page is loaded.

1. HTTP (Hyper Text Transfer Protocol)

HTTP is TCP/IP based communication protocol, which is used to deliver the data like image files, query results, HTML files etc on the World Wide Web (WWW) with the default port is TCP 80. It provides the standardized way for computers to communicate with each other.

There are three fundamental features that make the HTTP a simple and powerful protocol used for communication:

- **HTTP is media independent:** It refers to any type of media content can be sent by HTTP as long as both the server and the client can handle the data content.
- **HTTP is connectionless:** It is a connectionless approach in which HTTP client i.e., a browser initiates the HTTP request and after the request is sends the client disconnects from server and waits for the response.
- **HTTP is stateless:** The client and server are aware of each other during a current request only. Afterwards, both of them forget each other. Due to the stateless nature of protocol, neither the client nor the server can retain the information about different request across the web pages.

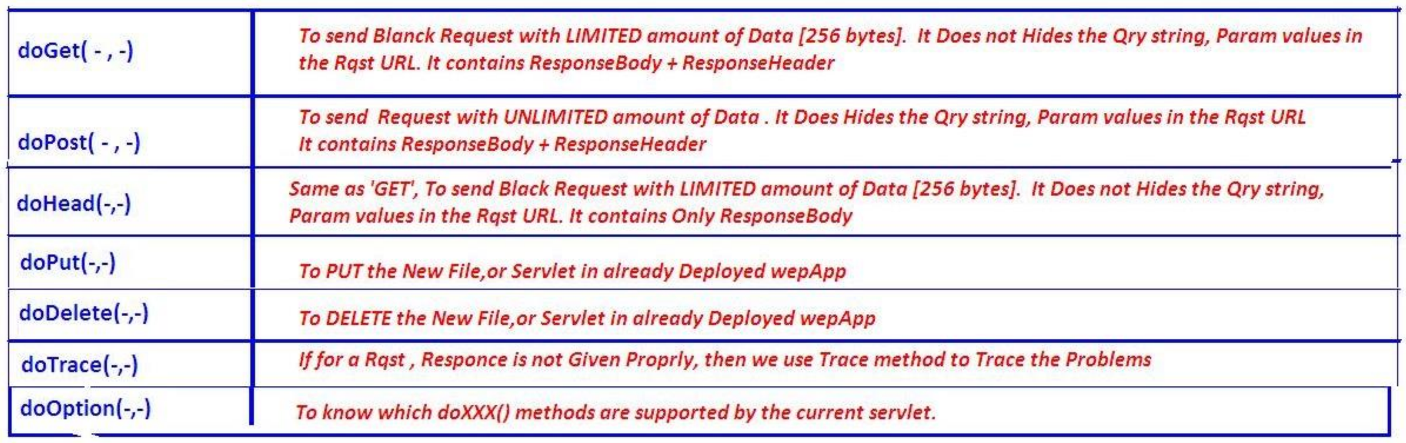
2. HTTP Requests

The request sends by the computer to a web server that contains all sorts of potentially interesting information is known as HTTP requests.

It will send following information to Server

- The analysis of source IP address, proxy and port
- The analysis of destination IP address, protocol, port and host
- The Requested URI (Uniform Resource Identifier)
- The Request method and Content
- The User-Agent header
- The Connection control header

We have following HTTP request methods:



doGet(- , -)	To send Blanck Request with LIMITED amount of Data [256 bytes]. It Does not Hides the Qry string, Param values in the Rqst URL. It contains ResponseBody + ResponseHeader
doPost(- , -)	To send Request with UNLIMITED amount of Data . It Does Hides the Qry string, Param values in the Rqst URL It contains ResponseBody + ResponseHeader
doHead(-,-)	Same as 'GET', To send Black Request with LIMITED amount of Data [256 bytes]. It Does not Hides the Qry string, Param values in the Rqst URL. It contains Only ResponseBody
doPut(-,-)	To PUT the New File,or Servlet in already Deployed wepApp
doDelete(-,-)	To DELETE the New File,or Servlet in already Deployed wepApp
doTrace(-,-)	If for a Rqst , Responce is not Given Proprly, then we use Trace method to Trace the Problems
doOption(-,-)	To know which doXXX() methods are supported by the current servlet.

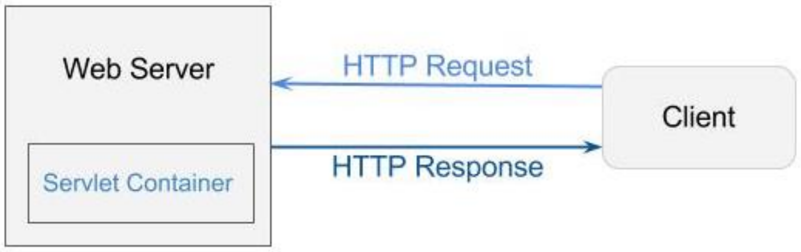
3. GET vs POST

GET	POST
1) In case of Get request, only **limited amount of data** can be sent because data is sent in header.	In case of post request, **large amount of data**can be sent because data is sent in body.
2) Get request is **not secured** because data is exposed in URL bar.	Post request is **secured** because data is not exposed in URL bar.
3) Get request **can be bookmarked.**	Post request **cannot be bookmarked.**
4) Get request is **idempotent.** It means second request will be ignored until response of first request is delivered	Post request is **non-idempotent.**
5) Get request is **more efficient** and used more than Post.	Post request is **less efficient** and used less than get.

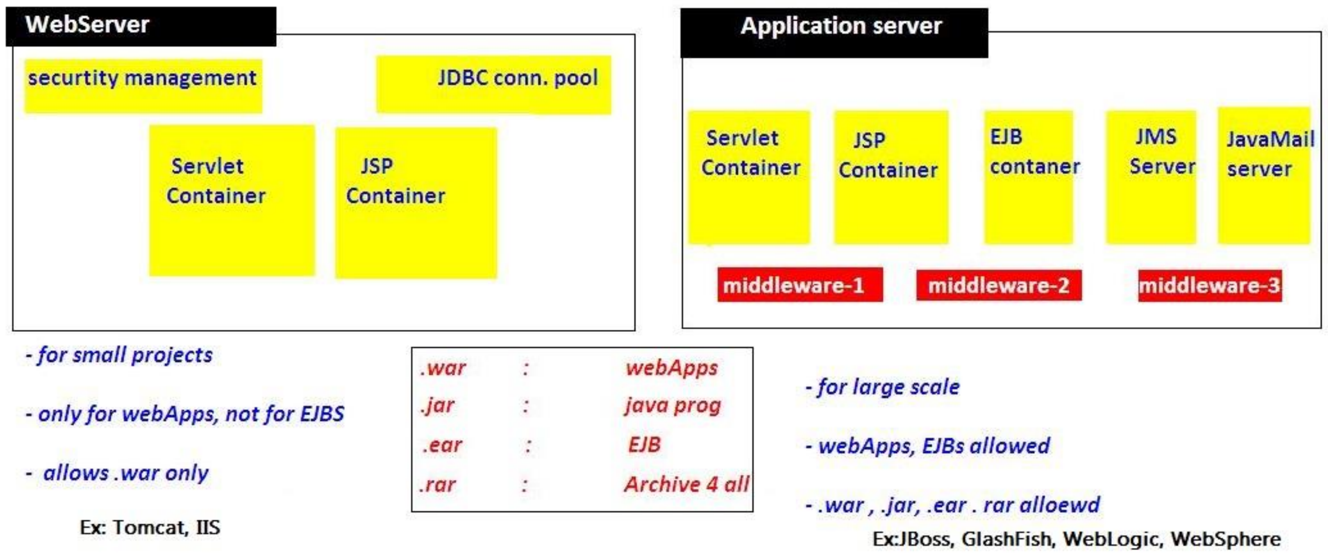
4. Servlet Container: is the place where Servlet programs are executed
The servlet container is used in java for dynamically generate the web pages on the server side. Therefore the servlet container is the part of a web server that interacts with the servlet for handling the dynamic web pages from the client.

The Servlet Container performs many operations that are given below:

1. **Life Cycle Management**
2. **Multithreaded support**
3. **Object Pooling**
4. **Security etc.**



5. Web Server VS Application Server



<u>6. Content Type</u>

Content Type is also known as MIME (Multipurpose internet Mail Extension) Type. It is a HTTP header that provides the description about what are you sending to the browser.

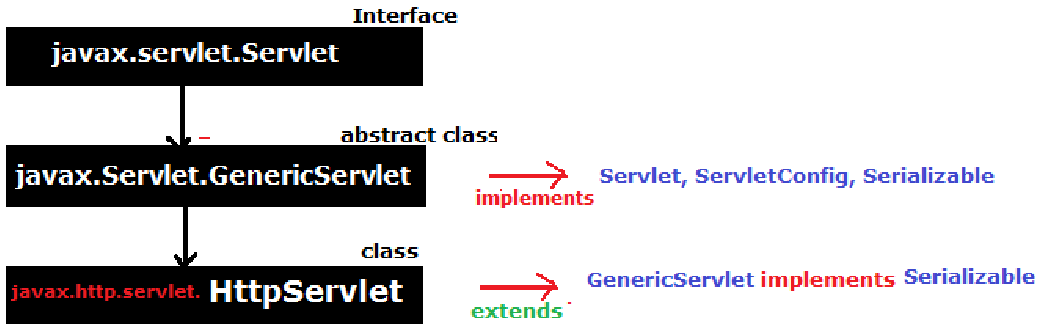
- **It supports the non-ASCII characters**
- **It supports the multiple attachments in a single message**
- **It supports the attachment contains audio, images and video files etc.**
- **It supports the unlimited message length.**

Commonly used content types are given below:

- **text/html**
- **text/plain**
- **application/msword**
- **application/vnd.ms-excel**
- **application/jar**
- **application/pdf**
- **application/octet-stream**
- **application/x-zip**
- **images/jpeg**
- **images/png**
- **images/gif**
- **audio/mp3**
- **video/mp4**
- **Video/quicktime etc.**

3.2 Servlet API

we can create any servlet program by using below 3 ways


Interface
javax.servlet.Servlet
abstract class
javax.Servlet.GenericServlet
implements
Servlet, ServletConfig, Serializable
class
javax.http.servlet. HttpServlet
extends
GenericServlet implements Serializable

1. javax.servlet.Servlet (Interface)

Servlet interface is the ROOT interface of Servlet API. It provides common behaviour to all the servlets.

Method	Description
public void init(ServletConfig config)	Initializes the servlet. It is the life cycle method of servlet and invoked by the web container **only once.**
public void service(ServletRequest req,ServletResponse response)	Provides response for the incoming request. **It is invoked at each request by the web container.**
public void destroy()	Is invoked only once and indicates that servlet is being destroyed.
public ServletConfig getServletConfig()	Returns the object of ServletConfig.
public String getServletInfo()	returns information about servlet such as writer, copyright, version etc.

Steps to implement Servlet program using Servlet Interface

1. Create a Class which **implements Servlet Interface**
2. **Implement** all **5** abstract **methods**
3. Write Request Processing logic in **service(req,res) method**

2. javax.servlet.GenericServlet (absraect class)

- GenericServlet class implements Servlet, ServletConfig and Serializable interfaces.
- It provides implementation for all methods of Servlet interface **except the service().**
- **it is protocol-independent**, so it can handle any request of any protocal
- Create servlet by providing the implementation of the service() method.

Init(),destroy(),getServletConfig(),getservletInfo() are inherted and implemented

1. public abstract void service(ServletRequest req, ServletResponse res)

2. public void init()
it is a convenient method for the servlet programmers, now there is no need to call super.init(config)

3. public ServletContext getServletContext()

4. public String getInitParameter(String name)

5. public Enumeration getInitParameterNames()

6. public String getServletName()

Steps to write Servlet Program using GenericServlet

1. Create a Class which **extends GenericServlet Interface**
2. Implement & Write Request Processing logic in **service(req,res) method**

3.javax.servlet.http.HttpServlet

HttpServlet class extends the GenericServlet class and implements Serializable interface. It provides http specific methods such as doGet, doPost, doHead, doTrace etc.

We have 2 service methods

1. **Public void service(ServletRequest req,ServletResponse res)** dispatches the request to the protected service method by converting the request and response object into http type.
2. **protected void service(HttpServletRequest req,HttpServletResponse res)**

   Receives the request from the service method, and dispatches the request to the doXXX() method depending on the incoming http request type.

7 proreddoXXX (HttpServletRequest, HttpServletResponce) service methods

1. **protected void doGet(Htt**pServletRequest req, HttpServletResponse res)
2. **protected void doPost(Ht**tpServletRequest req, HttpServletResponse res)
3. **protected void doHead(H**ttpServletRequest req, HttpServletResponse res)
4. **protected void doOptions**(HttpServletRequest req, HttpServletResponse res)
5. **protected void doPut(Htt**pServletRequest req, HttpServletResponse res)
6. **protected void doTrace(H**ttpServletRequest req, HttpServletResponse res)
7. **protected void doDelete(**HttpServletRequest req, HttpServletResponse res)

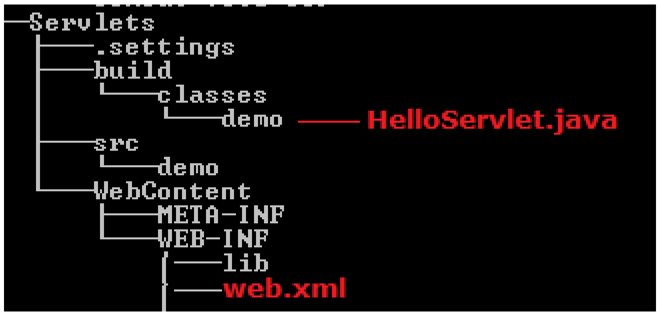
Steps to write Servlet Program using GenericServlet

1. Create a Class which **extends HttpServlet Interface**
2. Write Request Processing logic in **service(req,res)** **OR → Not Recommended**

3. Write Request Processing logic in **doXXX(req,res)** → **doGet,doPost Recommended**

3.3 Servlet Lifecycle

First we see the example, then we can understand the LifeCycle. For every Servlet program contains following strcuture



```
─Servlets
 ├───.settings
 ├───build
 │   └───classes
 │       └───demo ─── HelloServlet.java
 ├───src
 │   └───demo
 └───WebContent
     ├───META-INF
     └───WEB-INF
         ├───lib
         └───web.xml
```

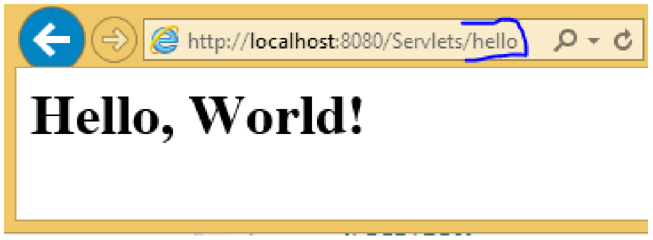
Here **Servlets** is Application name

Example 1: Using Servlet Interface

```
public class HelloServlet implements Servlet{
	ServletConfig config = null;
	@Override
	public void init(ServletConfig config) throws ServletException {
		this.config = config;
		System.out.println("1.Init...");
	}
	@Override
	public void service(ServletRequest req, ServletResponse res) throws
ServletException, IOException {
		System.out.println("2.Service ...");
	PrintWriter pw =  res.getWriter();
	pw.write("<h1>Hello, World!</h1>");
	}
	@Override
	public void destroy() {
		System.out.println("3.Destroy ..");
	}
	@Override
	public ServletConfig getServletConfig() {
		System.out.println("4.getServletConfig ..");
		return config;
	}
	@Override
	public String getServletInfo() {
		return "getServletInfo";
	}
}
```

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app>
	<servlet>
		<servlet-name>hello</servlet-name>
```

```
            <servlet-class>demo.HelloServlet</servlet-class>
      </servlet>

      <servlet-mapping>
            <servlet-name>hello</servlet-name>
            <url-pattern>/hello</url-pattern>
      </servlet-mapping>

      <welcome-file-list>
            <welcome-file>index.jsp</welcome-file>
      </welcome-file-list>
</web-app>
```



Hello, World!

Flow of Excecution

1. When ever we deploys the application, container loads the application & creates **ServletContext** Object & waits for the Request

2. if we give **<load-on-startup>**1**</load-on-startup>** container will creates ServletConfig Object when the time of Deploying application

3. when we give the url : **http://localhost:8080/Servlets/hello** , request goes to container, and it searches for **/hello** url pattern in web.xml

4. web.xml searches for **/hello** , in `<servlet-mapping>` and gets **Servelt-name**

5. container loads `demo.HelloServlet` class and creates creates **ServletConfig** Object and calls inti() method

6. for every request it will calls **service(req,res)** method, for 100 requests it will execute 100 times

7. **destroy()** method will be called before servlet is removed from the container, and finally it will be garbage collected as usual.

In above **<load-on-startup>**1**</load-on-startup>** we may give (1,2..10). based up on priority order it will creates the ServletConfig Object

<welcome-file-list>

- If we want to make any page/servlet as Homepage we have to specify in this tag
- If it contains more then 1 file, it will give priority by the Order

Example 2: Using GenericServlet

```
public class HelloServlet extends GenericServlet  {
	public void service(ServletRequest req, ServletResponse res) throws ServletException, IOException {
		res.setContentType("text/html");
		PrintWriter pw = res.getWriter();
		pw.write("Hello, Generic Servlet");
	}
}
```

Example 3: Using HttpServlet

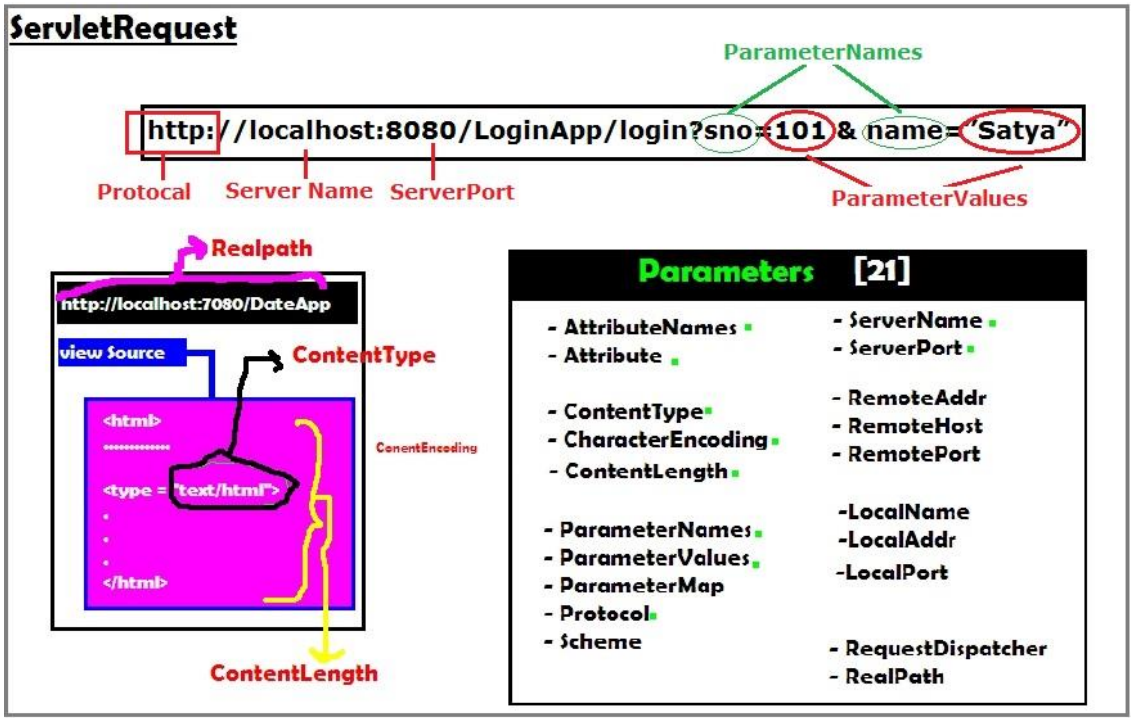
```
public class HelloServlet extends HttpServlet  {
	@Override
	public void service(ServletRequest req, ServletResponse res) throws ServletException, IOException {
		System.out.println("Public Service ........");
	}

	@Override
	protected void service(HttpServletRequest req, HttpServletResponse res) throws ServletException, IOException {
		System.out.println("Protecd Service ........");
	}

	@Override
	protected void doGet(HttpServletRequest req, HttpServletResponse resp) throws ServletException, IOException {
		System.out.println("doGet()  ....");
	}

	@Override
	protected void doPost(HttpServletRequest req, HttpServletResponse resp) throws ServletException, IOException {
		// TODO Auto-generated method stub
		System.out.println("doPost()  ....");
	}
}
```

```
INFO: Reloading Context with name [/Servlets] is completed
Public Service........
```

- Container first calls **public Service(req,res)** method
- Public Service() method internally calls **protected Service(req,res)** method
- Protected Service() method will internally calling **doGet() or doPost() or doXXX()** depends on the type of http method used by the client
- If the client is **not specifying the type of Http** method then Http protocol by **default consider GET method**,
- so **finally** the client request is processed at **doGet() method**

3.4 ServletRequest (interface) → getParamaters()

ServletRequest is send to Server to process particular request. It can send following details to servlet by submitting FORM or by URL.we can get these details at server side



Example to getRequest details

```
public class ServletReq extends HttpServlet {
      @Override
      protected void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            res.setContentType("text/html");
            PrintWriter pw = res.getWriter();
            pw.println("<br> getProtocol   \t:" + req.getProtocol());
            pw.println("<br> getServerName \t:" + req.getServerName());
            pw.println("<br> getServerPort \t:" + req.getServerPort());
            pw.println("<br> getRemotePort \t:" + req.getRemotePort());
            pw.println("<br> getLocalPort  \t:" + req.getLocalPort());

            pw.println("<br> getContentType   \t:" + req.getContentType());
            pw.println("<br> getContentLength \t:" + req.getContentLength());
      pw.println("<br> CharacterEncoding\t:" + req.getCharacterEncoding());
            pw.println("<br> req.getScheme    \t:" + req.getScheme());
      }
}
```

```
getProtocol   :HTTP/1.1
getServerName :localhost
getServerPort :8080
getRemotePort :63205
getLocalPort  :8080
getContentType :null
getContentLength :-1
CharacterEncoding :null
req.getScheme   :http
```

We mainly use ServletRequest **Object to retrieve data from FORM Submission or URL**

We can get the paramaters by using following methods

1. public String **getParameter("paramname");**

2. public Enumeration **getParameterNames();**
3. public String[] **getParamterValues("paramname");**
4. public Map **getParameterMap();**

Example: getParamater ()

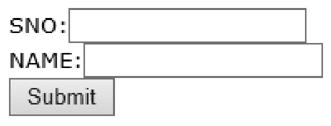
Index.html

```
      <form action="login" method="get">
            SNO:<input type="text" name="sno"><br>
            NAME:<input type="text" name="name"><br>
         <input type="submit" value="Submit">
      </form>
```

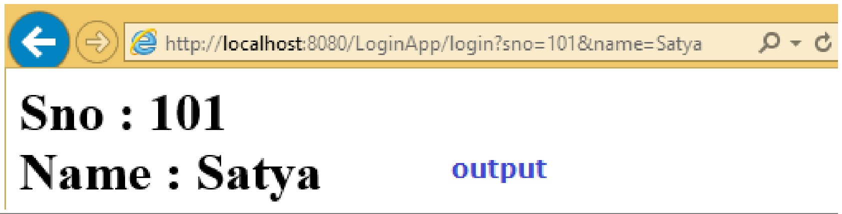
LoginServlet.java

```
public class LoginServlet extends HttpServlet {
      protected void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            PrintWriter pw = res.getWriter();
            res.setContentType("text/html");
            String sno = req.getParameter("sno");
            String name = req.getParameter("name");
            pw.println("<h1>Sno : " + sno);
            pw.println("<br>Name : " + name);
            pw.close();
      }
}
```

```
<web-app
  <servlet>
    <servlet-name>login</servlet-name>
    <servlet-class>demo.LoginServlet</servlet-class>
  </servlet>
  <servlet-mapping>
    <servlet-name>login</servlet-name>
    <url-pattern>/login</url-pattern>
  </servlet-mapping>
</web-app>
```



index.html


http://localhost:8080/LoginApp/login?sno=101&name=Satya

Sno : 101
Name : Satya

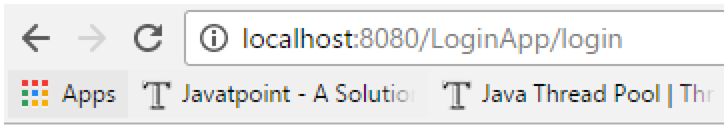
output

Make sure if we use GET method in form we must use doGet (Req, Res) & for POST we have to use doPost(req,res). Otherwise it throws Get/Post not supported error.in this type of case write logic doGet() & call doGet() in doPost()

public Enumeration getParameterNames();

Sometimes we don't know the request parameter names, in this case we use getParameterNames ();. See the same UI for this only Servlet code is changed

```
public class LoginServlet extends HttpServlet {
	protected void doPost(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
		PrintWriter pw = res.getWriter();
		res.setContentType("text/html");
		Enumeration e = req.getParameterNames();
		while (e.hasMoreElements()) {
			String s = (String) e.nextElement();
pw.write("Param Name :" +s + ",Param Value : " + req.getParameter(s)+"<br>");
		}
		pw.close();
	}
}
```



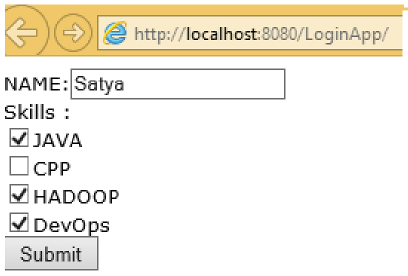
```
Param Name :sno , Param Value : 101
Param Name :name , Param Value : Satya
```

getParamterValues("paramname"), getParameterMap(); are used in the case of Single parameter can having multiple values, like checkboxes. See below example

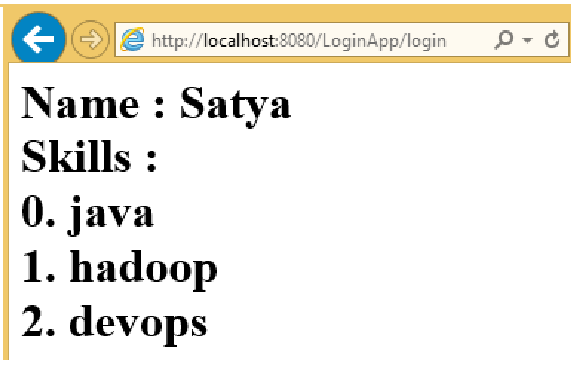
getParamterValues("paramname") Example

```
<form action="login" method="post">
		NAME:<input type="text" name="name"><br>
		Skills : <br>
		  <input type="checkbox" name="skill" value="java">JAVA<br>
		  <input type="checkbox" name="skill" value="cpp">CPP<br>
		  <input type="checkbox" name="skill" value="hadoop">HADOOP<br>
		  <input type="checkbox" name="skill" value="devops">DevOps<br>
		<input type="submit" value="Submit">
	</form>
```

```
public class LoginServlet extends HttpServlet {
	protected void doPost(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
		PrintWriter pw = res.getWriter();
		res.setContentType("text/html");
		pw.write("<h1> Name : " + req.getParameter("name"));
		pw.write("<br> Skills : <br> ");
		String[] skills = req.getParameterValues("skill");
		for (int i = 0; i < skills.length; i++) {
			pw.write(i + ". " + skills[i] + "<br>");
		}
		pw.close();
	}
}
```


http://localhost:8080/LoginApp/

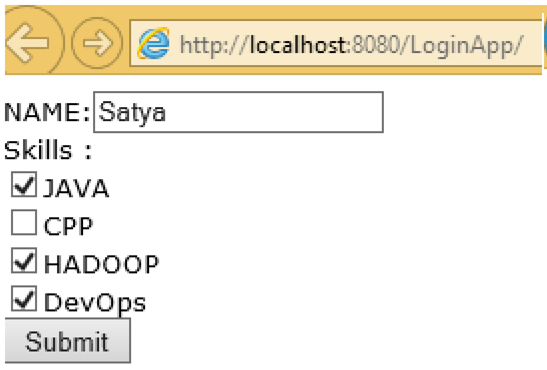
NAME: Satya
Skills :
☑ JAVA
☐ CPP
☑ HADOOP
☑ DevOps
Submit


http://localhost:8080/LoginApp/login

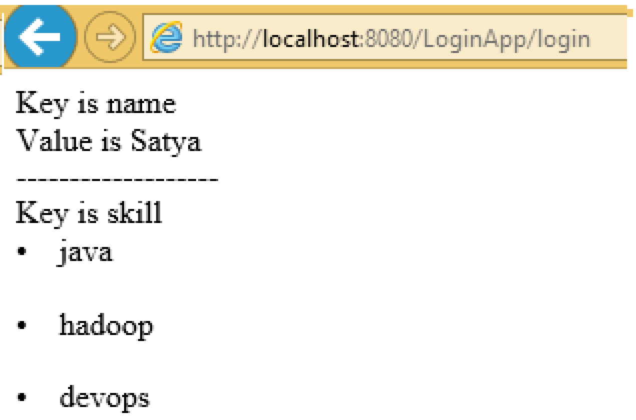
Name : Satya
Skills :
0. java
1. hadoop
2. devops

getParameterMap(); Example

```
public class LoginServlet extends HttpServlet {
      protected void doPost(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            PrintWriter pw = res.getWriter();
            res.setContentType("text/html");

            Map m = req.getParameterMap();
            Set s = m.entrySet();
            Iterator it = s.iterator();

            while (it.hasNext()) {
            Map.Entry  entry =  it.next();

            String key = entry.getKey();
            String[] value = entry.getValue();
            pw.println("Key is " + key + "<br>");

      if (value.length > 1) {
        for (int i = 0; i < value.length; i++) {
            pw.println("<li>" + value[i].toString() + "</li><br>");
            }
      } else
         pw.println("Value is " + value[0].toString() + "<br>");
      pw.println("-------------------<br>");
            }
            pw.close();
      }
}
```


http://localhost:8080/LoginApp/

NAME: Satya
Skills :
☑ JAVA
☐ CPP
☑ HADOOP
☑ DevOps
Submit


http://localhost:8080/LoginApp/login

```
Key is name
Value is Satya
-------------------
Key is skill
•  java

•  hadoop

•  devops
```

3.5 ServletConfig (interface) → getInitParamaters()

- ServletConfig is one of the **pre-defined interface**.
- ServletConfig object exists **one per servlet program**.
- An object of ServletConfig created by the container **during its initialization phase**.
- An object of ServletConfig is available to the servlet during its execution, once the servlet execution is completed, automatically ServletConfig interface object will be removed by the container.
- **It contains <init-param> details at web.xml, of a particular servlet.**
- The moment when we are using an object of ServletConfig, **we need to configure the web.xml by writing <init-param> tag under <servlet> tag of web.xml**.

1. How to get ServletConfig Object

We can ServletConfig object in 2 ways

1. By calling getServletConfig() on current servlet

ServletConfig conf = getServletConfig();

Above method is available in Servlet interface, inherited in to GenericServlet & HttpServlet

2. ServletConfig object will be available in init() method of the servlet.

```
  public void init(ServletConfig config)
{
// ………………….
}
```

2. How to place <init-param> in web.xml

We have to place **<init-param>** in between **<servlet>** tags

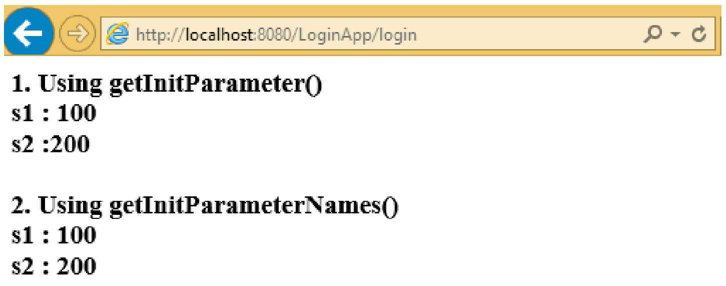
```
<web-app>
  <servlet>
    <servlet-name>login</servlet-name>
    <servlet-class>demo.LoginServlet</servlet-class>
   <init-param>
        <param-name>s1</param-name>
        <param-value> 100 </param-value>
     </init-param>

     <init-param>
        <param-name>s2</param-name>
        <param-value>200</param-value>
     </init-param>
  </servlet>
  <servlet-mapping>
    <servlet-name>login</servlet-name>
    <url-pattern>/login</url-pattern>
  </servlet-mapping>
</web-app>
```

3.how to get Initparameters in Servlet Programe

We can retrieve <init-param> values by using following methods

- public String **getInitParameter("param name");**
- public Enumeration **getInitParameterNames();**

```
public class LoginServlet extends HttpServlet {
      protected void doPost(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            PrintWriter pw = res.getWriter();
            res.setContentType("text/html");

            ServletConfig cfg = getServletConfig();
            pw.write("<h3> 1. Using getInitParameter()");
            pw.write("<br> s1 : " + cfg.getInitParameter("s1"));
            pw.write("<br> s2 :" + cfg.getInitParameter("s2"));

            pw.write("<br><br>  2. Using getInitParameterNames()");
            Enumeration e = cfg.getInitParameterNames();
            while (e.hasMoreElements()) {
                  String s = (String) e.nextElement();
                  pw.write("<br>" +s + "\t : " + cfg.getInitParameter(s));
            }
      }
}
```



http://localhost:8080/LoginApp/login

```
1. Using getInitParameter()
s1 : 100
s2 :200

2. Using getInitParameterNames()
s1 : 100
s2 : 200
```

3.6 ServletContext (interface) → getInitParamaters()

- Object of ServletContext interface is available **one per web application.**
- ServletContext object is automatically created by the container **when the web application is deployed.**
- <context-param> is placed between <web-app> tags. Because the paramaters can be accessed by all the servlets in the Web Application

1. how to get ServletContext Object

We have 3 ways

1. Using ServletConfig Object

```
ServletConfig conf        = getServletConfig();
ServletContext context    = conf.getServletContext();
```

2. By calling getServletContext() on GenericServlet

```
ServletContext ctx = getServletContext();
```
getServletContext () method is defined in GenericServlet

3. By calling getServletContext() on HttpServlet

```
ServletContext ctx = getServletContext();
```
getServletContext () method is defined in GenericServlet inherited to HttpServlet

2. How to place <context-param> in web.xml

<context-param> is placed between <web-app> tags. Because the paramaters can be accessed by all the servlets in the Web Application

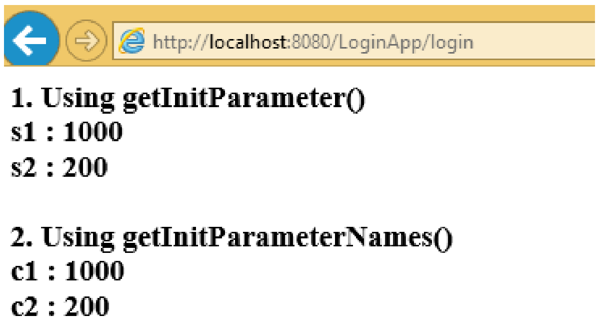
```
<web-app>
      <context-param>
            <param-name>c1 </param-name>
            <param-value>1000</param-value>
      </context-param>

      <context-param>
            <param-name>c2 </param-name>
            <param-value>200</param-value>
      </context-param>

      <servlet>
            <servlet-name>login</servlet-name>
            <servlet-class>demo.LoginServlet</servlet-class>
      </servlet>
      <servlet-mapping>
            <servlet-name>login</servlet-name>
            <url-pattern>/login</url-pattern>
      </servlet-mapping>
      <welcome-file-list>
            <welcome-file>index.html</welcome-file>
      </welcome-file-list>
</web-app>
```

3. how to context-params in Servlet Programe

We have two methods

- **public String** **getInitParameter("param name");**
- **public Enumeration** **getInitParameterNames();**

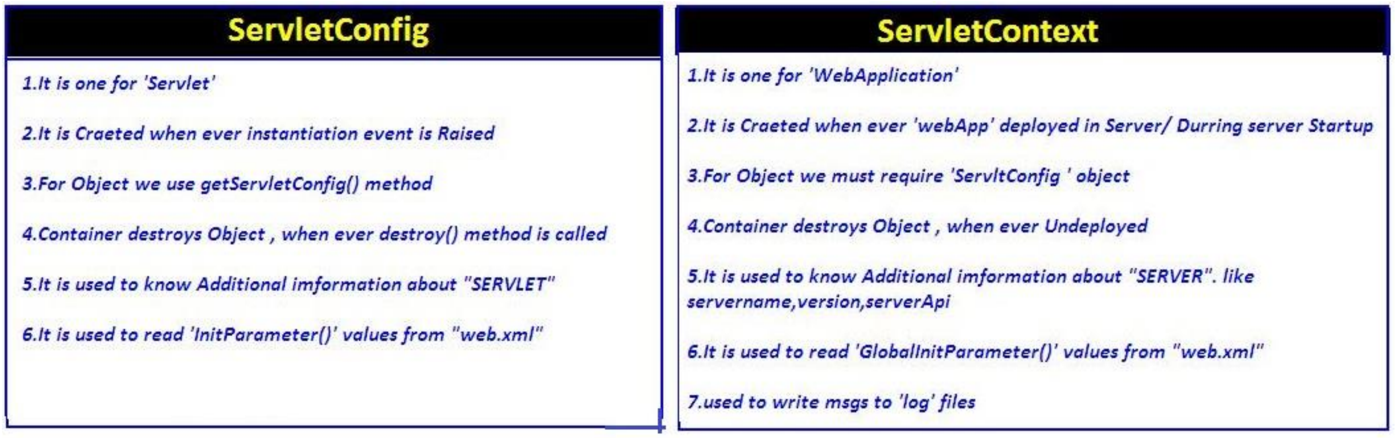
```
public class LoginServlet extends HttpServlet {
      protected void doPost(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            PrintWriter pw = res.getWriter();
            res.setContentType("text/html");

            ServletConfig cfg = getServletConfig();
            ServletContext context = cfg.getServletContext();

            pw.write("<h3> 1. Using getInitParameter()");
            pw.write("<br> s1 : " + context.getInitParameter("c1"));
            pw.write("<br> s2 : " + context.getInitParameter("c2"));

            pw.write("<br><br>  2. Using getInitParameterNames()");
            Enumeration e = context.getInitParameterNames();
            while (e.hasMoreElements()) {
                  String s = (String) e.nextElement();
            pw.write("<br>" + s + "\t : " + context.getInitParameter(s));
            }
      }
}
```



http://localhost:8080/LoginApp/login

1. Using getInitParameter()
s1 : 1000
s2 : 200

2. Using getInitParameterNames()
c1 : 1000
c2 : 200



ServletConfig	ServletContext
1.It is one for 'Servlet'	1.It is one for 'WebApplication'
2.It is Craeted when ever instantiation event is Raised	2.It is Craeted when ever 'webApp' deployed in Server/ Durring server Startup
3.For Object we use getServletConfig() method	3.For Object we must require 'ServltConfig ' object
4.Container destroys Object , when ever destroy() method is called	4.Container destroys Object , when ever Undeployed
5.It is used to know Additional information about "SERVLET"	5.It is used to know Additional information about "SERVER". like servername,version,serverApi
6.It is used to read 'InitParameter()' values from "web.xml"	6.It is used to read 'GlobalInitParameter()' values from "web.xml"
	7.used to write msgs to 'log' files

we never Creates our ServletClassObject, ServletConfig, ServletContext, Objects!

Bcoz ServletContainer Takes care about these things

3.7 ServletChaining

Servlet chaining is used to achive Communication beween servlets. To perform this we have to use RequestDisptcher inferface .following are the possible ways to achive ServletChaining

1. **rd. forward(req, res)**
2. **rd. include (req, res)**
3. **res.sendRedirect(/url)**

RequestDisptcher Interface

The RequestDispatcher interface provides the facility of dispatching the request to another resource it may be html, servlet or jsp. We have 2 main methods in this RequestDisptcher

1. **public void forward(ServletRequest req,ServletResponse res)**
2. **public void include (ServletRequest req,ServletResponse res)**

1. How to get RequestDisptcher Object

We have 3 ways to get RequestDisptcher object

1) using Request object

```
RequestDispatcher rd  =  request.getRequestDispatcher("/url or servletname");
      rd.forward(req, res);
      rd.include(req, res);
```

If we use **request** object, the webresource programs **are must be** in **same web application**

2) **using ServletContext object with getRequestDispatcher("url") method**

```
RequestDispatcher rd  =  context.getRequestDispatcher("/url or servletname");
      rd.forward(req, res);
      rd.include(req, res);
```

If we use **Context** object, the webresource programs **are may in same/different web applictions**

3) **using ServletContext object with getNamedDispatcher("servletname") method**

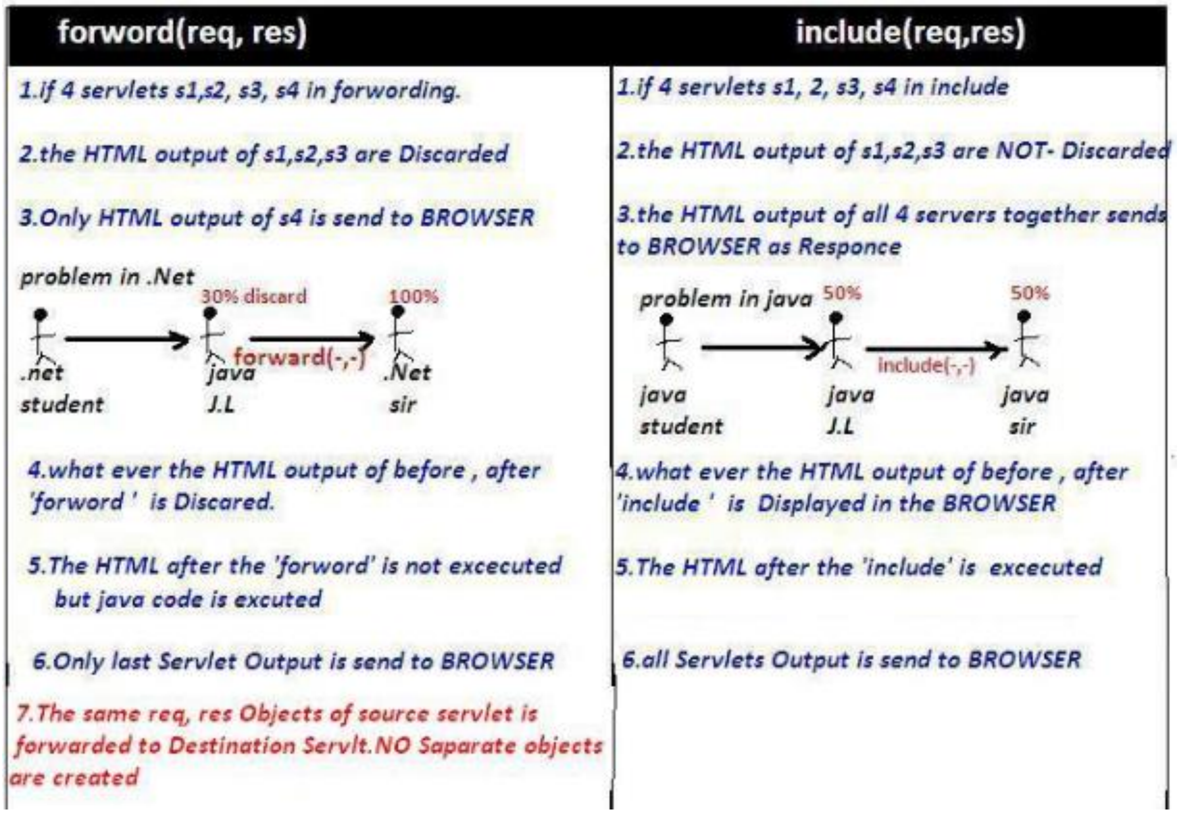
```
RequestDispatcher rd  =  context. getNamedDispatcher("serv1");
      rd.forward(req, res);
      rd.include(req, res);
```

- ✓ **/URL** → if we are placing .html, .jsp type of files we have to add **'/'** in path
- ✓ **Servltname** → if we are using logical names of servlet/jsp like serv1, serv2 etc, then **we must not to** add **'/'** in path

RequestDispatcher	NamedDispatcher
Invokable on both request & context Objects Exptects servlet url-pattren logical name or filenames of .html, .jsp files as argument RequestDisptacher Object can points destination servlets,jsps & .html pages	Invokable only on context Object Exptects only servlet url-pattren logical name as argument RequestDisptacher Object can points only destination servlets,jsps but not .html pages

Servlet chaining in Same Server

We can use forward(), include() methods to perform chaining between two servlets which are resides in same web application or different web applications of same server



forword(req, res)	include(req,res)
1.if 4 servlets s1,s2, s3, s4 in forwording.	1.if 4 servlets s1, 2, s3, s4 in include
2.the HTML output of s1,s2,s3 are Discarded	2.the HTML output of s1,s2,s3 are NOT- Discarded
3.Only HTML output of s4 is send to BROWSER	3.the HTML output of all 4 servers together sends to BROWSER as Responce
problem in .Net — 30% discard, 100%, forward(-,-), .net student, java J.L, .Net sir	problem in java — 50%, 50%, include(-,-), java student, java J.L, java sir
4.what ever the HTML output of before , after 'forword ' is Discared.	4.what ever the HTML output of before , after 'include ' is Displayed in the BROWSER
5.The HTML after the 'forword' is not excecuted but java code is excuted	5.The HTML after the 'include' is excecuted
6.Only last Servlet Output is send to BROWSER	6.all Servlets Output is send to BROWSER
7.The same req, res Objects of source servlet is forwarded to Destination Servlt.NO Saparate objects are created	

Forword() example

Input.html

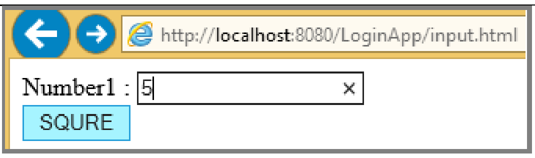
```
        <form action="s1" method="GET">
                Number1 : <input type="text" name="n1"><br>
                <input type="submit"  value="SQURE">
        </form>
```

Web.xml

```
<web-app>
        <servlet>
                <servlet-name>s1</servlet-name>
                <servlet-class>demo.srv1</servlet-class>
        </servlet>
        <servlet>
                <servlet-name>s2</servlet-name>
                <servlet-class>demo.srv2</servlet-class>
        </servlet>
        <servlet-mapping>
                <servlet-name>s1</servlet-name>
                <url-pattern>/s1</url-pattern>
        </servlet-mapping>
        <servlet-mapping>
                <servlet-name>s2</servlet-name>
                <url-pattern>/s2</url-pattern>
        </servlet-mapping>
</web-app>
```

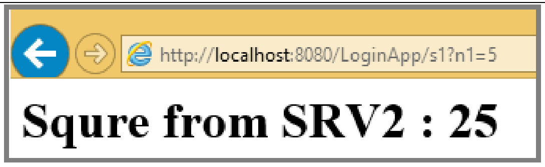
```
public class srv1 extends HttpServlet {
	public void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
		ServletConfig cg = getServletConfig();
		ServletContext sc = cg.getServletContext();
		res.setContentType("text/html");
		PrintWriter pw = res.getWriter();

		String s1 = req.getParameter("n1");
		int a = Integer.parseInt(s1);
		int b = a * a;

		pw.println("<h1>Before forword            :     " + b + "</h1>");
		RequestDispatcher rd = sc.getRequestDispatcher("/s2");
		rd.forward(req, res);     //→ (1)
		pw.println("<h1> After forword</h1>");
	}

	public void doPost(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
		doGet(req, res);
	}
}
```

```
public class srv2 extends HttpServlet {
	public void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
		res.setContentType("text/html");
		PrintWriter pw = res.getWriter();
		String s1 = req.getParameter("n1");
		int a = Integer.parseInt(s1);
		int b = a * a;
		pw.println("<h1>Squre from SRV2            :     " + b + "</h1>");
	}
	public void doPost(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
		doGet(req, res);
	}
}
```


http://localhost:8080/LoginApp/input.html

Number1 : 5

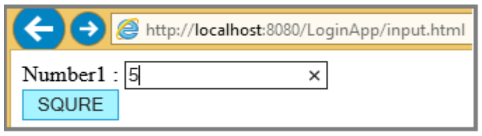
SQURE


http://localhost:8080/LoginApp/s1?n1=5

Squre from SRV2 : 25

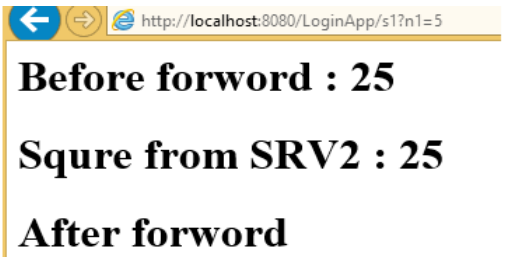
In above (1), if we just replace with **include(req, res)** as below it include serv1 result also

```
RequestDispatcher rd = sc.getRequestDispatcher("/s2");
                rd.include(req, res);
```


http://localhost:8080/LoginApp/input.html

Number1 : 5

SQURE


http://localhost:8080/LoginApp/s1?n1=5

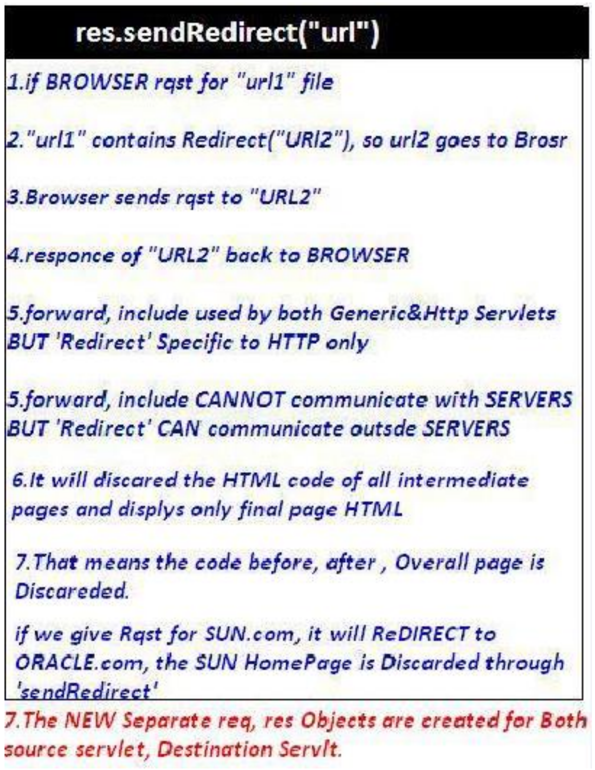
Before forword : 25

Squre from SRV2 : 25

After forword

Servlet chaining in Different Server 314 page in natraj

We can use res.sendRedirect(url) method to perform chaining between two servlets which are running on different servers



res.sendRedirect("url")

1.if BROWSER rqst for "url1" file

2."url1" contains Redirect("URl2"), so url2 goes to Brosr

3.Browser sends rqst to "URL2"

4.responce of "URL2" back to BROWSER

5.forward, include used by both Generic&Http Servlets BUT 'Redirect' Specific to HTTP only

5.forward, include CANNOT communicate with SERVERS BUT 'Redirect' CAN communicate outsde SERVERS

6.It will discared the HTML code of all intermediate pages and displys only final page HTML

7.That means the code before, after , Overall page is Discareded.

if we give Rqst for SUN.com, it will ReDIRECT to ORACLE.com, the SUN HomePage is Discarded through 'sendRedirect'

7.The NEW Separate req, res Objects are created for Both source servlet, Destination Servlt.

```
public class srv3 extends HttpServlet {
      public void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            res.setContentType("text/html");
            PrintWriter pw = res.getWriter();
            pw.println("<h1>Before sendReditrect</h1>");
            res.sendRedirect("http://www.google.com");
            pw.println("<h1>After sendReditrect</h1>");

      }
      public void doPost(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            doGet(req, res);
      }
}
```

forward() method	sendRedirect() method
The forward() method works at server side.	The sendRedirect() method works at client side.
It sends the same request and response objects to another servlet.	It always sends a new request.
It can work within the server only. **Example:** request.getRequestDispacher("servlet2").forward(request,response);	It can be used within and outside the server. **Example:** response.sendRedirect("servlet2");

3.8 Attribbutes

The servlet programmer can pass informations from one servlet to another using attributes. It is just like passing object from one class to another so that we can reuse the same object again and again.

We have 3 types of scopes for attribues

1) **Request scope**
2) **Session scope**
3) **Application scope (ServletContext Scope)**

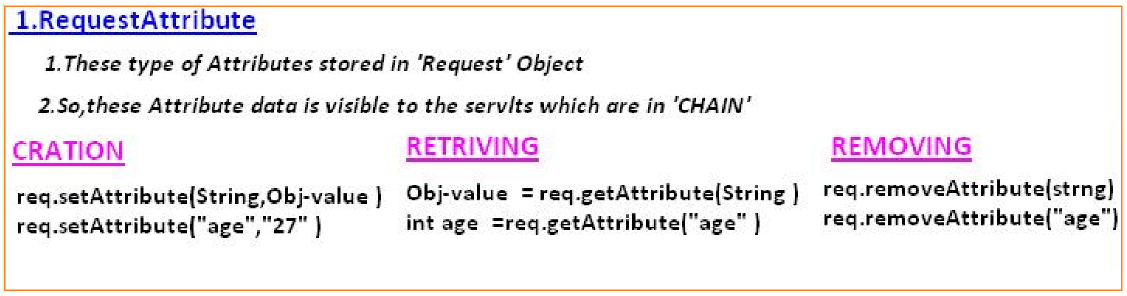
Attributes can be apply

- if Both Source& Destination Servlets are in same/difffrent webapplication
- if Both Source& Destination Servlets are in same Server
- It is **not** applicable if Both Source& Destination **Servlets are in different Server**

We have 3 methods to deal with attribues

1) **public void setAttribute(String name,Object object**
2) **public Object getAttribute(String name)**
3) **public void removeAttribute(String name)**

1. Request Attribute: It applicable only if both servlets must be in **CHAIN**

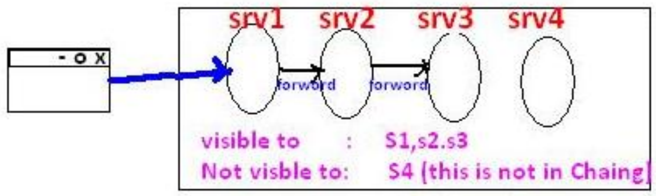


1.RequestAttribute

1.These type of Attributes stored in 'Request' Object

2.So,these Attribute data is visible to the servlts which are in 'CHAIN'

CRATION	RETRIVING	REMOVING
req.setAttribute(String,Obj-value)	Obj-value = req.getAttribute(String)	req.removeAttribute(strng)
req.setAttribute("age","27")	int age =req.getAttribute("age")	req.removeAttribute("age")

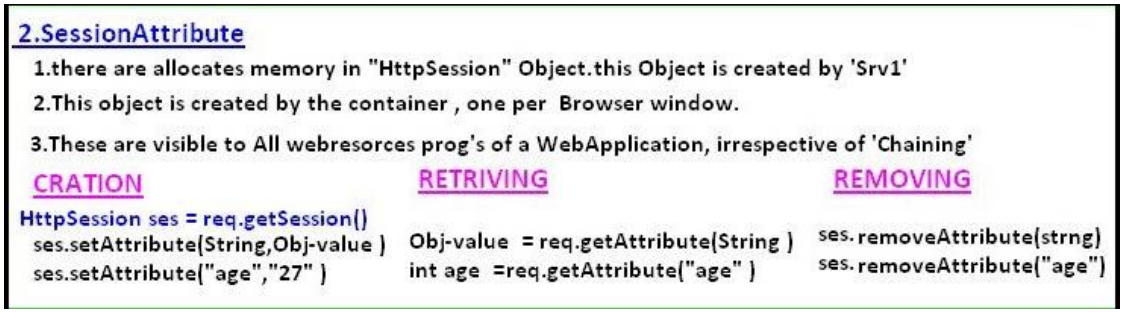


```
public class srv1 extends HttpServlet {
      public void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
             req.setAttribute("uname", "ADMIN");
             req.setAttribute("pwd", "123abc$");
             RequestDispatcher rd = req.getRequestDispatcher("/s2");
             rd.forward(req, res);
      }
}
```

```
public class srv2 extends HttpServlet {
	public void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
		res.setContentType("text/html");
		PrintWriter pw = res.getWriter();
		pw.write("Username : "+req.getAttribute("uname"));
		pw.write("Password : "+req.getAttribute("pwd"));
	}
}
```

Output: `Username: ADMIN  Password : 123abc$`

2. Session Attribute: It applicable per **one browser window** at a time. I.e Session is maintain in single window



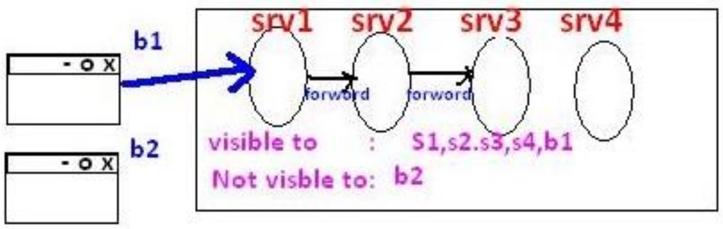
2.SessionAttribute

1.there are allocates memory in "HttpSession" Object.this Object is created by 'Srv1'

2.This object is created by the container , one per Browser window.

3.These are visible to All webresorces prog's of a WebApplication, irrespective of 'Chaining'

CRATION	RETRIVING	REMOVING
HttpSession ses = req.getSession()		
ses.setAttribute(String,Obj-value)	Obj-value = req.getAttribute(String)	ses.removeAttribute(strng)
ses.setAttribute("age","27")	int age =req.getAttribute("age")	ses.removeAttribute("age")

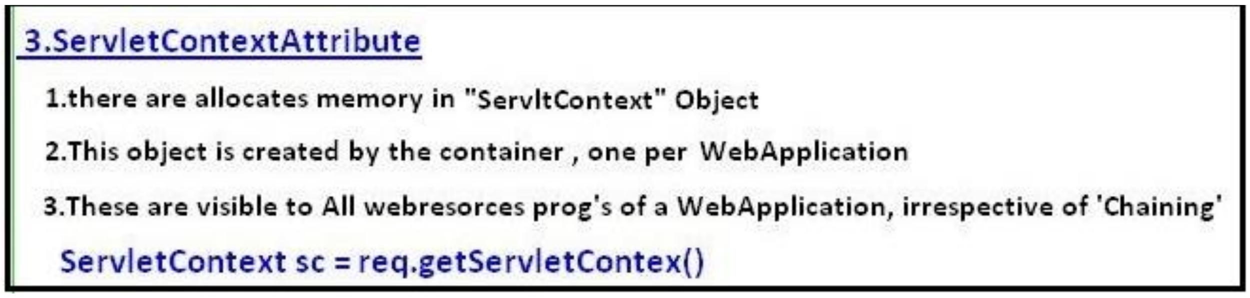


```
public class srv1 extends HttpServlet {
	public void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
		HttpSession sess = req.getSession();
		sess.setAttribute("id", "10001");
		sess.setAttribute("name", "Satya");
	}
}

public class srv2 extends HttpServlet {
	public void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
		res.setContentType("text/html");
		PrintWriter pw = res.getWriter();
		HttpSession sess = req.getSession();
		pw.write("ID : "+sess.getAttribute("id"));
		pw.write("<br>Name : "+sess.getAttribute("name"));
	}
}
```

Output → `ID : 10001   Name : Satya`

3. Application /Context Attribute

- It can applicable both servelts **must be in Single Server**
- No need of Servlet Chaining & Session because it is per web application



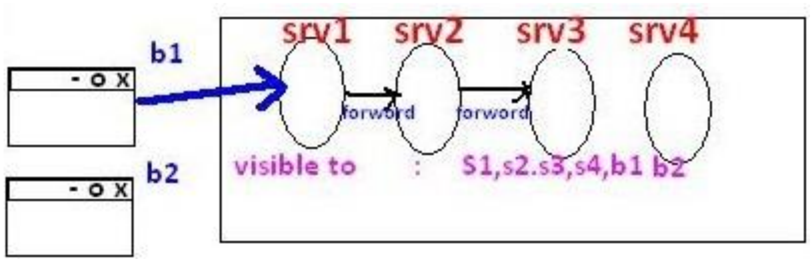
3.ServletContextAttribute

1.there are allocates memory in "ServltContext" Object

2.This object is created by the container , one per WebApplication

3.These are visible to All webresorces prog's of a WebApplication, irrespective of 'Chaining'

ServletContext sc = req.getServletContex()



```
public class srv1 extends HttpServlet {
      public void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            ServletContext cxt= req.getServletContext();
            cxt.setAttribute("name", "Johnny");
            cxt.setAttribute("age", "26");
      }
}
```

```
public class srv2 extends HttpServlet {
      public void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            res.setContentType("text/html");
            PrintWriter pw = res.getWriter();
            ServletContext cxt= req.getServletContext();
            pw.write("Name: "+cxt.getAttribute("name"));
            pw.write("Age : "+cxt.getAttribute("age"));
      }
}
```

Output: `Name: Johnny Age : 26`

Stateless Behaviour: is nothing but while processing current request in any web resource program is cannot use previous request data is nothing but Statteless here.

HTTP is a Stateless protocol that means each request is considered as the new request

To make our HttpServlet as a Statefull resource program we use Session Tracking

3.9 Session Tracking

Session Tracking is a way of remembering clinet data across the multiple requests during a session.

There are 4 techniques used in Session tracking:

1. **Hidden Form Field**
2. **Cookies**
3. **HttpSession**
4. **URL Rewriting**

1. Hidden Form Field

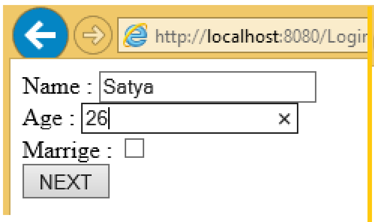
- We store the information in the hidden field and get it from another servlet
- <input type="hidden" name="uname" value="Satya">
- It easy to write

Disadvantages

- Used only on TextBoxes
- If we see the view-source of html page, the hidden values can visible
- Not secure

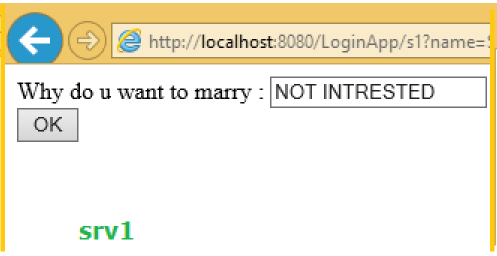
```
<form action = "s1"  method = "get">
      Name    :    <input type = "text" name = "name"><br>
      Age     :    <input type = "text" name = "age"><br>
      Marrige  :  <input type = "checkbox" name = "mrg" value = "yes"><br>
<input type = "submit" name = "btn" value = "NEXT"> <br>
</form>

public class srv1 extends HttpServlet {
      public void service(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            res.setContentType("text/html");
            PrintWriter pw = res.getWriter();

            String name = req.getParameter("name");
            String age = req.getParameter("age");
            String mrg = req.getParameter("mrg");

if (mrg == null) {
 mrg = "single";
 pw.println("<form action = 's2'>");
 pw.println("Why do u want to marry :<input type='text' name = 'why'><br>");
 pw.println("<input type = 'hidden' name = 'name' value = " + name + ">");
 pw.println("<input type = 'hidden' name = 'age' value = " + age + ">");
 pw.println("<input type = 'hidden' name = 'mrg' value = " + mrg + ">");
 pw.println("<input type = 'submit' name = 'btn' value = 'OK'><br>");
 pw.println("</form>");
}

else {
 mrg = "married";
 pw.println("<form action = 's2'>");
 pw.println("How Many Childrens:<input type = 'text' name = 'child'><br>");
 pw.println("<input type = 'hidden' name = 'name' value = " + name + ">");
 pw.println("<input type = 'hidden' name = 'age' value = " + age + ">");
 pw.println("<input type = 'hidden' name = 'mrg' value = " + mrg + ">");
 pw.println("<input type = 'submit' name = 'btn' value = 'OK'><br>");
 pw.println("</form>");
  }
}
}
```

```
public class srv2 extends HttpServlet {
      public void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            res.setContentType("text/html");
            PrintWriter pw = res.getWriter();
            pw.println("<h3>  Status of yours...........</h1>");
            pw.println("<h4> Name :" + req.getParameter("name"));
            pw.println("<br> Age  :" + req.getParameter("age"));
            pw.println("<br> Status  :" + req.getParameter("mrg"));

            if (req.getParameter("mrg").equals("single")) {
                  pw.println("<br> Reason  :" + req.getParameter("why"));
            }else{
            pw.println("<br> No.of Childrents :"+ req.getParameter("child"));
            }
      }
}
```


http://localhost:8080/Login

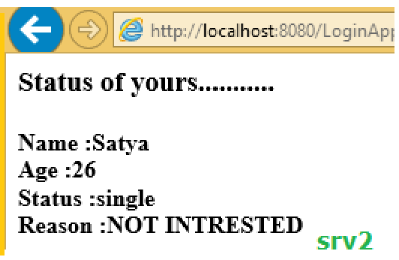
Name : Satya
Age : 26
Marrige : ☐
NEXT

input.html


http://localhost:8080/LoginApp/s1?name=

Why do u want to marry : NOT INTRESTED
OK

srv1


http://localhost:8080/LoginApp

Status of yours...........

Name :Satya
Age :26
Status :single
Reason :NOT INTRESTED

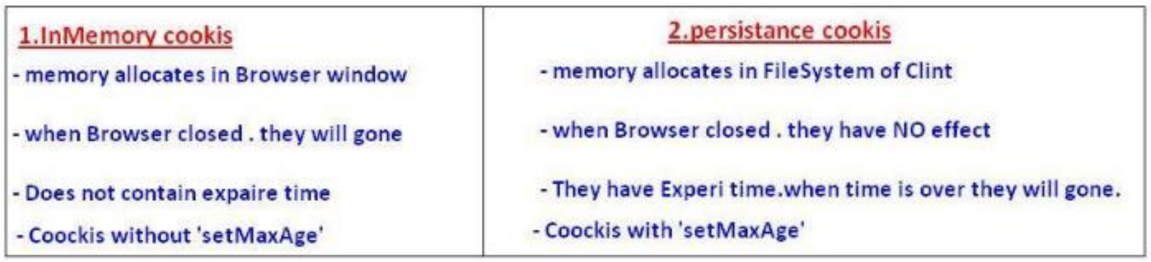
srv2

2. Cookies

A cookie is a small piece of information saved in the browser between the multiple client requests.

There are 2 types of cookies in servlets.

1. **Non-persistent cookie**
2. **Persistent cookie**



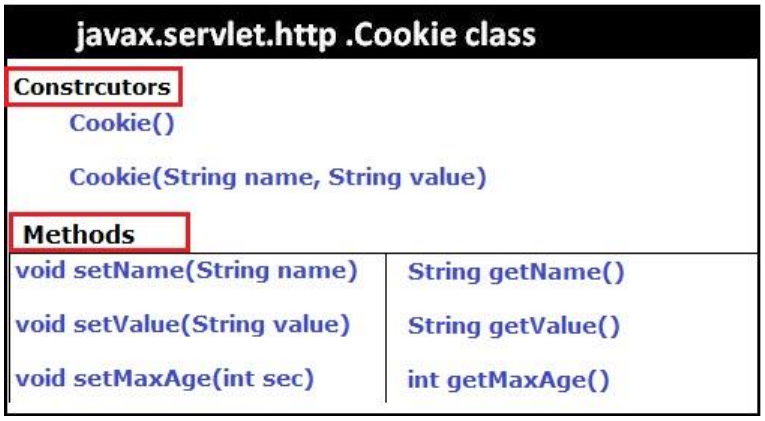
1.InMemory cookis	2.persistance cookis
- memory allocates in Browser window	- memory allocates in FileSystem of Clint
- when Browser closed . they will gone	- when Browser closed . they have NO effect
- Does not contain expaire time	- They have Experi time.when time is over they will gone.
- Coockis without 'setMaxAge'	- Coockis with 'setMaxAge'

Advantage of Cookies

- Simplest technique of maintaining the state.
- Cookies are maintained at client side.

Disadvantage of Cookies

- It will not work if cookie is disabled from the browser.
- Only textual information can be set in Cookie object.



javax.servlet.http .Cookie class

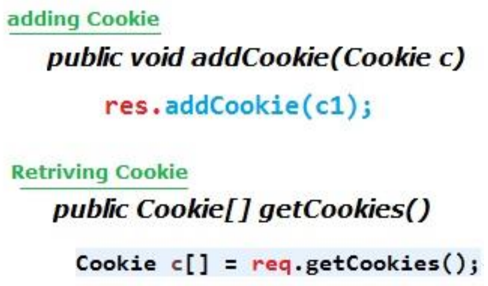
Constrcutors

Cookie()

Cookie(String name, String value)

Methods

void setName(String name)	String getName()
void setValue(String value)	String getValue()
void setMaxAge(int sec)	int getMaxAge()



adding Cookie

public void addCookie(Cookie c)

```
res.addCookie(c1);
```

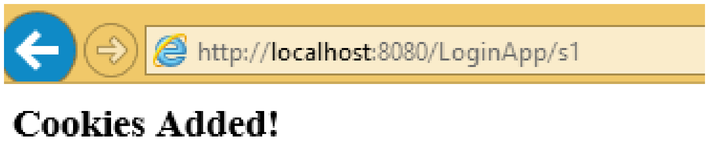
Retriving Cookie

public Cookie[] getCookies()

```
Cookie c[] = req.getCookies();
```

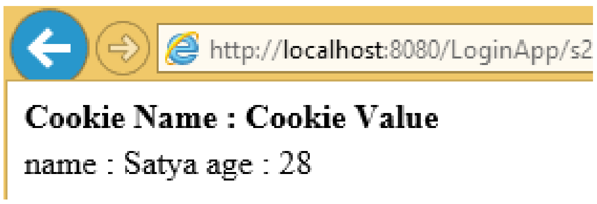
```
public class srv1 extends HttpServlet {
      public void service(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            res.setContentType("text/html");
            PrintWriter pw = res.getWriter();
            Cookie c1 = new Cookie("name", "Satya");
            Cookie c2 = new Cookie("age", "28");
            c1.setMaxAge(5000); //max 5 sec alive
            res.addCookie(c1);
            res.addCookie(c2);
            pw.write("<h3>Cookies Added!");
      }
}
```

```
public class srv2 extends HttpServlet {
      public void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            res.setContentType("text/html");
            PrintWriter pw = res.getWriter();
            Cookie c[] = req.getCookies();
            pw.println("<h4> Cookie Name  : Cookie Value   </h4>");
            for (int i = 0; i < c.length; i++) {
                  pw.println(c[i].getName() + " : " + c[i].getValue());
            }
      }
}
```



http://localhost:8080/LoginApp/s1

Cookies Added!



http://localhost:8080/LoginApp/s2

Cookie Name : Cookie Value

name : Satya age : 28

3. Http Session

- HttpSession Object memory **allocates in Server**
- it remembers the client data across the multiple requests in the form of **Session Attribute values**
- Every Session object contains **SessionID, & stored in browser.**
- Session of a browser can be identified by SessionID.

Constrcurors

1. **public HttpSession getSession():**
    - Returns the current session associated with this request
    - If the request does not have a session, creates one.

2. **public HttpSession getSession(boolean create**
    - Returns the current session associated with this request
    - **True** → request does not have a session, creates new session.
    - **False** → request does not have a session, it wont create new session

Methods

- **public String getId()** :Returns a string containing the unique identifier value.
- **public long getCreationTime()** :Returns the time when this session was created
- public long **getLastAccessedTime():**Returns the last time the client sent a
- **public void invalidate():** Invalidates this session then unbinds any objects bound to it.

```
public class srv1 extends HttpServlet {
      public void service(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            res.setContentType("text/html");
            PrintWriter pw = res.getWriter();
            HttpSession ses = req.getSession();
            ses.setAttribute("name", "Ravi");
            ses.setAttribute("city", "HYD");
            pw.write("<h3>Session Added!");
      }
}
```

```
public class srv2 extends HttpServlet {
      public void doGet(HttpServletRequest req, HttpServletResponse res)
throws ServletException, IOException {
            res.setContentType("text/html");
            PrintWriter pw = res.getWriter();
            HttpSession sess =      req.getSession();
            pw.write("Name : "+sess.getAttribute("name"));
            pw.write("City : "+sess.getAttribute("city"));
      }
}
```

Output : Name : Ravi , City : HYD

4. URL Rewriting

In URL rewriting, we append a token or identifier to the URL of the next Servlet or the next resource.

We can send parameter name/value pairs using the following format:

url?name1=value1&name2=value2&??

Advantage of URL Rewriting

- It will always work whether cookie is disabled or not (browser independent).
- Extra form submission is not required on each pages.

Disadvantage of URL Rewriting

- It will work only with links.
- It can send only textual information.
- Not Secure, user can read the information what we are sending

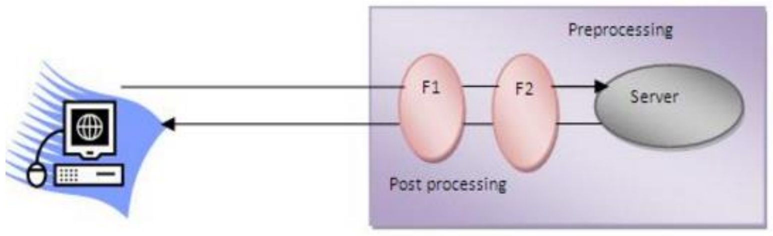
```
<form action="servlet1">
Name:<input type="text" name="userName"/><br/>
<input type="submit" value="go"/>
</form>
```

```
public class FirstServlet extends HttpServlet {

public void doGet(HttpServletRequest request, HttpServletResponse response){

        response.setContentType("text/html");
        PrintWriter out = response.getWriter();

        String n=request.getParameter("userName");
        out.print("Welcome "+n);

        //appending the username in the query string
        out.print("<a href='servlet2?uname="+n+"'>visit</a>");

        out.close();
    }
}
```

```
public class SecondServlet extends HttpServlet {

public void doGet(HttpServletRequest request, HttpServletResponse response)
        response.setContentType("text/html");
        PrintWriter out = response.getWriter();

        //getting value from the query string
        String n=request.getParameter("uname");
        out.print("Hello "+n);
        out.close();
    }
}
```

3.10 Filters

A filter is invoked at the **preprocessing and postprocessing of a request.**



Filter is defined in the web.xml file, if we remove the entry of filter from the web.xml file, filter will be removed automatically and we don't need to change the servlet. So it will be easier to maintain the web application.

Usage of Filter

- recording all incoming requests
- logs the IP addresses of the computers from which the requests originate
- conversion
- data compression
- encryption and decryption
- Input validation etc.

Advantage of Filter

- Filter is pluggable.
- One filter don't have dependency onto another resource.
- Less Maintenance

Filter API

Like servlet filter have its own API.**The javax.servlet** package contains the **3 interfaces**

1. **Filter**
2. **FilterChain**
3. **FilterConfig**

1) Filter interface

For creating any filter, you must implement the Filter interface.Filter interface provides the life cycle methods for a filter.

Method	**Description**
public void init(FilterConfig config)	init() method is invoked only once. It is used to initialize the filter.
Public void doFilter(HttpServletRequest req,HttpServletResponse res, FilterChain chain)	doFilter() method is invoked every time when user request to any resource, to which the filter is mapped.It is used to perform filtering tasks.
public void destroy()	This is invoked only once when filter is taken out of the service.

2) FilterChain interface

The object of FilterChain is responsible to invoke the next filter or resource in the chain.This object is passed in the doFilter method of Filter interface.The FilterChain interface contains only one method:

public void doFilter(HttpServletRequest, HttpServletResponse):
It passes the control to the next filter or resource.

Example

index.html

```
<a href="servlet1">click here</a>
```

```
public class MyFilter implements Filter{

public void init(FilterConfig arg0) throws ServletException {}

public void doFilter(ServletRequest req, ServletResponse resp, FilterChain chain) throws IOException, Serv
letException {

    PrintWriter out=resp.getWriter();
    out.print("filter is invoked before");

    chain.doFilter(req, resp);//sends request to next resource

    out.print("filter is invoked after");
    }
    public void destroy() {}
}
```

```
public class HelloServlet extends HttpServlet {
    public void doGet(HttpServletRequest request, HttpServletResponse response)
            throws ServletException, IOException {

        response.setContentType("text/html");
        PrintWriter out = response.getWriter();

        out.print("<br>welcome to servlet<br>");
    }
}
```

```
<web-app>

<servlet>
<servlet-name>s1</servlet-name>
<servlet-class>HelloServlet</servlet-class>
</servlet>

<servlet-mapping>
<servlet-name>s1</servlet-name>
<url-pattern>/servlet1</url-pattern>
</servlet-mapping>

<filter>
<filter-name>f1</filter-name>
<filter-class>MyFilter</filter-class>
</filter>

<filter-mapping>
<filter-name>f1</filter-name>
<url-pattern>/servlet1</url-pattern>
</filter-mapping>

</web-app>
```

FilterConfig

An object of FilterConfig is created by the web container. This object can be used to get the configuration information from the web.xml file.

1. **public void init(FilterConfig config):** init() method is invoked only once it is used to initialize the filter.
2. **public String getInitParameter(String parameterName):** Returns the parameter value for the specified parameter name.
3. **public java.util.Enumeration getInitParameterNames():** Returns an enumeration containing all the parameter names.
4. **public ServletContext getServletContext():** Returns the ServletContext object

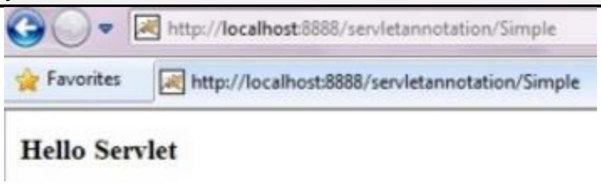
```
<filter>
  <filter-name>f1</filter-name>
  <filter-class>MyFilter</filter-class>
        <init-param>
                <param-name>age</param-name>
                <param-value>27</param-value>
        </init-param>
  </filter>

  <filter-mapping>
  <filter-name>f1</filter-name>
  <url-pattern>/servlet1</url-pattern>
  </filter-mapping>
```

Servlet with Annotation (feature of servlet3):

- Annotation represents the metadata.
- If you use annotation, deployment descriptor (web.xml file) is not required.
- But you should have tomcat7 as it will not run in the previous versions of tomcat.

@WebServlet("/url") annotation is used to map the servlet with the specified name.

```
@WebServlet("/Simple")
public class Simple extends HttpServlet {
    private static final long serialVersionUID = 1L;

    protected void doGet(HttpServletRequest request, HttpServletResponse response)
                        throws ServletException, IOException {


        response.setContentType("text/html");
        PrintWriter out=response.getWriter();

        out.print("<html><body>");
        out.print("<h3>Hello Servlet</h3>");
        out.print("</body></html>");
    }
}
```


http://localhost:8888/servletannotation/Simple
Favorites
http://localhost:8888/servletannotation/Simple

Hello Servlet

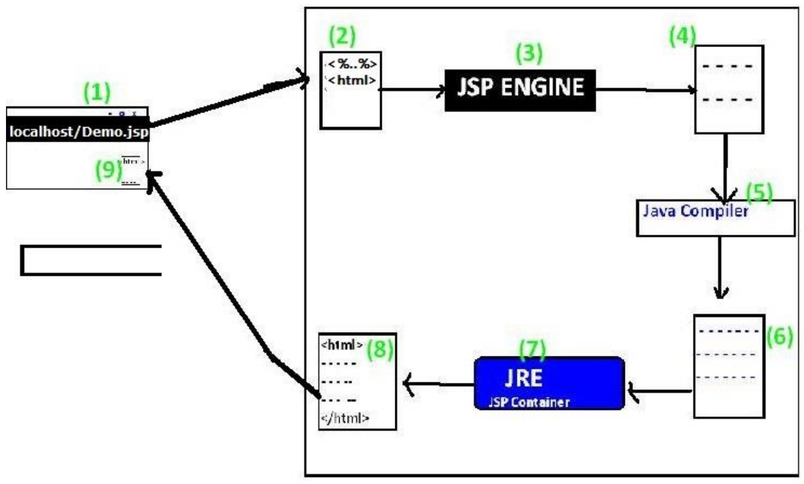
4. JSP

1. JSP Introduction

Features of JSP

- Extension to Servlet
- Easy to maintain
- Fast Development: No need to recompile and redeploy
- Less code than Servlet

JSP Architecure



1.Clinet sends the Rqst from Browser for Demo.jsp

2.JSP is Deployed in server, that is Loaded

3.JSP Engine Converts JSP code [html,DHTML,java script] into approprate 'SERVLET' code

4.'.java' of Servlet Contains Converted code of JSP Tags, and <html> just palced as same.Bcoz Java Compiler cannot under stand <HTML> code

5."JavaCompiler" takes that code and Exicuted

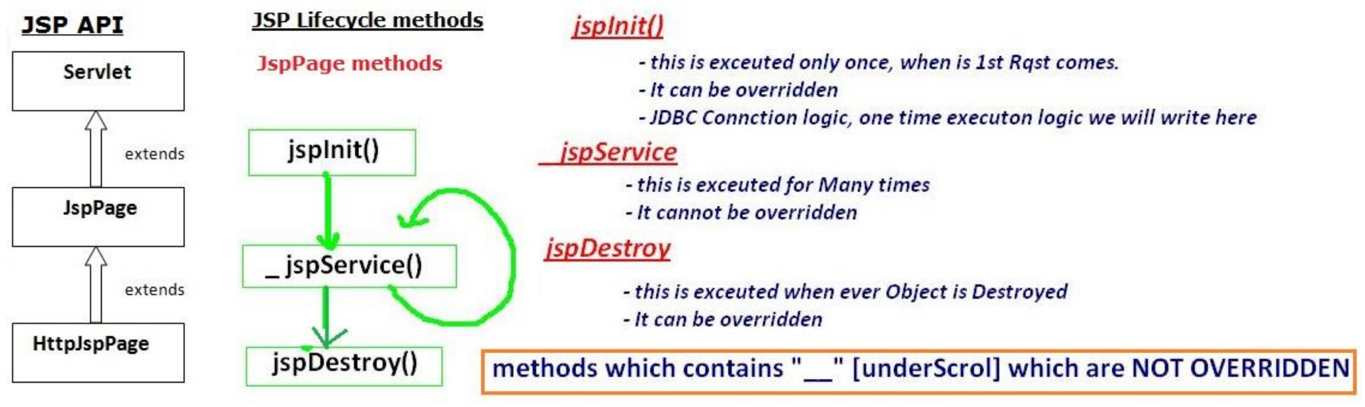
6.'.java' is Converted into ".class" file

7.that '.class' is Taken by JRE and Exicuted

8.That JRE gives Output as <HTML> code, and send to clint

9.the <html> code is exicuted by Browser,and gives Output

JSP Lifecycle



jspInit()
- *this is exceuted only once, when is 1st Rqst comes.*
- *It can be overridden*
- *JDBC Connction logic, one time executon logic we will write here*

_jspService
- *this is exceuted for Many times*
- *It cannot be overridden*

jspDestroy
- *this is exceuted when ever Object is Destroyed*
- *It can be overridden*

methods which contains "__" [underScrol] which are NOT OVERRIDDEN

2. JSP Scriptlets

In JSP, java code can be written inside the jsp page using the scriptlet tag

The scripting elements provides the ability to insert java code inside the jsp. There are three types of scripting elements:

1. **scriptlet tag**
2. **expression tag**
3. **declaration tag**

1. Scriptlet tag

A scriptlet tag is used to execute java source code in JSP. Syntax is as follows:

```
<% java source code %>
```

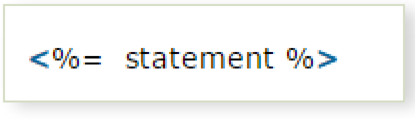
```
<html>
<body>
      <%
            out.print("welcome to jsp");
      %>
</body>
</html>
```

Output: `welcome to jsp`

It is placed in **_JspService ()** method. So method declarations not possible

2. Expression tag

It is mainly used for **printing calculations, print the values of variable or method**. The code placed within JSP expression tag is written to the output stream of the response. So **you need not write out.print () to write data.** Below is the syntax



```
<%=  statement %>
```

```
<html>
<body>
      Date:<%=java.util.Calendar.getInstance().getTime()%>
</body>
</html>
```

```
Date:Thu Sep 22 19:10:14 IST 2016
```

It is placed in **JspInit()** method.

: Do not end your statement with semicolon in case of expression tag.

3. Declaration tag

- The JSP declaration tag is used to **declare fields and methods.**
- Code written inside the jsp declaration tag is placed **outside the service()** method

```
<%!  field or method declaration %>
```

Variable Declaration

```
<html>
<body>
      <%!int data = 50;%>
      <%="Value of the variable is:" + data%>
</body>
</html>
```

Method Declaration

```
<html>
<body>
<%!
      int cube(int n){
            return n*n*n;
      }
%>

<%="Cube of 3 is:" + cube(3)%>
</body>
</html>
```

3. JSP Implicit objects

There are 9 jsp implicit objects. These objects are created by the web container that are available to all the jsp pages.

Object	Type
out	JspWriter
request	HttpServletRequest
response	HttpServletResponse
config	ServletConfig
application	ServletContext
session	HttpSession
pageContext	PageContext
page	Object
exception	Throwable

Index.jsp

```
<%
out.print("1.welcome to jsp");

String name=request.getParameter("a");
out.print("<br> 2.Request :"+name);

response.sendRedirect("http://www.google.com");
out.print("3.Responce :  ");

String cfg=config.getInitParameter("config");
out.print("<br> 4.Config ="+cfg);

String cxt=application.getInitParameter("context");
out.print("<br> 5.Application ="+cfg);

session.setAttribute("user","Satya");
out.print("<br> 6.Session ="+session.getAttribute("user"));
%>
```

```
<web-app>
	<servlet>
		<servlet-name>jsp</servlet-name>
		<jsp-file>/index.jsp</jsp-file>
		<init-param>
			<param-name>config</param-name>
			<param-value>iam Config Value</param-value>
		</init-param>
	</servlet>

	<servlet-mapping>
		<servlet-name>jsp</servlet-name>
		<url-pattern>/jsp</url-pattern>
	</servlet-mapping>

	<context-param>
		<param-name>context</param-name>
		<param-value>iam Context Value</param-value>
	</context-param>

</web-app>
```

7) pageContext implicit object

The pageContext object can be used to **set, get or remove attributes** from one of the following scopes:

• **Page**	→	PageContext.PAGE_SCOPE
• **Request**	→	PageContext.REQUEST_SCOPE
• **Session**	→	PageContext.SESSION_SCOPE
• **Application**	→	PageContext.APPLICATION_SCOPE

pageContext.setAttribute("name",” value”,PageContext.SESSION_SCOPE);

first.jsp

```
<html>
<body>
<%

String name=request.getParameter("uname");
out.print("Welcome "+name);

pageContext.setAttribute("user",name,PageContext.SESSION_SCOPE);

<a href="second.jsp">second jsp page</a>

%>
</body>
</html>
```

Second.jsp

```
<html>
<body>
<%
        String name=(String)pageContext.getAttribute("user",PageContext.SESSION_SCOPE);
        out.print("Hello "+name);
%>
</body>
</html>
```

8. Page implicit object

Page is an implicit object of type **Object class**

9. Exception

- Exception is an implicit object of type java.lang.Throwable class.
- This object can be used to print the exception.
- it can only be used in error pages

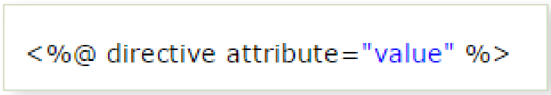
```
<%@ page isErrorPage="true" %>
<html>
<body>

Sorry following exception occured:<%= exception %>

</body>
</html>
```

4. JSP Directives

The jsp directives are messages that tells the web container how to translate a JSP page into the corresponding servlet.

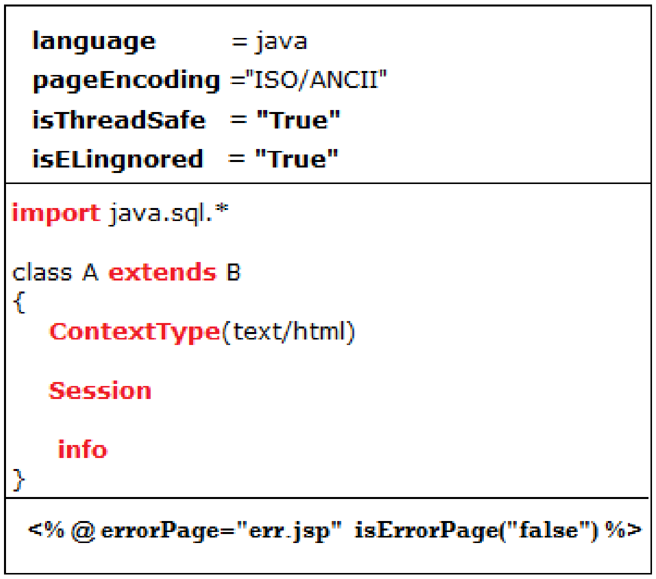
There are three types of directives:

1. **page directive**
2. **include directive**
3. **taglib directive**



```
<%@ directive attribute="value" %>
```

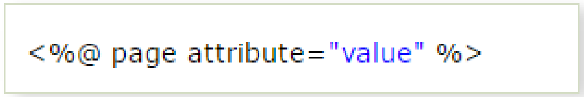
1. Page Directive



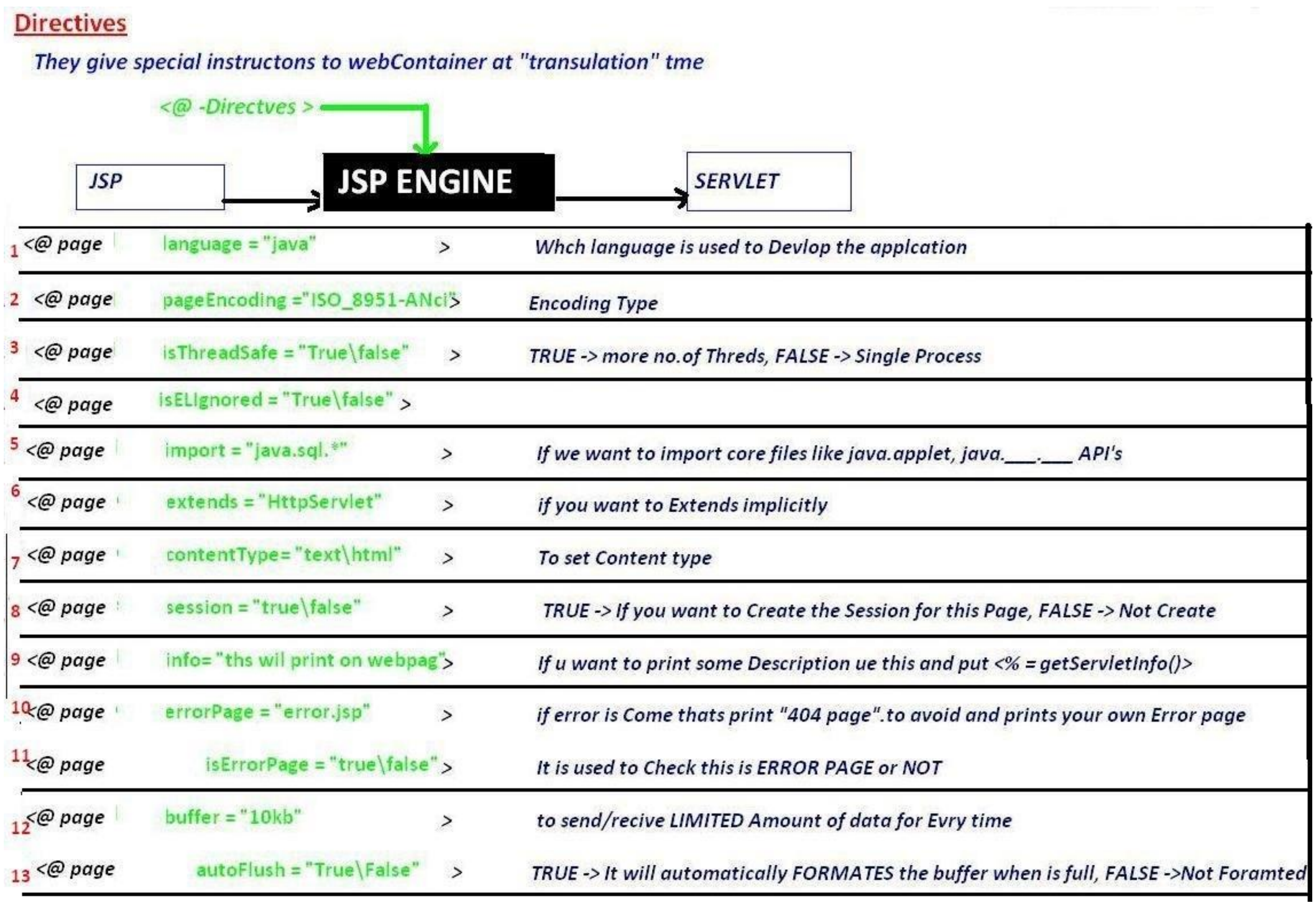
```
language        = java
pageEncoding  ="ISO/ANCII"
isThreadSafe    = "True"
isELingnored   = "True"
```

```
import java.sql.*

class A extends B
{
   ContextType(text/html)

   Session

    info
}
```

```
<% @ errorPage="err.jsp"  isErrorPage("false") %>
```



```
<%@ page attribute="value" %>
```



Directives

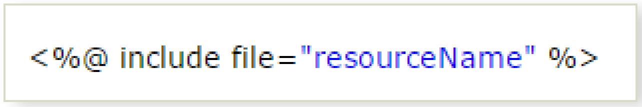
They give special instructons to webContainer at "transulation" tme

1	<@ page	language = "java" >	Whch language is used to Devlop the applcation
2	<@ page	pageEncoding ="ISO_8951-ANci">	Encoding Type
3	<@ page	isThreadSafe = "True\false" >	TRUE -> more no.of Threds, FALSE -> Single Process
4	<@ page	isELIgnored = "True\false" >	
5	<@ page	import = "java.sql.*" >	If we want to import core files like java.applet, java.___.___ API's
6	<@ page	extends = "HttpServlet" >	if you want to Extends implicitly
7	<@ page	contentType= "text\html" >	To set Content type
8	<@ page	session = "true\false" >	TRUE -> If you want to Create the Session for this Page, FALSE -> Not Create
9	<@ page	info= "ths wil print on webpag">	If u want to print some Description ue this and put <% = getServletInfo()>
10	<@ page	errorPage = "error.jsp" >	if error is Come thats print "404 page".to avoid and prints your own Error page
11	<@ page	isErrorPage = "true\false" >	It is used to Check this is ERROR PAGE or NOT
12	<@ page	buffer = "10kb" >	to send/recive LIMITED Amount of data for Evry time
13	<@ page	autoFlush = "True\False" >	TRUE -> It will automatically FORMATES the buffer when is full, FALSE ->Not Foramted

```
<%@ page language="java" %>
<%@ page pageEncoding="ISO-8859-1"%>
<%@ page isELIgnored="false"%>
<%@ page isThreadSafe="true"%>
<%@ page errorPage="err.jsp" isErrorPage="false"%>
<%@ page import="java.lang.*"%>
<%@ page extends="java.lang.Object"%>
<%@ page contentType="text/html"%>
<%@ page session="true"%>
<%@ page info="Some Info Print on web page"%>
<%@ page buffer="8kb"%>
<%@ page autoFlush="true"%>
```

2. include directive

The include directive is used to include the contents of any resource it may be jsp file, html file or text file. The include directive includes the original content of the included resource at page translation time (The jsp page is translated only once so it will be better to include static resource).



```
<%@ include file="resourceName" %>
```

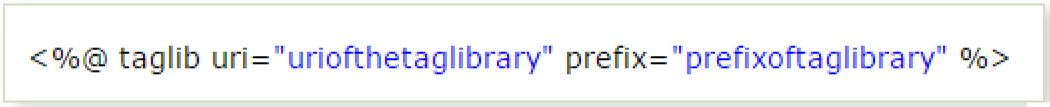
In this example, we are including the content of the header.html file. To run this example you must create a header.html file.

```
<html>
<body>

<%@ include file="header.html" %>

Today is: <%= java.util.Calendar.getInstance().getTime() %>

</body>
</html>
```

The include directive includes the original content, so the actual page size grows at runtime.

3. TagLib directive

- The JSP taglib directive is used to define a tag library that defines many tags.
- We use the TLD (Tag Library Descriptor) file to define the tags.
- We can insert custom tags by using this.



```
<%@ taglib uri="uriofthetaglibrary" prefix="prefixoftaglibrary" %>
```

```
<html>
<body>
<%@ taglib uri="http://www.javatpoint.com/tags" prefix="mytag" %>
<mytag:currentDate/>
</body>
</html>
```

5. JSP Action Tags

The action tags are used to control the flow between pages and to use Java Bean. The Jsp action tags are given below.

JSP Action Tags	Description
jsp:forward	Forwards the request and response to another resource.
jsp:include	Includes another resource.
jsp:param	Sets the parameter value. It is used in forward and include mostly.
jsp:useBean	Creates or locates bean object.
jsp:setProperty	Sets the value of property in bean object.
jsp:getProperty	Prints the value of property of the bean.
jsp:plugin	Embeds another components such as applet.
jsp:fallback	Can be used to print the message if plugin is working. It is used in jsp: plugin.

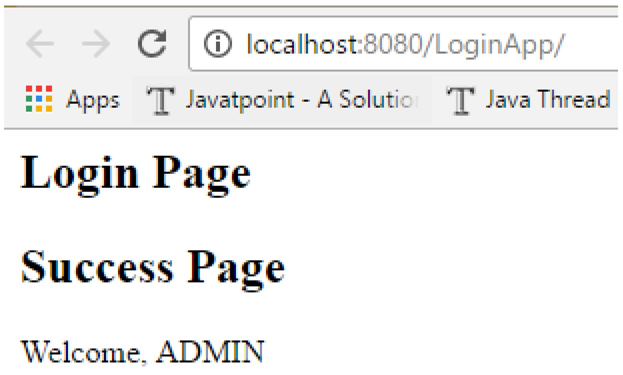
Forward, include, param example

Login.jsp

```
<h2>Login Page</h2>

<jsp:include page="Success.jsp">
      <jsp:param name="uname" value="ADMIN" />
      <jsp:param name="pwd" value="admin" />
</jsp:include>
```

Success.jsp

```
<h2>Success Page</h2>
 Welcome, <%= request.getParameter("uname")  %>
```



Login Page

Success Page

Welcome, ADMIN

Similarly we can use for <jsp:forward> also

UserBean Example

1. First we have choose the Input values for the Login page

```
<form action="set.jsp" method="post">
      Email <input type="text" name="email"><br>
      Pass  <input type="text" name="pwd"><br>
      <input type="submit" value="Login"><br>
</form>
```

2. We have to create UserBean class as per Input page parameters (email, pwd)

```
public class UserBean {
        String email;
        String pwd;
        public String getEmail() {
                return email;
        }
        public void setEmail(String email) {
                this.email = email;
        }
        public String getPwd() {
                return pwd;
        }
        public void setPwd(String pwd) {
                this.pwd = pwd;
        }
}
```

3. UserBean will set the values automatically by comparing property names

```
<jsp:useBean id="user" class="demo.UserBean">
   <jsp:setProperty name="user" property="email"/>
    <jsp:setProperty name="user" property="pwd"/>
</jsp:useBean>

<h3>getProperty Details</h3>
<jsp:getProperty name="user" property="email" /><br>
<jsp:getProperty name="user" property="pwd" /><br>
```

Here **name** is Object of bean class. & **propery** is the userbean property names

Output

```
getProperty Details
satyajohnny1@gmail.com
qw
```

jsp:plugin, jsp:fallbacks

The **jsp:plugin** action tag is used to embed applet in the jsp file.

<jsp:plugin height="500" width="500" type="applet" code="MouseDrag.class" **/>**

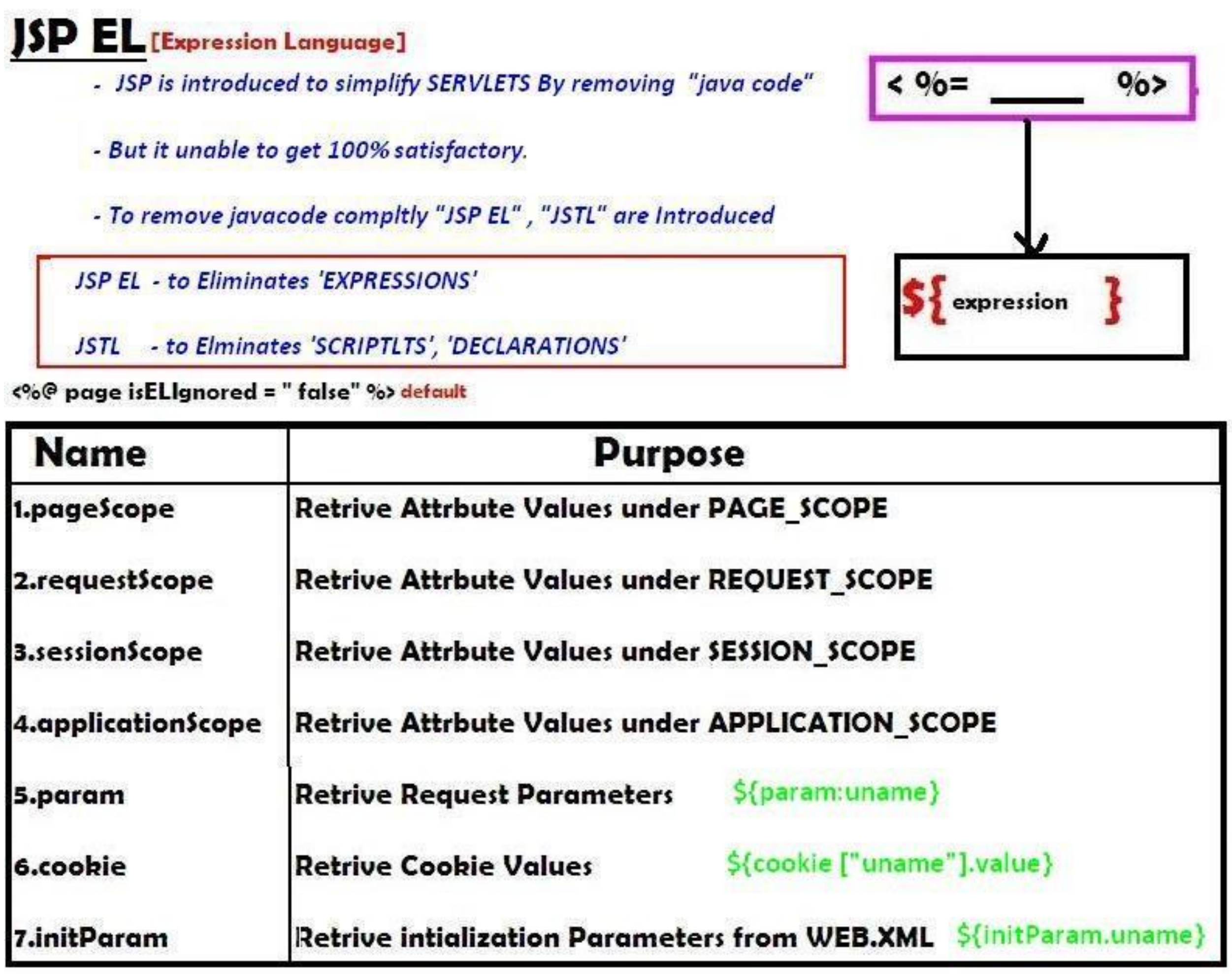
jsp:fallback action tag is used to display some message if Applet is not loading

<jsp:fallback>

<p> Unable to start plugin </p>

</jsp:fallback>

6. JSP EL (JSP Expression Language)



JSP EL [Expression Language]

- JSP is introduced to simplify SERVLETS By removing "java code"
- But it unable to get 100% satisfactory.
- To remove javacode compltly "JSP EL" , "JSTL" are Introduced

JSP EL - to Eliminates 'EXPRESSIONS'

JSTL - to Elminates 'SCRIPTLTS', 'DECLARATIONS'

<%= ______ %>

${ expression }

<%@ page isELIgnored = " false" %> default

Name	Purpose
1.pageScope	Retrive Attrbute Values under PAGE_SCOPE
2.requestScope	Retrive Attrbute Values under REQUEST_SCOPE
3.sessionScope	Retrive Attrbute Values under SESSION_SCOPE
4.applicationScope	Retrive Attrbute Values under APPLICATION_SCOPE
5.param	Retrive Request Parameters ${param:uname}
6.cookie	Retrive Cookie Values ${cookie ["uname"].value}
7.initParam	Retrive intialization Parameters from WEB.XML ${initParam.uname}

It simplifies for retrieving following types values mainly

1. **Request Paramters** → **req.getParamter("")**
2. **Init Patamter values** → **getInitParameter("")**
3. **Attribute Values** → **getAttribute("") in 4 scopes**
4. **Cookie values** → **getCookie("")**

```
<form action="jspel.jsp" method="post">
        Name <input type="text" name="name"><br>
        <input type="submit" value="Login"><br>
        <%
        session.setAttribute("pwd", "123456");
        %>
</form>
```

Jspel.jsp

```
Name :    ${ param.name }
Session: ${sessionScope.pwd}
```

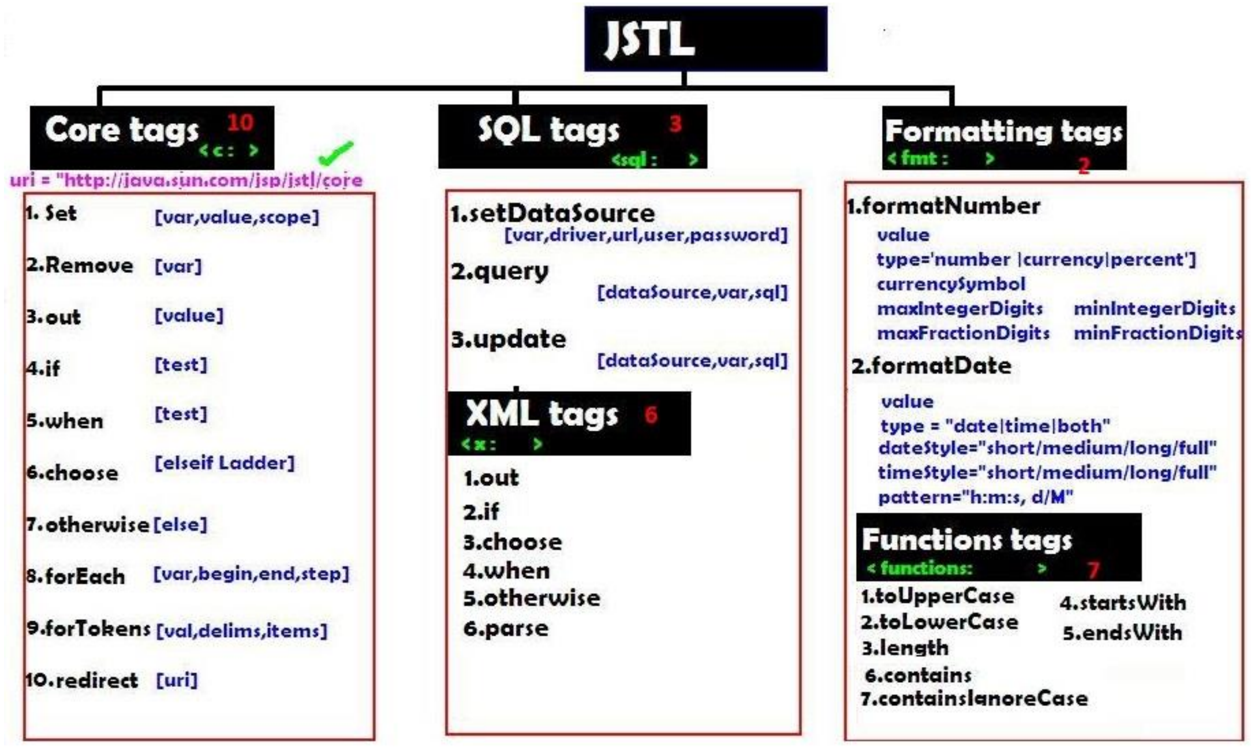
```
Name : Satya Session: 123456
```

7. JSP - Standard Tag Library (JSTL)

- JSP Standard Tag Library (JSTL) is a standard library of readymade tags.
- The JSTL contains several tags already implemented common functionalities.
- JSTL is external tags it is not come by default with JDK.we have to download jstl.jar seperatly and placed in **lib/** folder

The JSTL tags can be classified, according to their functions, into following JSTL tag library groups that can be used when creating a JSP page:

1.	**Core Tags**	**→ used for import,if, foreach loops**
2.	**Formatting tags**	**→ used for formatting text, Date,number,URLencoding**
3.	**SQL tags**	**→ Used for SQL operations like INSERT,SELECT., etc**
4.	**XML tags**	**→ provides support for XML processing**
5.	**JSTL Functions**	**→ provides support for string manipulation.**


JSTL
Core tags 10 <c: >
uri = "http://java.sun.com/jsp/jstl/core
1. Set [var,value,scope]
2.Remove [var]
3.out [value]
4.if [test]
5.when [test]
6.choose [elseif Ladder]
7.otherwise [else]
8.forEach [var,begin,end,step]
9.forTokens [val,delims,items]
10.redirect [uri]
SQL tags 3 <sql : >
1.setDataSource [var,driver,url,user,password]
2.query [dataSource,var,sql]
3.update [dataSource,var,sql]
XML tags 6 <x: >
1.out
2.if
3.choose
4.when
5.otherwise
6.parse
Formatting tags <fmt : > 2
1.formatNumber
value
type='number |currency|percent']
currencySymbol
maxIntegerDigits minIntegerDigits
maxFractionDigits minFractionDigits
2.formatDate
value
type = "date|time|both"
dateStyle="short/medium/long/full"
timeStyle="short/medium/long/full"
pattern="h:m:s, d/M"
Functions tags < functions: > 7
1.toUpperCase
2.toLowerCase
3.length
4.startsWith
5.endsWith
6.contains
7.containsIgnoreCase

1. core tags

we have to attach jstl/core url at the top of the jsp as below

```
<%@ taglib uri="http://java.sun.com/jsp/jstl/core" prefix="c" %>
```

```
<%@ taglib uri="http://java.sun.com/jsp/jstl/core" prefix="c" %>
<c:set var="salary" scope="session" value="${2000*2}"/>
Salary : <c:out value="${salary}"/>

<c:if test="${salary > 2000}">
   <p>My salary is: <c:out value="${salary}"/><p>
</c:if>
```

```
<!-- it is like if-else loop -->
<c:choose>
    <c:when test="${salary <= 0}">
       Salary is very low to survive.
    </c:when>
    <c:when test="${salary > 1000}">
        Salary is very good.
    </c:when>
    <c:otherwise>
        No comment sir...
    </c:otherwise>
</c:choose>

<!-- it is mainly used on Number prints[1,2,3,4,5]-->
<c:forEach var="i" begin="1" end="5">
   <c:out value="${i}"/><p>
</c:forEach>

<!-- it is mainly used on String-->
<c:forTokens items="Zara,nuha,roshy" delims="," var="name">
   <c:out value="${name}"/><p>
</c:forTokens>

<c:remove var="salary"/>
<br>Salary : <c:out value="${salary}"/>
```

2. SQL Tags

```
<sql:setDataSource var="con" driver="com.mysql.jdbc.Driver"
     url="jdbc:mysql://localhost/TEST"
     user="root"  password="pass123"
<sql:setDataSource/>


<sql:update dataSource="${con}" var="count">
   INSERT INTO Employees VALUES (104, 2, 'Nuha', 'Ali');
</sql:update>


<sql:query dataSource="${snapshot}" var="result">
   SELECT * from Employees;
</sql:query>


<c:forEach var="row" items="${result.rows}">
        <tr>
        <td><c:out value="${row.id}"/></td>
        <td><c:out value="${row.first}"/></td>
        <td><c:out value="${row.last}"/></td>
        <td><c:out value="${row.age}"/></td>
        </tr>
</c:forEach>
```

3. Formatting Tags

```
<h3> Format Number:</h3>
<c:set var="balance" value="120000.2309" />
<p>Cuurency <fmt:formatNumber value="${balance}" type="currency"/></p>
<p>Integr<fmt:formatNumber type="number" maxIntegerDigits="3" value="${balance}" />


<h3> Format Date:</h3>
<c:set var="now" value="<%=new java.util.Date()%>" />
<p>Only Time <fmt:formatDate type="time"  value="${now}" /></p>
<p>Only Date <fmt:formatDate type="date"  value="${now}" /></p>
<p>Time+Date <fmt:formatDate type="both"  value="${now}" /></p>
```

4. Function Tags (String Operations)

```
<c:set var="str" value="I am a test String"/>

<c:set var="lowStr" value="${fn:toLowerCase(string1)}" />

<c:set var="uprStr" value="${fn:toUpperCase(string1)}" />

<p>Length: ${fn:length(str)}</p>
```

8. JSP Custom Tags

For creating any custom tag, we need to follow following steps:

1. **Create the Tag handler class** (.java)
2. **Create the Tag Library Descriptor (TLD) file** and define tags**(.tld)**
3. **Create the JSP file that uses the Custom tags (.JSP)**

1.Create the Tag handler class (.java)

- To create the Tag Handler, we are inheriting the **TagSupport class**
- And override **doStartTag().**
- To write data for the jsp, we need to use the **JspWriter** class.its like res.getWriter()
- **PageContext** class provides **getOut()** method that returns **JspWriter** instance
- These classes are not Default with servlet-api.we have to download jsp-api.jar

```
public class MyTag extends TagSupport{

        public int doStartTag() throws JspException
        {
           JspWriter out=pageContext.getOut();//returns the instance of JspWriter
           out.print(Calendar.getInstance().getTime());//printing date using JspWriter
            return SKIP_BODY;//will not evaluate the body content of the tag
        }
}
```

2. Create the Tag Library Descriptor (TLD) file and define tags(.tld)

Tag Library Descriptor (TLD) file contains information of tag and Tag Hander classes. It must be contained inside the **WEB-INF** directory.

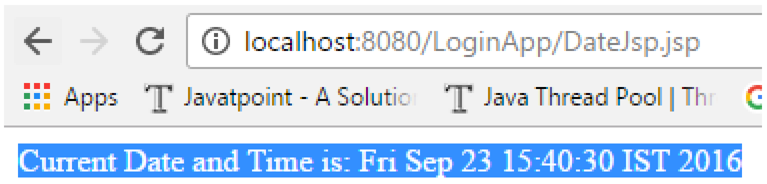
mytag.tld

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
<!DOCTYPE taglib
        PUBLIC "-//Sun Microsystems, Inc.//DTD JSP Tag Library 1.2//EN"
    "http://java.sun.com/j2ee/dtd/web-jsptaglibrary_1_2.dtd">

<taglib>
      <tlib-version>1.0</tlib-version>
      <jsp-version>1.2</jsp-version>
      <short-name>simple</short-name>
      <uri>http://tomcat.apache.org/example-taglib</uri>
      <tag>
            <name>today</name>
            <tag-class>demo.MyTag</tag-class>
      </tag>
</taglib>
```

3. Create the JSP file that uses the Custom tags (.JSP)

DateJsp.jsp

```
<%@ taglib uri="WEB-INF/mytag.tld" prefix="m" %>
Current Date and Time is: <m:today/>
```



```
Current Date and Time is: Fri Sep 23 15:40:30 IST 2016
```

### 5. Webservices

By using webservices we can communicate different applications on different platforms. For example java application in Windows platform can easily communicate with the application developed using .net/php in Linux operation system.

Web Services are mainly of 2 types,

1. **SOAP [Simple Object Access Protocol]**
2. **REST [Representational state transfer]**

1. SOAP [Simple Object Access Protocol]

SOAP stands for Simple Object Access Protocol. **SOAP is an XML based** industry standard protocol for designing and developing web services. **Since it's XML based, its platform and language independent.** So our Service can be based on JAVA and client can be on .NET, PHP etc. and vice versa. **SOAP gives the output only in XML format**

We have following API's to implement SOAP Webservices in our java applications

- **JAX-WS**
- **Apache Axis2**

- **URI - Uniform Resource Identitier**
- **URL - Uniform Resource Link**

2. REST [Representational state transfer]

- What ever the data/response we will get from the server is known as **Resource**.

- Each resource can be accessed by its URI's.

- We can get the resource from RESTful service in different formats like, **HTML, XML, JSON, TEXT, PDF** and in the **Image formats** as well, **but in real time we mainly we will prefer JSON.**

- REST guidelines always talks about stateless communication between client and the Server. Stateless means, every single request from client to server will be considered as a fresh request. Because of this reason REST always prefers to choose HTTP as it a stateless protocol

We have following API's to implement RESTful Webservices in our java applications

- **JAX-RS**

Apache CXF provides implementation for SOAP and RESTful services both.

REST is a style of software architecture. RESTful is typically used to refer to web services implementing such an architecture

No.	SOAP	REST
1)	SOAP is a **protocol**.	REST is an **architectural style**.
2)	SOAP stands for **Simple Object Access Protocol**.	REST stands for **REpresentational State Transfer**.
3)	SOAP **can't use REST** because it is a protocol.	REST **can use SOAP** web services because it is a concept and can use any protocol like HTTP, SOAP.
4)	SOAP **uses services interfaces to expose the business logic**.	REST **uses URI to expose business logic**.
5)	**JAX-WS** is the java API for SOAP web services.	**JAX-RS** is the java API for RESTful web services.
6)	SOAP **defines standards** to be strictly followed.	REST does not define too much standards like SOAP.
7)	SOAP **requires more bandwidth** and resource than REST.	REST **requires less bandwidth** and resource than SOAP.
8)	SOAP **defines its own security**.	RESTful web services **inherits security measures** from the underlying transport.
9)	SOAP **permits XML** data format only.	REST **permits different** data format such as Plain text, HTML, XML, JSON etc.
10)	SOAP is **less preferred** than REST.	REST **more preferred** than SOAP.

1.1 SOAP [Simple Object Access Protocol

Simple Object Access Protocol (SOAP) is a standard protocol specification for message exchange based on XML. Communication between the web service and client happens using XML messages.

A simple web service architecture has two components

1. **Client**
2. **Service provider**

To communicate clinet with service provider clinet must know about following things

- Location of WebServices Server
- Functions available, signature and return types of function.
- Communication protocol
- Input output formats

Service provider will create a standard XML file which will have all above information. So if this XML file is given to client, then client will be able to access web service. **This XML file is called "WSDL"**.

WSDL (Web Services Description Language):
WSDL stands for **Web Service Description Language**. It is **an XML file that describes the technical details** of how to implement a web service, more specifically the **URI, port, method names, arguments, and data types**. Since WSDL is XML, it is both human-readable and machine-consumable.

Using this WSDL file we can understand things like,

- Port / Endpoint – URL of the web service
- Input message format
- Output message format
- Security protocol that needs to be followed
- Which protocol the webservice uses?

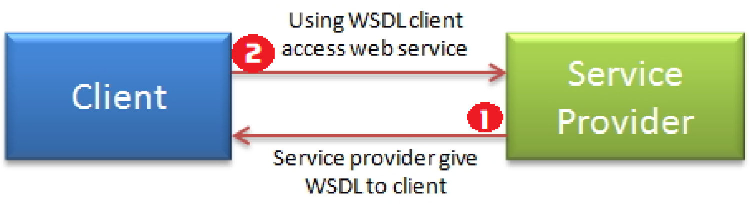
How to access web service:

There are two ways to access web service

1. **If Service provider knows client**
2. **If Service provider register its WSDL to UDDI and client can access it from UDDI**

1. If Service provider knows client

If Service provider knows client, then it will provide its **wsdl** to client and client will be able to access web service.

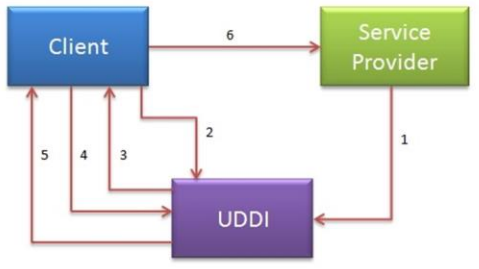

Using WSDL client access web service
2
Client
Service Provider
1
Service provider give WSDL to client

(If Service provider knows client)

2. If Service provider register its WSDL to UDDI and client can access it from UDDI

Service provider register its WSDL to UDDI and client can access it from UDDI:
UDDI stands for **Universal Description, Discovery and Integration**.It is a directory service. Web services can register with a UDDI and make themselves available through it for discovery. So following steps are involved.

1. ***Service provider registers with UDDI.***
2. ***Client searches for service in UDDI.***
3. ***UDDI returns all service providers offering that service.***
4. ***Client chooses service provider***
5. ***UDDI returns WSDL of chosen service provider.***
6. ***Using WSDL of service provider, client accesses web service***



UDDI:

- UDDI is an XML-based standard for describing, publishing, and finding web services.
- UDDI is a specification for a distributed registry of web services

A business or a company can register three types of information into a UDDI registry. This information is contained in three elements of UDDI.

These three elements are:

1. **White Pages**: Basic information about the company and its business
2. **Yellow Pages**: contain more details about the company
3. **Green Pages**: contains technical information about a web service (url locations etc)

1.2 REST [Representation State Transfer]

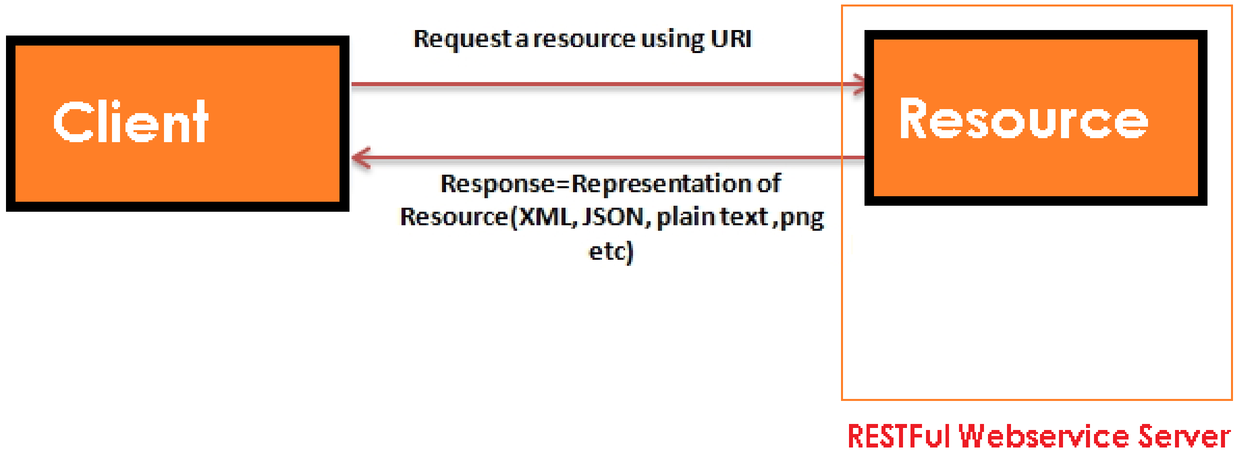
REpresentational State Transfer (REST) is a stateless client-server architecture in which the web services are viewed as **resources** and can **be identified by their URIs.** Web service clients that want to use these resources access via globally defined set of remote methods that describe the action to be performed on the resource.

It consists of two components

1. **REST server:** which provides access to the resources
2. **REST client** : which accesses and modify the REST resources.

In the REST architecture style, clients and servers exchange result representations of resources by using a standardized interface and protocol.**REST isn't protocol specific, but when people talk about REST they usually mean REST over HTTP.**

The response from server is considered as the result representation of the resources. This result representation can be generated from one resource or more number of resources. REST allows that resources have different result representations, **e.g.xml, json etc**. The rest client can ask for specific result representation via the HTTP protocol


Client
Request a resource using URI
Resource
Response=Representation of Resource(XML, JSON, plain text ,png etc)
RESTFul Webservice Server

HTTP methods:

RESTful web services use HTTP protocol methods for the operations they perform.

Methods are:

- **GET**: It defines a reading access of the resource without side-effects. This operation is idempotent i.e. they can be applied multiple times without changing the result
- **PUT**: It is generally used for updating resouce. It must also be idempotent.
- **DELETE:** It removes the resources. The operations are idempotent i.e. they can get repeated without leading to different results.
- **POST**: It is used for creating a new resource. It is not idempotent.

Idempotent

Idempotent means result of multiple successful request will not change state of resource, after initial application

For example:
GET is idempotent. If Delete() is idempotent method because when you first time use delete, it will delete the resource (initial application) but after that, all other request will have no result(same result) because resource is already deleted.

Post is not idempotent method because when you use post to create resource, it will keep creating resource for each new request, so result of multiple successful request will not be same.

Some important features of Restful web services are:

1.Resource identification through URI:Resources are identified by their URIs (typically links on internet). So, a client can directly access a RESTful Web Services using the URIs of the resources (same as you put a website address in the browser's address bar and get some representation as response).

2.Uniform interface: Resources are manipulated using a fixed set of four create, read, update, delete operations: PUT, GET, POST, and DELETE.

3.Client-Server: A clear separation concerns is the reason behind this constraint. Separating concerns between the Client and Server helps improve portability in the Client and Scalability of the server components.

4.Stateless: each request from client to server must contain all the information necessary to understand the request, and cannot take advantage of any stored context on the server.

5.Cache: to improve network efficiency responses must be capable of being labeled as cacheable or non-cacheable.

6.Named resources - the system is comprised of resources which are named using a URL.

7.Interconnected resource representations - the representations of the resources are interconnected using URLs, thereby enabling a client to progress from one state to another.

8.Layered components - intermediaries, such as proxy servers, cache servers, gateways, etc, can be inserted between clients and resources to support performance, security, etc.

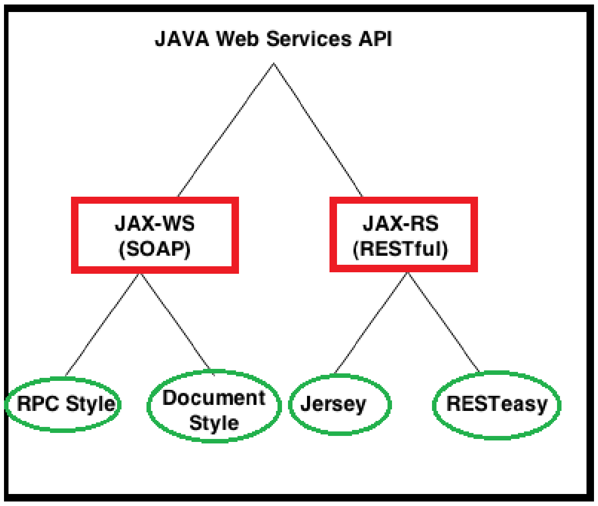
9.Self-descriptive messages: Resources are decoupled from their representation so that their content can be accessed in a variety of formats, such as HTML, XML, plain text, PDF, JPEG, JSON, and others.

1.3 Java Web Services API

There are two main API's defined by Java for developing web service applications since JavaEE 6.

1. **JAX-WS:** for SOAP web services. The **are 2 ways to write JAX-WS** application code: by
    - i. ***RPC style***
    - ii. ***Document style.***

2. **JAX-RS:** for RESTful web services. There are **mainly 2 implementations** currently in use for creating **JAX-RS** application:
    - i. ***Jersey***
    - ii. ***RESTeasy***.



We have some other RESTFul webservices providers like

- ***Jersey***
- ***RestEasy***
- ***Restlet***
- ***CFX***
- ***Spring Rest webservices***

2. JAX-WS (SOAP web services)

SOAP stands for Simple Object Access Protocol. It is a XML-based protocol for accessing web services.

SOAP is a W3C recommendation for communication between two applications.

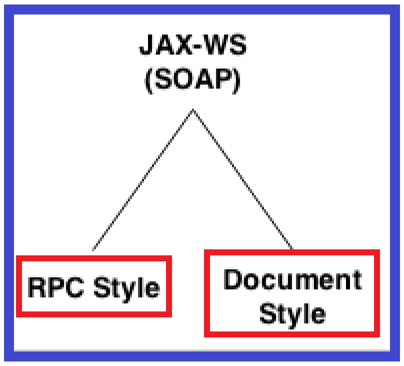
SOAP is XML based protocol. It is platform independent and language independent. By using SOAP, you will be able to interact with other programming language applications.

Advantages of Soap Web Services

- **WS Security**: SOAP defines its own security known as WS Security.
- **Language and Platform independent**: SOAP web services can be written in any programming language and executed in any platform

There are two ways to develop JAX-WS example.

1. **RPC style**
2. **Document style**



There are two encoding use models that are used to translate a WSDL binding to a SOAP message. They are: **literal, and encoded.**

The combination of the different style and use models give us four different ways to translate a WSDL binding to a SOAP message.

```
Document/literal
Document/encoded
RPC/literal
RPC/encoded
```

When using a literal use model, the body contents should conform to a user-defined **XML-schema (XSD) structure**. The advantage is two-fold. For one, you can validate the message body with the user-defined XML-schema, moreover, you can also transform the message using a transformation language like XSLT.

With a (SOAP) encoded use model, the message has to use XSD datatypes, but the structure of the message need not conform to any user-defined XML schema. This makes it difficult to validate the message body or use XSLT based transformations on the message body.

2.1 Diffrence between RPC-Style and Document Style

The way of generating SOAP message formate is main difffrence beteween them.

1. RPC Stlye:
SOAP Body must conform to a structure that indicates the **method name & Parameters name**

```
<soap:envelope>
    <soap:body>
        <myMethod>
            <x xsi:type="xsd:int">5</x>
            <y xsi:type="xsd:float">5.0</y>
        </myMethod>
    </soap:body>
</soap:envelope>
```

2. Document Style
SOAP Body can be structurted in any way you like. their is no TYPE attribute here

```
<soap:envelope>
    <soap:body>
        <xElement>5</xElement>
        <yElement>5.0</yElement>
    </soap:body>
</soap:envelope>
```

2.2 JAX-WS Annotations

We have following important annonotations in order to workwith JAX-WS webservices. They are

1. **@WebService**
2. **@SoapBinding**
3. **@WebMethod**
4. **@WebResult**
5. **@WebServiceClient**
6. **@RequestWrapper**
7. **@ResponseWrapper**
8. **@Oneway**
9. **@HandlerChain**

1.@WebService

This annotation can be used in 2 ways

1. To mark the class as the implementing the Web Service

```
Package webservice;

import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.jws.soap.SOAPBinding;
import javax.jws.soap.SOAPBinding.Style;

@WebService
@SOAPBinding(style=Style.RPC)
public interface HelloWorld {
        @WebMethod
        String getHelloworldMessage(String msg);
}
```

2. Defining a Web Service Interface (SEI), in other words Service Endpoint Interface

```
import javax.jws.WebService;

@WebService(endpointInterface="webservice.HelloWorld ")
public class HelloWorldImpl implements HelloWorld{
        @Override
        public String getHelloworldMessage (String name) {
                return "Hello World JAX-WS " + name;
        }
}
```

@Webservice with all attributes as below formate

```
@WebService(portName = "SoapPort", serviceName = " HelloWorld ",
 targetNamespace = "http://apache.org/hello_world_soap_http",
 endpointInterface="webservice.HelloWorld ")
```

2.@SoapBinding

This annotation is used to specify the SOAP messaging style which can either be **RPC** or **DOCUMENT**

```
/Service Endpoint Interface
@WebService
@SOAPBinding(style = Style.RPC)
//@SOAPBinding(style = Style. DOCUMENT)
public interface HelloWorld{
        @WebMethod
        String getHelloWorldAsString(String name);
}
```

@SoapBinding with all attributes as below formate

```
@SOAPBinding(style=SOAPBinding.Style.DOCUMENT,
             use=SOAPBinding.Use.LITERAL,
             parameterStyle=SOAPBinding.ParameterStyle.WRAPPED)
```

3.@WebMethod

@WebMethod JAX-WS annotation can be applied over a method only. This specified that the method represents a web service operation.it will be used in Interface (***Service Endpoint Interface***) level method only, not in implementation method level.()

```
/Service Endpoint Interface
@WebService
public interface HelloWorld{
        @WebMethod
        String getHelloWorldAsString(String name);
}
```

@WebMethod with all attributes as below formate

```
@WebMethod(operationName="echoComplexType", action=" SOAPAction")
```

4.@WebResult

@WebResult can be used to determine **what the generated WSDL shall look like**

```
@WebService
public interface HelloWorld{
@WebMethod
@WebResult(partName="Helloworld Method")
String getHelloWorldAsString(String name);
}
```

```
//Service Implementation
@WebService(endpointInterface = "com.mkyong.ws.HelloWorld")
public class HelloWorldImpl implements HelloWorld{
        @Override
        public String getHelloWorldAsString(String name) {
                return "Hello World JAX-WS " + name;
        }
}
```

```
public class WSPublisher {
        public static void main(String[] args) {
                Endpoint.publish("http://127.0.0.1:9999/ctf", new getHelloWorldAsString ());
        }
}
```

On publishing the generated WSDL (at URL: `http://127.0.0.1:9999/ctf?wsdl`) would be like:

```
<definitions
        xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd"
        xmlns:wsp="http://www.w3.org/ns/ws-policy"
xmlns:wsp1_2="http://schemas.xmlsoap.org/ws/2004/09/policy"
        xmlns:wsam="http://www.w3.org/2007/05/addressing/metadata"
xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
        xmlns:tns="http://webresult.jaxWsAnnotations.examples.SatyaCodes.com/"
        xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns="http://schemas.xmlsoap.org/wsdl/"
        targetNamespace="http://webresult.jaxWsAnnotations.examples.SatyaCodes.com/"
        name="WSAnnotationsWebResultImplService">
        <types />
        <message name=" getHelloWorldAsString ">
                <part name="arg0" type="xsd: string " />
        </message>
        <message name=" Helloworld Method ">
                <part name=" getHelloWorldAsString " type="xsd:string" />
        </message>

</definitions>
```

5.@WebServiceClient

```
@WebServiceClient(
name = "WsAnnotationsWebServiceImplService",
targetNamespace = "http://webservice.SatyaCodes.com/", wsdlLocation =
"file:/Users/satyakaveti/Downloads/ctf.wsdl")
```

The information specified in this annotation helps in identifying a wsdl: service element inside a WSDL document. This element represents the Web service for which the generated service interface provides a client view.

6.@RequestWrapper

`@RequestWrapper` JAX-WS annotation is used to annotate methods in the Service Endpoint Interface with the request wrapper bean to be used at runtime.

It has 4 optional elements; `className` that represents the request wrapper bean name, `localName` that represents element's local name, `partName` that represent the part name of the wrapper part in the generated WSDL file, and `targetNamespace` that represents the element's namespace

```
@WebService
@SOAPBinding(style=Style.RPC)
public interface WSRequestWrapperInterface {
        @WebMethod
        @RequestWrapper(localName="CTF",
        targetNamespace="http://SatyaCodes.com/tempUtil",
        className="com.SatyaCodes.examples.jaxWsAnnotations.webservice.CTF")
        float celsiusToFarhenheit(float celsius);
}
```

7.@ResponseWrapper

`@ResponseWrapper` JAX-WS annotation is used to annotate methods in the Service Endpoint Interface with the response wrapper bean to be used at runtime. It has 4 optional elements; `className` that represents the response wrapper bean name, `localName` that represents element's local name, `partName` that represent the part name of the wrapper part in the generated WSDL file, and `targetNamespace` that represents the element's namespace.

```
public interface WSResponseWrapperInterfaceI {
        @WebMethod
        @ResponseWrapper(localName="CTFResponse",
        targetNamespace="http:// SatyaCodes.com/tempUtil",
        className="com. SatyaCodes.examples.jaxWsAnnotations.webservice.CTFResponse")
        float celsiusToFarhenheit(float celsius);
}
```

8.@Oneway

`@Oneway` JAX-WS annotation is applied to WebMethod which means that method will have only input and no output. When a `@Oneway` method is called, control is returned to calling method even before the actual operation is performed. It means that nothing will escape method neither response neither exception.

```
@WebService
@SOAPBinding(style = Style.RPC)
public interface WSAnnotationsOnewayI {
        @WebMethod
        @Oneway
        void sayHello();
}
```

9.@HandlerChain

Web Services and their clients may need to access the SOAP message for additional processing of the message request or response. A SOAP message handler provides a mechanism for intercepting the SOAP message during request and response.

A handler at server side can be a validator. Let's say we want to validate the temperature before the actual service method is called. To do this our validator class shall implement interface `SOAPHandler`

```
package handler;

public class TemperatureValidator implements SOAPHandler {

        @Override
        public boolean handleMessage(SOAPMessageContext context) {
                // TODO Auto-generated method stub
                return false;
        }

        @Override
        public boolean handleFault(SOAPMessageContext context) {
                // TODO Auto-generated method stub
                return false;
        }

        @Override
        public void close(MessageContext context) {
                // TODO Auto-generated method stub

        }

        @Override
        public Set getHeaders() {
                // TODO Auto-generated method stub
                return null;
        }

}
```

```
// soap-handler.xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<javaee:handler-chains xmlns:javaee="http://java.sun.com/xml/ns/javaee"
        xmlns:xsd="http://www.w3.org/2001/XMLSchema">
        <javaee:handler-chain>
                <javaee:handler>
                        <javaee:handler-
class>com.SatyaCodes.examples.jaxWsAnnotations.handler.TemperatureValidator
                        </javaee:handler-class>
                </javaee:handler>
        </javaee:handler-chain>
</javaee:handler-chains>
```

```
package handler;

@WebService
@SOAPBinding(style = Style.RPC)
public interface WSAnnotationsHandlerChainI {
        @HandlerChain(file = "soap-handler.xml")
        @WebMethod
        float celsiusToFarhenheit(float celsius);
}
```

2.3 JAX-WS RPC Style

1. RPC style web services use **method name and parameters to generate XML structure**.
2. The generated **WSDL is difficult to be validated against schema**.
3. In RPC style, **SOAP message is sent as many elements**.
4. RPC **style message is tightly coupled.**
5. In RPC style, **SOAP message keeps the operation name**.
6. In RPC style, **parameters are sent as discrete values.**

Steps to create JAX-WS RPC Style Example

1. JAX-WS Web Service End Point files

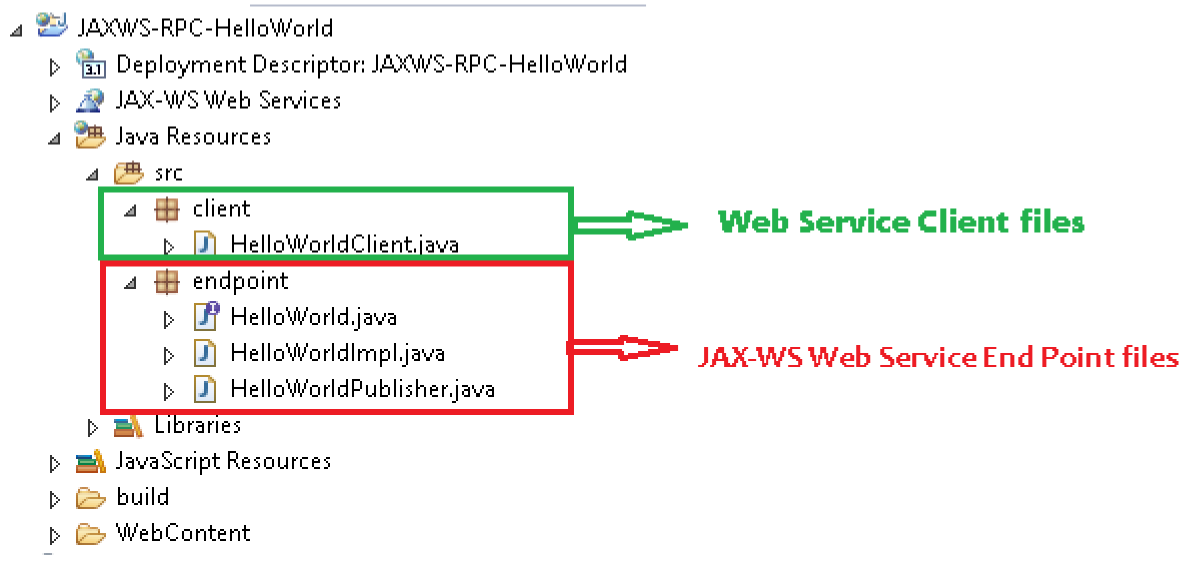
1. Create a Web Service Endpoint Interface with **@SOAPBinding(style = Style.RPC)**
2. Create a Web Service Endpoint Implementation
3. Create an Endpoint Publisher
4. Test generated WSDL. Ex: **http://localhost:8080/ws/hello?wsdl**

2. Web Service Client files

1. Java Web Service Client

- **In general words, "web service endpoint" is a service which published outside for user to access;**
- **where "web service client" is the party who access the published service.**

Example : Hello World using JAX-WS RPC Style



1. JAX-WS Web Service End Point files

1. Create a Web Service Endpoint Interface

```
package endpoint;
import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.jws.soap.SOAPBinding;
import javax.jws.soap.SOAPBinding.Style;
//Service Endpoint Interface
@WebService
@SOAPBinding(style = Style.RPC)
public interface HelloWorld{
 @WebMethod
 String getHelloWorldMsg(String msg);
}
```

2. Create a Web Service Endpoint Implementation

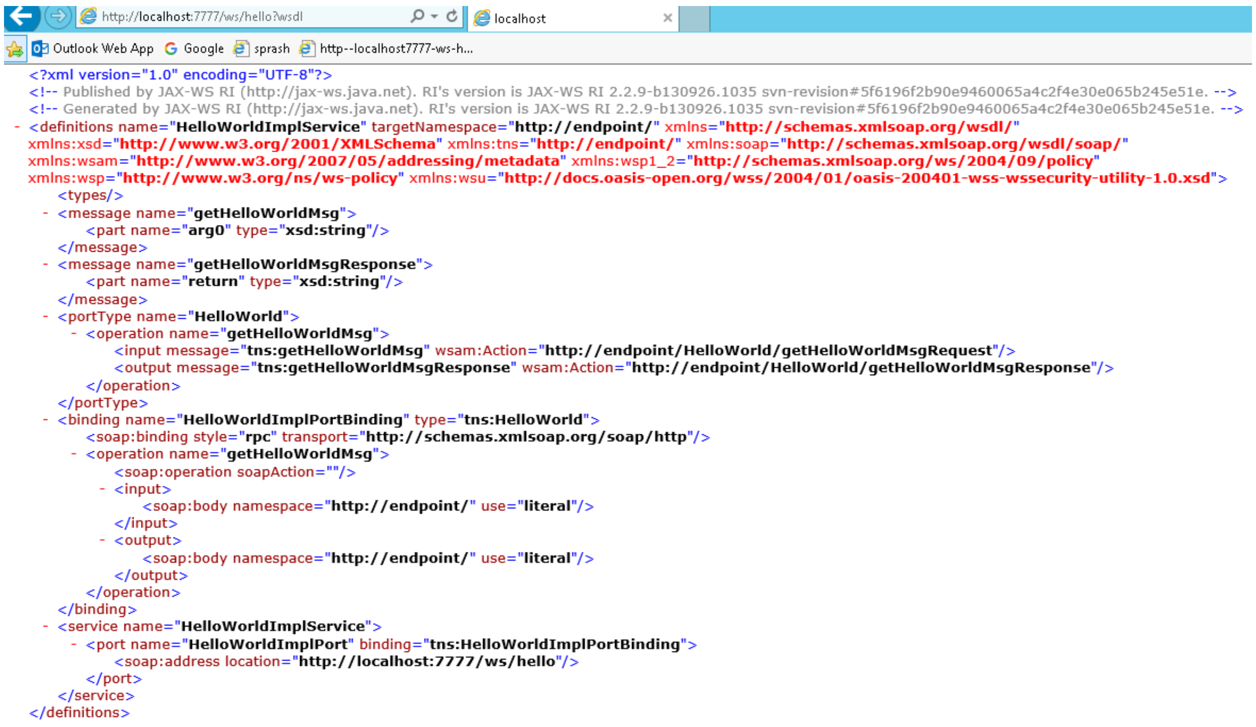
```
package endpoint;
import javax.jws.WebService;
//Service Implementation
@WebService(endpointInterface = "endpoint.HelloWorld")
public class HelloWorldImpl implements HelloWorld{
        @Override
        public String getHelloWorldMsg(String msg) {
                // TODO Auto-generated method stub
                return "Your Message from WebService is : "+msg;
        }
}
```

3. Create an Endpoint Publisher

```
package endpoint;
import javax.xml.ws.Endpoint;
//Endpoint publisher
public class HelloWorldPublisher{
    public static void main(String[] args) {
       Endpoint.publish("http://localhost:7777/ws/hello", new HelloWorldImpl());
       System.out.println("WSDL Published !!");
        }
}
```

4. Test generated WSDL

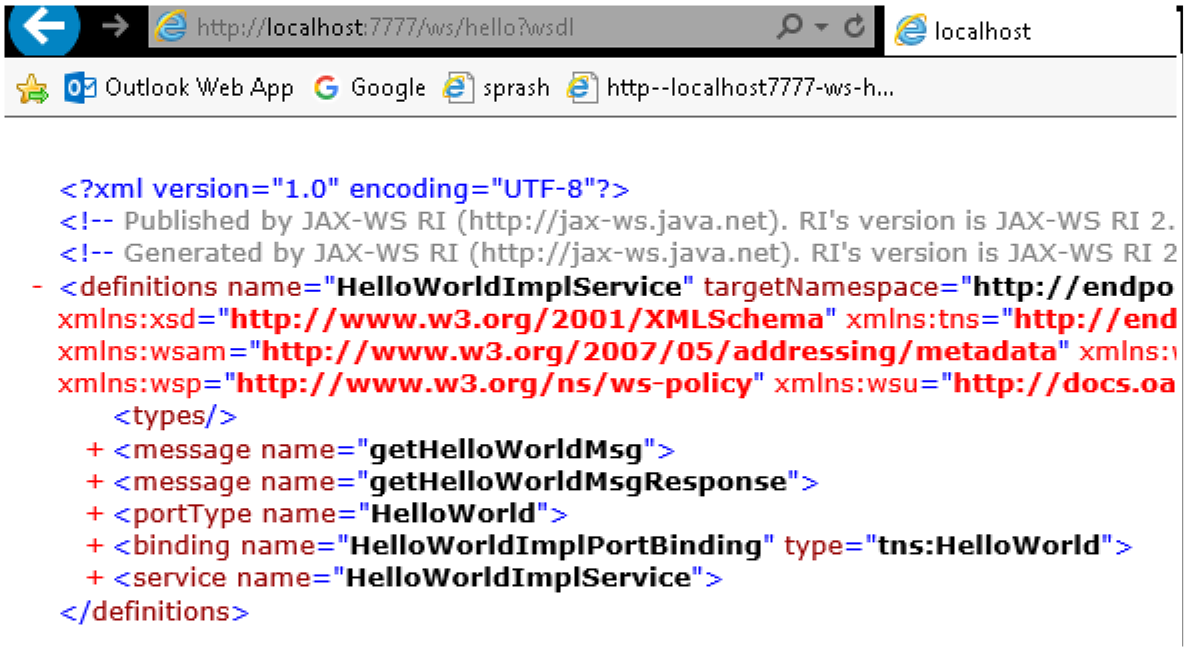
Run HelloWorldPublisher as Java Application & access url: ***http://localhost:7777/ws/hello?wsdl***



```
http://localhost:7777/ws/hello?wsdl        localhost
Outlook Web App  Google  sprash  http--localhost7777-ws-h...

  <?xml version="1.0" encoding="UTF-8"?>
  <!-- Published by JAX-WS RI (http://jax-ws.java.net). RI's version is JAX-WS RI 2.2.9-b130926.1035 svn-revision#5f6196f2b90e9460065a4c2f4e30e065b245e51e. -->
  <!-- Generated by JAX-WS RI (http://jax-ws.java.net). RI's version is JAX-WS RI 2.2.9-b130926.1035 svn-revision#5f6196f2b90e9460065a4c2f4e30e065b245e51e. -->
- <definitions name="HelloWorldImplService" targetNamespace="http://endpoint/" xmlns="http://schemas.xmlsoap.org/wsdl/"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:tns="http://endpoint/" xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
  xmlns:wsam="http://www.w3.org/2007/05/addressing/metadata" xmlns:wsp1_2="http://schemas.xmlsoap.org/ws/2004/09/policy"
  xmlns:wsp="http://www.w3.org/ns/ws-policy" xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd">
      <types/>
    - <message name="getHelloWorldMsg">
          <part name="arg0" type="xsd:string"/>
      </message>
    - <message name="getHelloWorldMsgResponse">
          <part name="return" type="xsd:string"/>
      </message>
    - <portType name="HelloWorld">
        - <operation name="getHelloWorldMsg">
              <input message="tns:getHelloWorldMsg" wsam:Action="http://endpoint/HelloWorld/getHelloWorldMsgRequest"/>
              <output message="tns:getHelloWorldMsgResponse" wsam:Action="http://endpoint/HelloWorld/getHelloWorldMsgResponse"/>
          </operation>
      </portType>
    - <binding name="HelloWorldImplPortBinding" type="tns:HelloWorld">
          <soap:binding style="rpc" transport="http://schemas.xmlsoap.org/soap/http"/>
        - <operation name="getHelloWorldMsg">
              <soap:operation soapAction=""/>
            - <input>
                  <soap:body namespace="http://endpoint/" use="literal"/>
              </input>
            - <output>
                  <soap:body namespace="http://endpoint/" use="literal"/>
              </output>
          </operation>
      </binding>
    - <service name="HelloWorldImplService">
        - <port name="HelloWorldImplPort" binding="tns:HelloWorldImplPortBinding">
              <soap:address location="http://localhost:7777/ws/hello"/>
          </port>
      </service>
  </definitions>
```

http://endpoint/" uses package name of Service endpoint publisher

the main components of WSDL documents are as below.



```
http://localhost:7777/ws/hello?wsdl        localhost
Outlook Web App  Google  sprash  http--localhost7777-ws-h...

  <?xml version="1.0" encoding="UTF-8"?>
  <!-- Published by JAX-WS RI (http://jax-ws.java.net). RI's version is JAX-WS RI 2.
  <!-- Generated by JAX-WS RI (http://jax-ws.java.net). RI's version is JAX-WS RI 2
- <definitions name="HelloWorldImplService" targetNamespace="http://endpo
  xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:tns="http://end
  xmlns:wsam="http://www.w3.org/2007/05/addressing/metadata" xmlns:
  xmlns:wsp="http://www.w3.org/ns/ws-policy" xmlns:wsu="http://docs.oa
      <types/>
    + <message name="getHelloWorldMsg">
    + <message name="getHelloWorldMsgResponse">
    + <portType name="HelloWorld">
    + <binding name="HelloWorldImplPortBinding" type="tns:HelloWorld">
    + <service name="HelloWorldImplService">
  </definitions>
```

hello.xml

WSDL Explanation

1. first Meaage part contains service method name & parameter list

```
<message name="getHelloWorldMsg">
        <part name="arg0" type="xsd:string"/>
</message>
```

2. Second Meaage part contains autogenerated Response method & return type

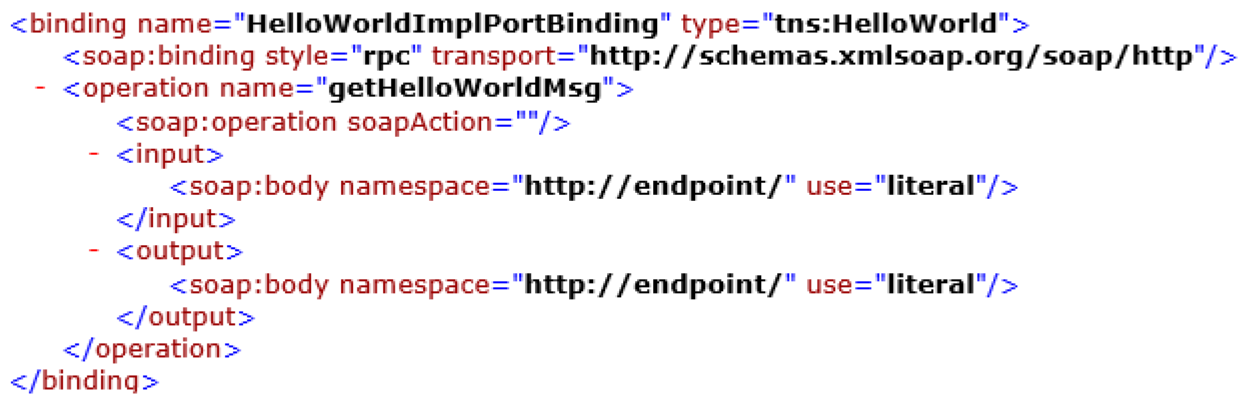
```
<message name="getHelloWorldMsgResponse">
        <part name="return" type="xsd:string"/>
</message>
```

3. PortType information is about ServiceEndpoint interface & input,output action urls

```
<portType name="HelloWorld">
<operation name="getHelloWorldMsg">
        <input message="tns:getHelloWorldMsg"
        wsam:Action="http://endpoint/HelloWorld/getHelloWorldMsgRequest"/>
        <output message="tns:getHelloWorldMsgResponse"
        wsam:Action="http://endpoint/HelloWorld/getHelloWorldMsgResponse"/>
</operation>
</portType>
```

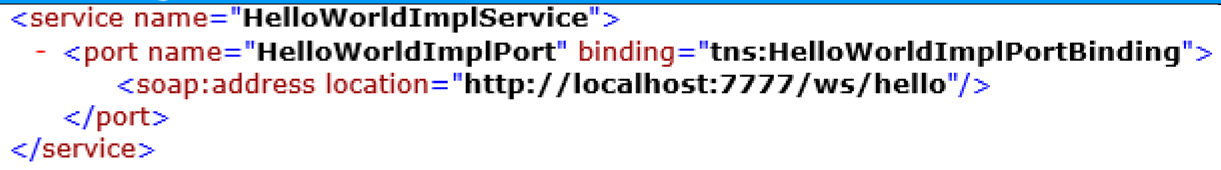
Here http://endpoint **it will take package name as automatically if we won't provide anything**

4. Binding will generate automatically by taking RPC Style/ Document Style



```
<binding name="HelloWorldImplPortBinding" type="tns:HelloWorld">
    <soap:binding style="rpc" transport="http://schemas.xmlsoap.org/soap/http"/>
  - <operation name="getHelloWorldMsg">
        <soap:operation soapAction=""/>
      - <input>
            <soap:body namespace="http://endpoint/" use="literal"/>
        </input>
      - <output>
            <soap:body namespace="http://endpoint/" use="literal"/>
        </output>
    </operation>
</binding>
```

5. Service tag contains service details & WSDL document location



```
<service name="HelloWorldImplService">
  - <port name="HelloWorldImplPort" binding="tns:HelloWorldImplPortBinding">
        <soap:address location="http://localhost:7777/ws/hello"/>
    </port>
</service>
```

2. Web Service Client file

Follow below steps to write Webservice client

1. Create **URL** object by passing WSDL document location

```
URL url = new URL("http://localhost:7777/ws/hello?wsdl");
```

2. Create **QName** by passing service URI, Service name as arguments

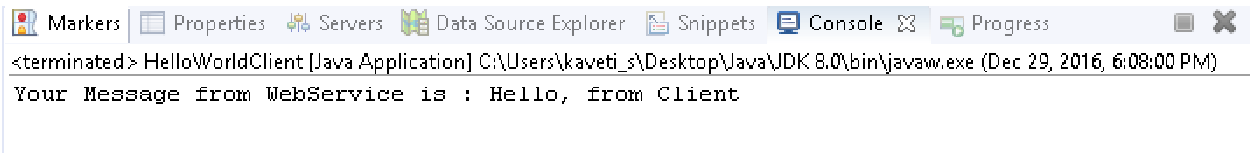
```
QName qname = new QName("http://endpoint/", "HelloWorldImplService");
```

3. Create Service Object by **calling create (-,-)** by passing URL,QName as arguments. Service objects provide the client view of a Web service. ports available on a service can be enumerated using the getPorts method

```
Service service  = Service.create(url, qname);
HelloWorld hello = service.getPort(HelloWorld.class);
```

```
package client;
import java.net.URL;
import javax.xml.namespace.QName;
import javax.xml.ws.Service;

import endpoint.HelloWorld;
public class HelloWorldClient{
    public static void main(String[] args) throws Exception {
    URL url = new URL("http://localhost:7777/ws/hello?wsdl");

        //1st argument service URI, refer to wsdl document above
        //2nd argument is service name, refer to wsdl document above
        QName qname = new QName("http://endpoint/", "HelloWorldImplService");
       Service service = Service.create(url, qname);
       HelloWorld hello = service.getPort(HelloWorld.class);
       System.out.println(hello.getHelloWorldMsg("Hello, from Client"));
    }
}
```

By running Clinet application we will get output as below



```
<terminated> HelloWorldClient [Java Application] C:\Users\kaveti_s\Desktop\Java\JDK 8.0\bin\javaw.exe (Dec 29, 2016, 6:08:00 PM)
Your Message from WebService is : Hello, from Client
```

2.4 JAX-WS Document Style

1. **SOAP Body can be structurted in any way you like**
2. Document style web services can be **validated against predefined schema**.
3. In document style, **SOAP message is sent as a single document**.
4. Document **style message is loosely coupled**.
5. In Document style, SOAP message loses the operation name.
6. In Document style, parameters are sent in XML format.

In JAX-WS development, convert from "*RPC style*" to "*Document style*" is very easy, just change the @SOAPBinding style option

Example

1. JAX-WS Web Service End Point files

1. Create a Web Service Endpoint Interface with **@SOAPBinding(style = Style.Document)**

```
package endpoint;

import javax.jws.WebMethod;
import javax.jws.WebService;
import javax.jws.soap.SOAPBinding;
import javax.jws.soap.SOAPBinding.Style;
//Service Endpoint Interface
@WebService
@SOAPBinding(style = Style.DOCUMENT)
public interface HelloWorld{
 @WebMethod
 String getHelloWorldMsg(String msg);
}
```

2. Create a Web Service Endpoint Implementation

```
package endpoint;

import javax.jws.WebService;
//Service Implementation
@WebService(endpointInterface = "endpoint.HelloWorld")
public class HelloWorldImpl implements HelloWorld{
        @Override
        public String getHelloWorldMsg(String msg) {
                // TODO Auto-generated method stub
                return "Your Message from WebService is : "+msg;
        }
}
```

3. Create an Endpoint Publisher & Run as Java Application

```
package endpoint;

import javax.xml.ws.Endpoint;
//Endpoint publisher
public class HelloWorldPublisher{
    public static void main(String[] args) {
       Endpoint.publish("http://localhost:7771/ws/hellodoc", new HelloWorldImpl());
       System.out.println("WSDL Published !!");
        }
}
```

4. Test generated WSDL. Ex: http://localhost:7771/ws/hellodoc**?wsdl**

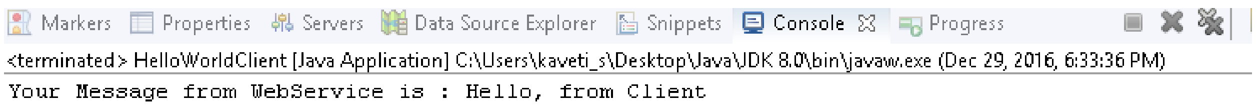
hellodoc.xml

```
xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:tns="http://endpoint/" xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
xmlns:wsam="http://www.w3.org/2007/05/addressing/metadata" xmlns:wsp1_2="http://schemas.xmlsoap.org/ws/2004/09/policy"
xmlns:wsp="http://www.w3.org/ns/ws-policy" xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd">
 - <types>
   - <xsd:schema>
       <xsd:import namespace="http://endpoint/" schemaLocation="http://localhost:7771/ws/hellodoc?xsd=1"/>
     </xsd:schema>
   </types>
 - <message name="getHelloWorldMsg">
     <part name="parameters" element="tns:getHelloWorldMsg"/>
   </message>
 - <message name="getHelloWorldMsgResponse">
     <part name="parameters" element="tns:getHelloWorldMsgResponse"/>
   </message>
 - <portType name="HelloWorld">
   - <operation name="getHelloWorldMsg">
       <input message="tns:getHelloWorldMsg" wsam:Action="http://endpoint/HelloWorld/getHelloWorldMsgRequest"/>
       <output message="tns:getHelloWorldMsgResponse" wsam:Action="http://endpoint/HelloWorld/getHelloWorldMsgResponse"/>
     </operation>
   </portType>
 - <binding name="HelloWorldImplPortBinding" type="tns:HelloWorld">
     <soap:binding style="document" transport="http://schemas.xmlsoap.org/soap/http"/>
   - <operation name="getHelloWorldMsg">
       <soap:operation soapAction=""/>
     - <input>
         <soap:body use="literal"/>
       </input>
     - <output>
         <soap:body use="literal"/>
       </output>
     </operation>
   </binding>
 - <service name="HelloWorldImplService">
   - <port name="HelloWorldImplPort" binding="tns:HelloWorldImplPortBinding">
       <soap:address location="http://localhost:7771/ws/hellodoc"/>
     </port>
   </service>
</definitions>
```

2. Web Service Client files

Create Java Web Service Client & Run as Java Application

```java
package client;

import java.net.URL;
import javax.xml.namespace.QName;
import javax.xml.ws.Service;

import endpoint.HelloWorld;
public class HelloWorldClient{
    public static void main(String[] args) throws Exception {
    URL url = new URL("http://localhost:7771/ws/hellodoc?wsdl");

        //1st argument service URI, refer to wsdl document above
        //2nd argument is service name, refer to wsdl document above
        QName qname = new QName("http://endpoint/", "HelloWorldImplService");
       Service service = Service.create(url, qname);
       HelloWorld hello = service.getPort(HelloWorld.class);
       System.out.println(hello.getHelloWorldMsg("Hello, from Client"));
    }
}
```



```
<terminated> HelloWorldClient [Java Application] C:\Users\kaveti_s\Desktop\Java\JDK 8.0\bin\javaw.exe (Dec 29, 2016, 6:33:36 PM)
Your Message from WebService is : Hello, from Client
```

2.5 JAX-WS Tools

So far we created WebService applications manually. We have some tools to generate web service classes. let's start understanding them

2.5.1 wsimport tool(WSDL import → Generate Java Files)

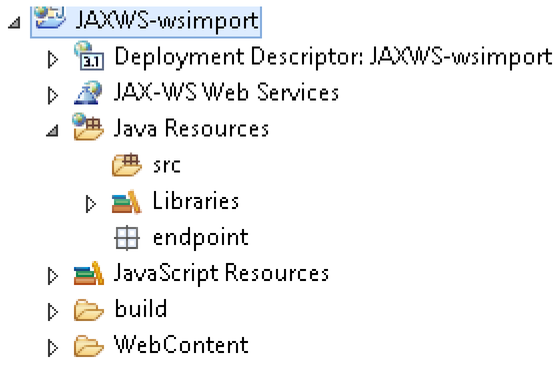
The **wsimport** tool is used to **parse an existing Web Services Description Language (WSDL)** file and generate required files (JAX-WS portable artifacts & JAX-WS Web Service End Point files).

We have to write web service client to access the published web services. This wsimport tool is available in the **$JDK/bin**(`C:\Users\kaveti_s\Desktop\Java\JDK 8.0\bin\wsimport.exe`) folder. We no need add these tools to PATH, because they are built in tools

In this example we are using JAXWS-Doc-HelloWorld published WSDL to generate JAX-WS portable artifacts. The WSDL URL is

To generate JAX-WS portable artifacts using wsimport tool follow below steps

1. Create an Empty Project & create endpoint package for saving generated artifacts

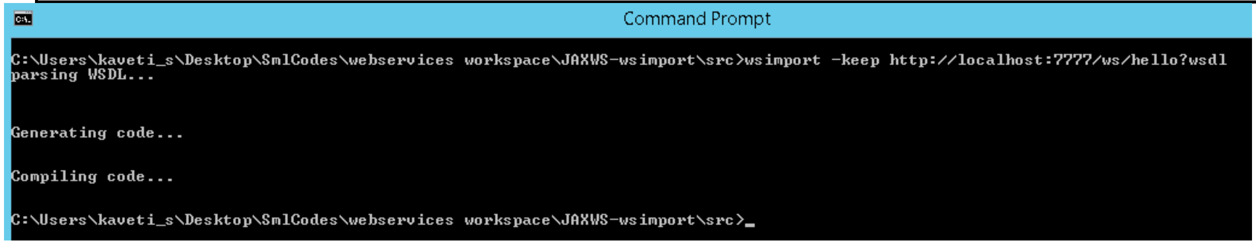


2. **Open command promt→ go to project location run wsimport with wsdl doc location as below**

```
wsimport  wsdl-location-path  -d -keep
```

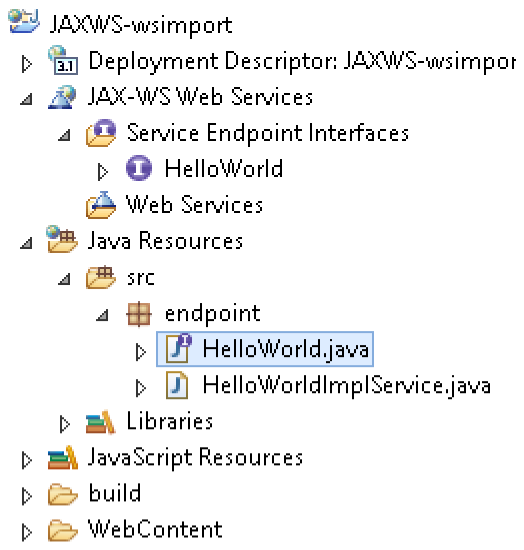
- **wsdl-location-path** : Is the location of wsdl file existence.
- **-d** : specify the directory where all the generated classes should be placed.
- **-keep** : It will keep the java source code of generated classes in the respective directory mentioned.

```
>wsimport -keep http://localhost:7777/ws/hello?wsdl
```



```
C:\Users\kaveti_s\Desktop\SmlCodes\webservices workspace\JAXWS-wsimport\src>wsimport -keep http://localhost:7777/ws/hello?wsdl
parsing WSDL...


Generating code...

Compiling code...

C:\Users\kaveti_s\Desktop\SmlCodes\webservices workspace\JAXWS-wsimport\src>_
```

By running this it is generated Service Endpoint files as below


```
JAXWS-wsimport
  Deployment Descriptor: JAXWS-wsimpor
  JAX-WS Web Services
    Service Endpoint Interfaces
      HelloWorld
    Web Services
  Java Resources
    src
      endpoint
        HelloWorld.java
        HelloWorldImplService.java
    Libraries
  JavaScript Resources
  build
  WebContent
```

```java
// HelloWorld.java
package endpoint;

import javax.jws.WebMethod;
import javax.jws.WebParam;
import javax.jws.WebResult;
import javax.jws.WebService;
import javax.jws.soap.SOAPBinding;
import javax.xml.ws.Action;

/**
 * This class was generated by the JAX-WS RI. JAX-WS RI 2.2.9-b130926.1035 Generated source version: 2.2*/
@WebService(name = "HelloWorld", targetNamespace = "http://endpoint/")
@SOAPBinding(style = SOAPBinding.Style.RPC)
public interface HelloWorld {

        /**
         * @param arg0
         * @return returns java.lang.String
         */
        @WebMethod
        @WebResult(partName = "return")
        @Action(input = "http://endpoint/HelloWorld/getHelloWorldMsgRequest", output =
"http://endpoint/HelloWorld/getHelloWorldMsgResponse")
        public String getHelloWorldMsg(@WebParam(name = "arg0", partName = "arg0") String arg0);

}
```

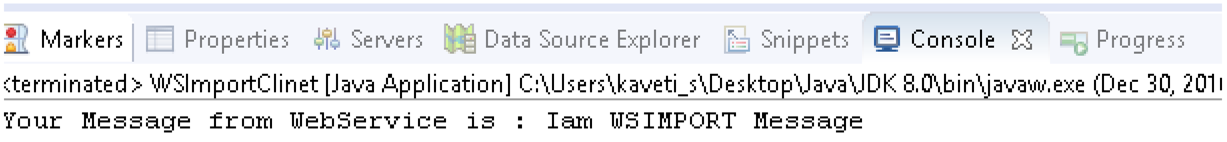
```java
package endpoint;
import java.net.MalformedURLException;
import java.net.URL;
import javax.xml.*;
@WebServiceClient(name = "HelloWorldImplService", targetNamespace = "http://endpoint/", wsdlLocation =
"http://localhost:7777/ws/hello?wsdl")
public class HelloWorldImplService extends Service {

        private final static URL HELLOWORLDIMPLSERVICE_WSDL_LOCATION;
        private final static WebServiceException HELLOWORLDIMPLSERVICE_EXCEPTION;
        private final static QName HELLOWORLDIMPLSERVICE_QNAME = new QName("http://endpoint/",
"HelloWorldImplService");
```

```
        static {
                URL url = null;
                WebServiceException e = null;
                try {
                        url = new URL("http://localhost:7777/ws/hello?wsdl");
                } catch (MalformedURLException ex) {
                        e = new WebServiceException(ex);
                }
                HELLOWORLDIMPLSERVICE_WSDL_LOCATION = url;
                HELLOWORLDIMPLSERVICE_EXCEPTION = e;
        }

        public HelloWorldImplService() {
                super(__getWsdlLocation(), HELLOWORLDIMPLSERVICE_QNAME);
        }

        public HelloWorldImplService(WebServiceFeature... features) {
                super(__getWsdlLocation(), HELLOWORLDIMPLSERVICE_QNAME, features);
        }

        public HelloWorldImplService(URL wsdlLocation) {
                super(wsdlLocation, HELLOWORLDIMPLSERVICE_QNAME);
        }

        public HelloWorldImplService(URL wsdlLocation, WebServiceFeature... features) {
                super(wsdlLocation, HELLOWORLDIMPLSERVICE_QNAME, features);
        }

        public HelloWorldImplService(URL wsdlLocation, QName serviceName) {
                super(wsdlLocation, serviceName);
        }

        public HelloWorldImplService(URL wsdlLocation, QName serviceName, WebServiceFeature... features) {
                super(wsdlLocation, serviceName, features);
        }

        /**
         * @return returns HelloWorld
         */
        @WebEndpoint(name = "HelloWorldImplPort")
        public HelloWorld getHelloWorldImplPort() {
           return super.getPort(new QName("http://endpoint/", "HelloWorldImplPort"), HelloWorld.class);
        }

        @WebEndpoint(name = "HelloWorldImplPort")
        public HelloWorld getHelloWorldImplPort(WebServiceFeature... features) {
           return super.getPort(new QName("http://endpoint/", "HelloWorldImplPort"), HelloWorld.class,
features);
        }

        private static URL __getWsdlLocation() {
                if (HELLOWORLDIMPLSERVICE_EXCEPTION != null) {
                        throw HELLOWORLDIMPLSERVICE_EXCEPTION;
                }
                return HELLOWORLDIMPLSERVICE_WSDL_LOCATION;
        }

}
```

Now, create a Java web service client which depends on the above generated files

```
package client;

import endpoint.HelloWorld;
import endpoint.HelloWorldImplService;

public class WSImportClinet {
public static void main(String[] args) {
        HelloWorldImplService service = new HelloWorldImplService();
        HelloWorld helloWorld = service.getHelloWorldImplPort();
        String output =helloWorld.getHelloWorldMsg("Iam WSIMPORT Message");
        System.out.println(output);      }
}
```

Run this application we will get following Output



```
<terminated> WSImportClinet [Java Application] C:\Users\kaveti_s\Desktop\Java\JDK 8.0\bin\javaw.exe (Dec 30, 201
Your Message from WebService is : Iam WSIMPORT Message
```

2.5.2 wsgen tool(WSDL Generator - Read Java Files→ Generate WSDL)

The `wsgen` tool is used to parse an existing web service implementation class and generates required files (JAX-WS portable artifacts) for web service deployment. This `wsgen` tool is available in `$JDK/bin` folder.

2 common use cases for wsgen tool:

1. ***Generates JAX-WS portable artifacts (Java files) for web service deployment.***
2. ***Generates WSDL and xsd files***
3. ***Create web service client for testing***

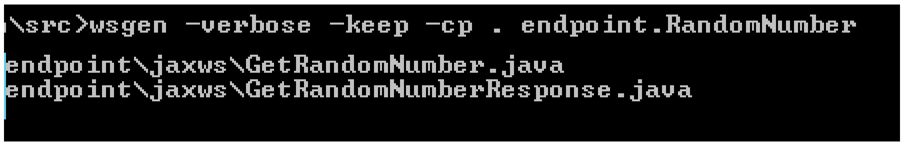
We need to create web service implementation class, remaing files will be generated by `wsgen` tool

```
package endpoint;
import javax.jws.WebMethod;
import javax.jws.WebService;

@WebService
public class RandomNumber {
        @WebMethod
        public String getRandomNumber() {
                return "Random Number Is : " + Math.random();
        }
}
```

1. Generates JAX-WS portable artifacts (Java files) for web service deployment.

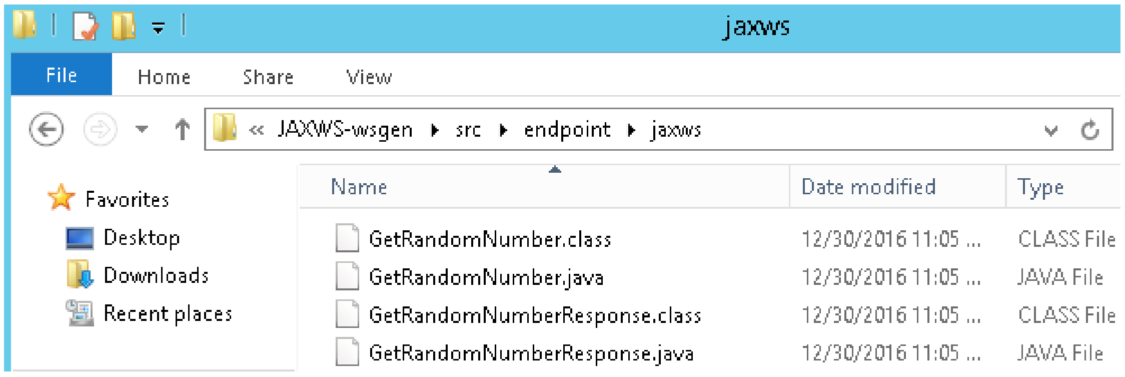
To generate all the JAX-WS portable artifacts for above web service implementation class (`RandomNumber.java`), use following command by going src folder from command prompt

```
>wsgen -verbose -keep -cp . endpoint.RandomNumber
```



```
\src>wsgen -verbose -keep -cp . endpoint.RandomNumber

endpoint\jaxws\GetRandomNumber.java
endpoint\jaxws\GetRandomNumberResponse.java
```

It will generate 2 .java files & 2 .class files



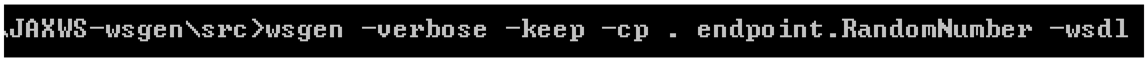
Name	Date modified	Type
GetRandomNumber.class	12/30/2016 11:05 ...	CLASS File
GetRandomNumber.java	12/30/2016 11:05 ...	JAVA File
GetRandomNumberResponse.class	12/30/2016 11:05 ...	CLASS File
GetRandomNumberResponse.java	12/30/2016 11:05 ...	JAVA File

```java
// GetRandomNumber.java
package endpoint.jaxws;

import javax.xml.bind.annotation.XmlAccessType;
import javax.xml.bind.annotation.XmlAccessorType;
import javax.xml.bind.annotation.XmlRootElement;
import javax.xml.bind.annotation.XmlType;

@XmlRootElement(name = "getRandomNumber", namespace = "http://endpoint/")
@XmlAccessorType(XmlAccessType.FIELD)
@XmlType(name = "getRandomNumber", namespace = "http://endpoint/")
public class GetRandomNumber {


}
```

```java
// GetRandomNumberResponse.java
package endpoint.jaxws;

import javax.xml.bind.annotation.XmlAccessType;
import javax.xml.bind.annotation.XmlAccessorType;
import javax.xml.bind.annotation.XmlElement;
import javax.xml.bind.annotation.XmlRootElement;
import javax.xml.bind.annotation.XmlType;

@XmlRootElement(name = "getRandomNumberResponse", namespace = "http://endpoint/")
@XmlAccessorType(XmlAccessType.FIELD)
@XmlType(name = "getRandomNumberResponse", namespace = "http://endpoint/")
public class GetRandomNumberResponse {

        @XmlElement(name = "return", namespace = "")
        private String _return;

        /**
         *
         * @return returns String
         */
        public String getReturn() {
                return this._return;
        }

        /**
         *
         * @param _return
         *            the value for the _return property
         */
        public void setReturn(String _return) {
                this._return = _return;
        }

}
```

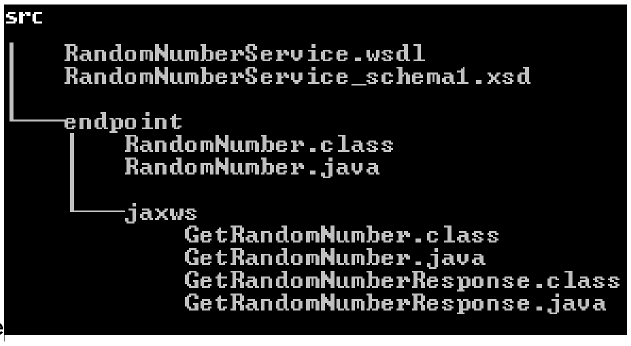
2. Genarates WSDL and xsd

To generate WSDL and xsd files for above web service implementation class (`RandomNumber.java`), add an extra **-wsdl** in the `wsgen` command



```
.JAXWS-wsgen\src>wsgen -verbose -keep -cp . endpoint.RandomNumber -wsdl
```

In this case it will generate 6 files (**2 java +2 class + 1 WSDL + 1 schema.xsd**). Files under src/ folder are



```
src
│   RandomNumberService.wsdl
│   RandomNumberService_schema1.xsd
│
└───endpoint
    │   RandomNumber.class
    │   RandomNumber.java
    │
    └───jaxws
            GetRandomNumber.class
            GetRandomNumber.java
            GetRandomNumberResponse.class
            GetRandomNumberResponse.java
```

RandomNumberService_schema1.xsd

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<xs:schema version="1.0" targetNamespace="http://endpoint/" xmlns:tns="http://endpoint/"
xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:element name="getRandomNumber" type="tns:getRandomNumber"/>
  <xs:element name="getRandomNumberResponse" type="tns:getRandomNumberResponse"/>
  <xs:complexType name="getRandomNumber">
    <xs:sequence/>
  </xs:complexType>
  <xs:complexType name="getRandomNumberResponse">
    <xs:sequence>
      <xs:element name="return" type="xs:string" minOccurs="0"/>
    </xs:sequence>
  </xs:complexType>
</xs:schema>
```

RandomNumberService.wsdl

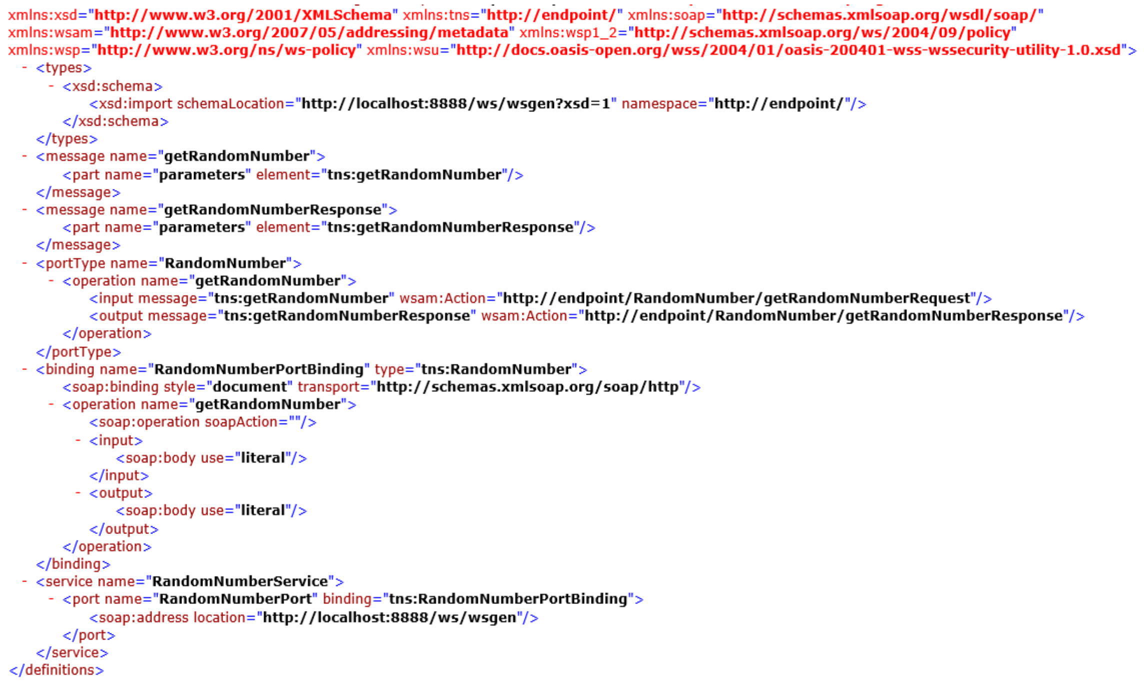
```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<definitions targetNamespace="http://endpoint/" name="RandomNumberService"
xmlns="http://schemas.xmlsoap.org/wsdl/" xmlns:wsp="http://www.w3.org/ns/ws-policy"
xmlns:wsp1_2="http://schemas.xmlsoap.org/ws/2004/09/policy" xmlns:tns="http://endpoint/"
xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
xmlns:wsam="http://www.w3.org/2007/05/addressing/metadata">
  <types>
    <xsd:schema>
      <xsd:import namespace="http://endpoint/" schemaLocation="RandomNumberService_schema1.xsd"/>
    </xsd:schema>
  </types>
  <message name="getRandomNumber">
    <part name="parameters" element="tns:getRandomNumber"/>
  </message>
  <message name="getRandomNumberResponse">
    <part name="parameters" element="tns:getRandomNumberResponse"/>
  </message>
  <portType name="RandomNumber">
    <operation name="getRandomNumber">
      <input wsam:Action="http://endpoint/RandomNumber/getRandomNumberRequest"
message="tns:getRandomNumber"/>
      <output wsam:Action="http://endpoint/RandomNumber/getRandomNumberResponse"
message="tns:getRandomNumberResponse"/>
    </operation>
  </portType>
  <binding name="RandomNumberPortBinding" type="tns:RandomNumber">
    <soap:binding transport="http://schemas.xmlsoap.org/soap/http" style="document"/>
    <operation name="getRandomNumber">
      <soap:operation soapAction=""/>
      <input>
        <soap:body use="literal"/>
      </input>
      <output>
        <soap:body use="literal"/>
      </output>
    </operation>
  </binding>
  <service name="RandomNumberService">
    <port name="RandomNumberPort" binding="tns:RandomNumberPortBinding">
      <soap:address location="REPLACE_WITH_ACTUAL_URL"/>
    </port>
  </service>
</definitions>
```

All files are ready.we have to write Publisher class to publish the WSDL document

```java
package endpoint;
import javax.xml.ws.Endpoint;
public class RandomNumberPublisher {
        public static void main(String[] args) {
                Endpoint.publish("http://localhost:8888/ws/wsgen", new RandomNumber());
                System.out.println("Service is published!");
        }
}
```

Run as Java Application. It will shows output as `Service is published!`

http://localhost:8888/ws/wsgen?wsdl it is as same as generated WSDL document



```
xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:tns="http://endpoint/" xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
xmlns:wsam="http://www.w3.org/2007/05/addressing/metadata" xmlns:wsp1_2="http://schemas.xmlsoap.org/ws/2004/09/policy"
xmlns:wsp="http://www.w3.org/ns/ws-policy" xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd">
 - <types>
   - <xsd:schema>
       <xsd:import schemaLocation="http://localhost:8888/ws/wsgen?xsd=1" namespace="http://endpoint/"/>
     </xsd:schema>
   </types>
 - <message name="getRandomNumber">
     <part name="parameters" element="tns:getRandomNumber"/>
   </message>
 - <message name="getRandomNumberResponse">
     <part name="parameters" element="tns:getRandomNumberResponse"/>
   </message>
 - <portType name="RandomNumber">
   - <operation name="getRandomNumber">
       <input message="tns:getRandomNumber" wsam:Action="http://endpoint/RandomNumber/getRandomNumberRequest"/>
       <output message="tns:getRandomNumberResponse" wsam:Action="http://endpoint/RandomNumber/getRandomNumberResponse"/>
     </operation>
   </portType>
 - <binding name="RandomNumberPortBinding" type="tns:RandomNumber">
     <soap:binding style="document" transport="http://schemas.xmlsoap.org/soap/http"/>
   - <operation name="getRandomNumber">
       <soap:operation soapAction=""/>
     - <input>
         <soap:body use="literal"/>
       </input>
     - <output>
         <soap:body use="literal"/>
       </output>
     </operation>
   </binding>
 - <service name="RandomNumberService">
   - <port name="RandomNumberPort" binding="tns:RandomNumberPortBinding">
       <soap:address location="http://localhost:8888/ws/wsgen"/>
     </port>
   </service>
</definitions>
```

Finally Note these

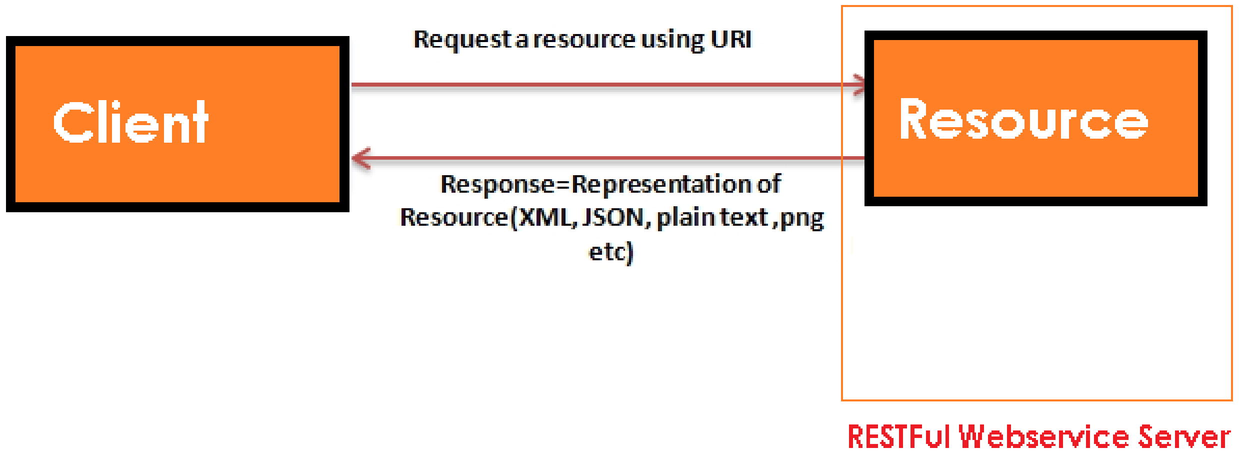
Wsimport → Uses the WSDL, generates java code for the service/client implementation.

Wsgen → Uses compiled code, generates WSDL (and artifacts)

3. JAX-RS (RESTFul web services)

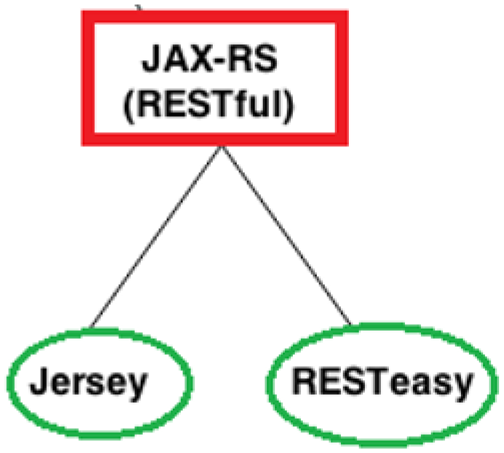
- **JAX-RS** is a specification for RESTful Web Services with Java and it is given by Sun.
- **Since JAX-RS** it is a specification, other frameworks can be written to implement these specifications.
- Few implemetations are ***Jersey*** from Oracle, ***Resteasy*** from Jboss, ***CXF*** from Apache, etc.

We can get the resource from RESTful service in different formats like, **HTML, XML, JSON, TEXT, PDF** and in the Image formats as well, but in real time we mainly we will prefer JSON. REST guidelines always talks about stateless communication between client and the Server. Stateless means, every single request from client to server will be considered as a fresh request. Because of this reason REST always prefers to choose HTTP as it a stateless protocol.


Request a resource using URI
Client
Resource
Response=Representation of Resource(XML, JSON, plain text ,png etc)
RESTFul Webservice Server

There are two main implementation of JAX-RS API.

1. **Jersey**
2. **RESTeasy**



3.1 JAX-RS Annotations

We have many annotations. But below are the majorly used annotations in RESTFul webservices

- **@Path('Path')**
- **@GET**
- **@POST**
- **@PUT**
- **@DELETE**
- **@Produces(MediaType.TEXT_PLAIN [, more-types])**
- **@Consumes(type[, more-types])**
- **@PathParam()**
- **@QueryParam()**
- **@MatrixParam()**
- **@FormParam()**

1.@Path()

- Its a Class & Method level of annotation
- This will check the path next to the base URL

Syntax: http**://localhost:(port)/<YourApplicationName>/<UrlPattern In Web.xml>/<path>**
Here `<path>` is the part of URI, and this will be identified by @path annotation at class/method level.

2.@GET

Its a method level of annotation, this annotation indicates that the following method should respond to the HTTP GET request only, if we annotate our method with @GET, the execution flow will enter that following method if we send GET request from the client

3.@POST

It's a method level of annotation, this annotation indicates that the following method should respond to the HTTP POST request only.

4.@PUT

It's a method level of annotation, this annotation indicates that the following method should respond to the HTTP PUT request only.

5.@DELETE

It's a method level of annotation, this annotation indicates that the following method should respond to the HTTP DELETE request only.

6.@Produces

It's a method or field level annotation, this tells which **MIME** type is delivered by the method annotated with **@GET**. Whenever we send a HTTP GET request to our RESTful service, it will invokes particular method and produces the output in different formats. There you can specifies in what are all formats (MIME) your method can produce the output, by using @produces annotation.

Remember: We will use @Produces annotation for GET requests only.

7.@Consumes

This is a class and method level annotation; this will define which MIME type is consumed by the particular method. It means in which format the **method can accept the input from the client**.

@PathParam, @QueryParam, @MatrixParam **annotations will come into picture in case if we are passing the input values to the restful service through the URL**

8.@PathParam

http://localhost:8001/<Rest Service Name>/rest/customers/100/Satya

Here the two parameters appear in the end of the above URL [100 & Satya], which are separated by forward slash **(/)** are called as **path parameters**

9.@QueryParam

http://localhost:8001/…/rest/customers?custNo=100&custName=Satya

If the client sends an input in the form of query string in the URL, then those parameters are called as **Query Parameters**. If you observe the above syntax, client passing **custNo=100&custName=Satya** started after question mark **(?)** symbol and each parameter is separated by **&** symbol, those parameters are called as query parameters.

10.@MatrixParam

http://localhost:8001/…/rest/customers;custNo=100;custName=Satya

Matrix parameters are another way defining the parameters to be added to URL. If you observe the above syntax, client is passing two parameters each are separated by **semicolon (;),** these parameters are called as matrix parameters. **Remember these parameters may appear any where in the path**.

11.@ FormParam

If we have a HTML form having two input fields and submit button. Lets client enter those details and submit to the RESTful web service. Then the rest service will extract those details by using this **@FormParam** annotation.

3.2 JAX-RS JERSEY

Jersey, reference implementation to develope RESTful web service based on the JAX-RS (JSR 311) specification.

If we want to implement Webservices using Jersey we need to download Jersey jar files from **Jersey website**

The major change between JERSEY & RESTEASY is just changing the configuration in web.xml

Download & install Maven, configure maven in Eclipse

Steps to Create Jersey Web Service Application

1. Create Dynamic web project in eclipse, convert that into Maven Project

2. Add Jersey jar files manually / through Maven by writing repo details in pom.xml

3. Create RESTFul webservice

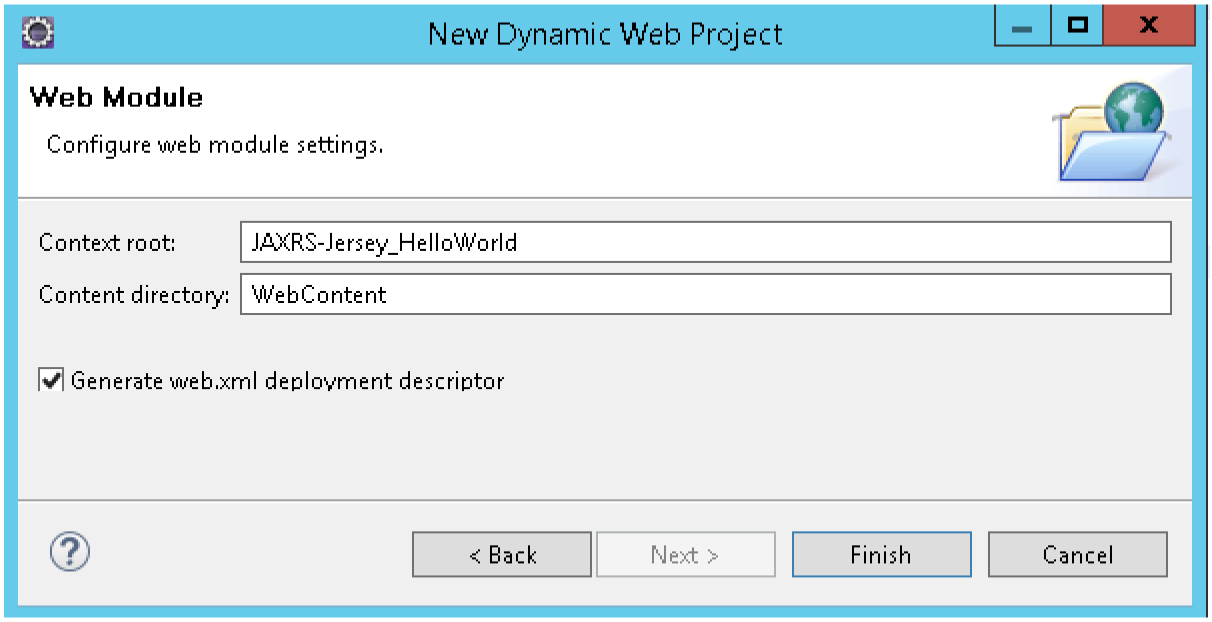
4. Configure `web.xml`

5. Test Webservice directly by using URL / writing webservice client

Example: JAXRS-Jersey-HelloWorld

1. Create Dynamic web project in eclipse, convert that into Maven Project

New → Dynamic web project → Provide project details → finish



Context root: JAXRS-Jersey_HelloWorld

Content directory: WebContent

[✓] Generate web.xml deployment descriptor

Right-click on Project →Configure → Convert to Maven Project .

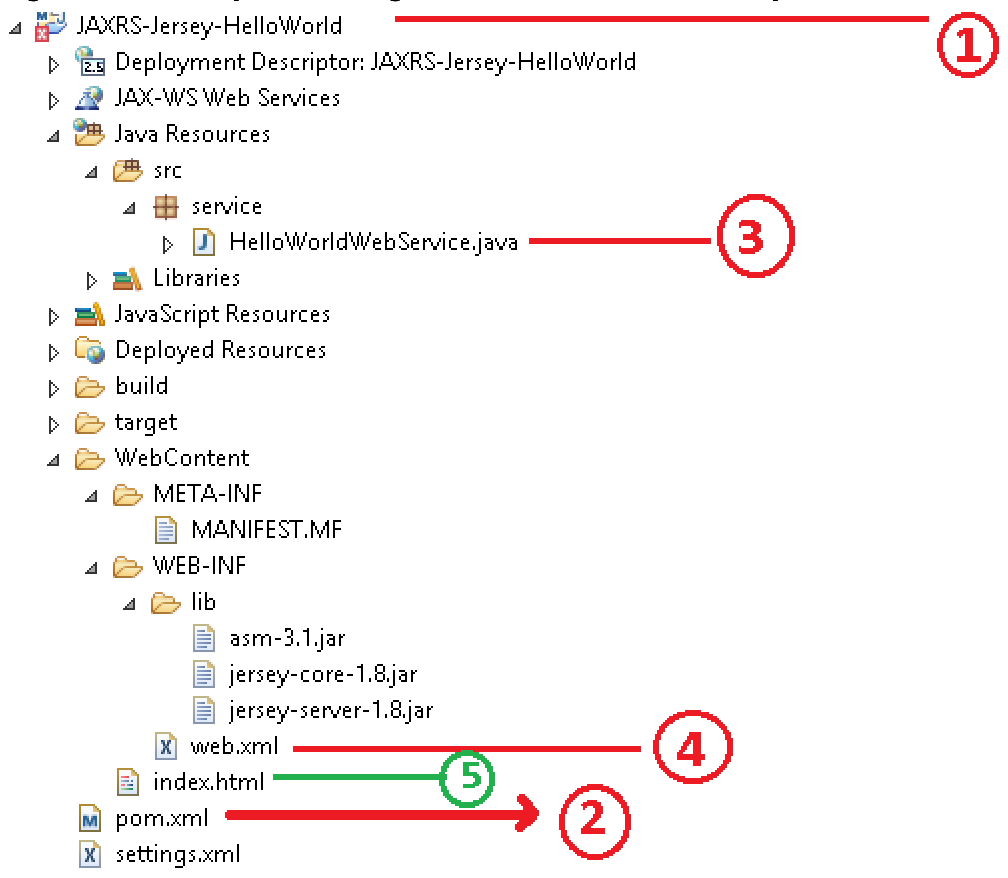


Figure 1 Directory Structure after adding all files

2. Add Jersey jar files manually / through Maven by writing repo details in pom.xml

Jersey is published in Java.net Maven repository. To develop Jersey REST application, just declares "jersey-server" in Maven **pom.xml**.

```
<project …>
        <repositories>
                <repository>
                        <id>maven2-repository.java.net</id>
                        <name>Java.net Repository for Maven</name>
                        <url>http://download.java.net/maven/2/</url>
                        <layout>default</layout>
                </repository>
        </repositories>

        <dependencies>
                <dependency>
                        <groupId>com.sun.jersey</groupId>
                        <artifactId>jersey-server</artifactId>
                        <version>1.8</version>
                </dependency>
                <dependency>
                        <groupId>com.sun.jersey</groupId>
                        <artifactId>jersey-client</artifactId>
                        <version>1.19.3</version>
                </dependency>
        </dependencies>
</project>
```

3. Create RESTFul webservice at Server End

```
package service;

@Path("/hellojersey")
public class HelloWorldWebService {
  // This method is called if HTML and XML is not requested
  @GET
  @Produces(MediaType.TEXT_PLAIN)
  public String sayPlainTextHello() {
    return "Hello Jersey Plain";
  }

  // This method is called if HTML is requested
  @GET
  @Produces(MediaType.TEXT_HTML)
  public String sayHtmlHello() {
    return "<h1>" + "Hello Jersey HTML" + "</h1>";
  }
}
```

4.Configure web.xml

In web.xml,

- register "com.sun.jersey.spi.container.servlet.ServletContainer",
- In "com.sun.jersey.config.property.packages"., provide package name, where WebService classes are implemented

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app>
        <display-name>Restful Web Application</display-name>

        <servlet>
                <servlet-name>jersey-serlvet</servlet-name>
                <servlet-class>
                     com.sun.jersey.spi.container.servlet.ServletContainer
                </servlet-class>
                <init-param>
                     <param-name>com.sun.jersey.config.property.packages</param-name>
                     <param-value>service</param-value>
                </init-param>
                <load-on-startup>1</load-on-startup>
        </servlet>

        <servlet-mapping>
                <servlet-name>jersey-serlvet</servlet-name>
                <url-pattern>/rest/*</url-pattern>
        </servlet-mapping>

</web-app>
```

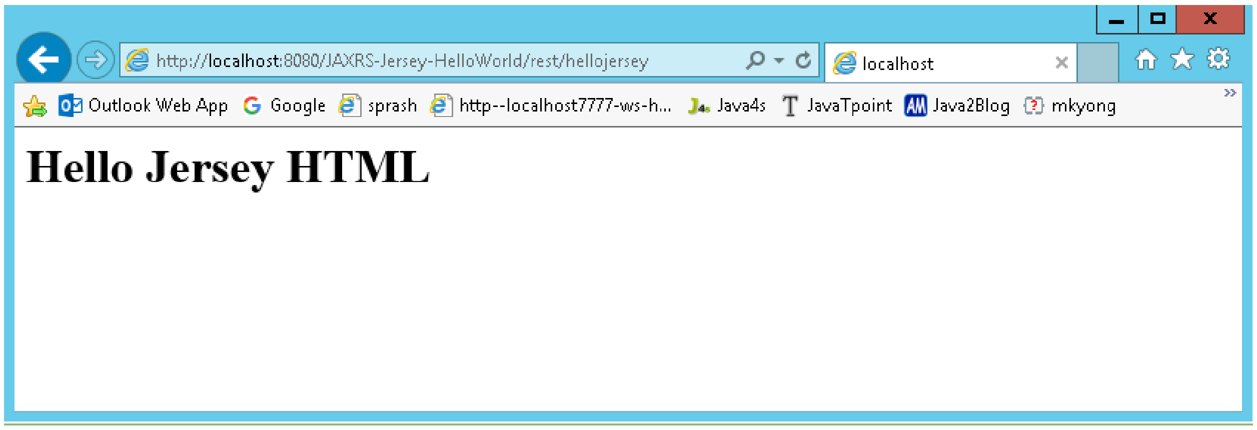
5. Test Webservice directly by using URL / writing webservice client

In this example, web request from "**projectURL/rest/hellojersy/**" will match to **"HelloWorldWebService"**, via **@Path("/hellojersey")** So we are created a test index.html conatining following url for testing purpose

Index.html

```
<h1>Test JERSEY WEBSERVICE </h1>

<h3><a href="rest/hellojersey">Default</a></h3>
```

Direct Testing URL : **http://localhost:8080/JAXRS-Jersey-HelloWorld/rest/hellojersey**


http://localhost:8080/JAXRS-Jersey-HelloWorld/rest/hellojersey
localhost
Outlook Web App
Google
sprash
http--localhost7777-ws-h...
Java4s
JavaTpoint
Java2Blog
mkyong

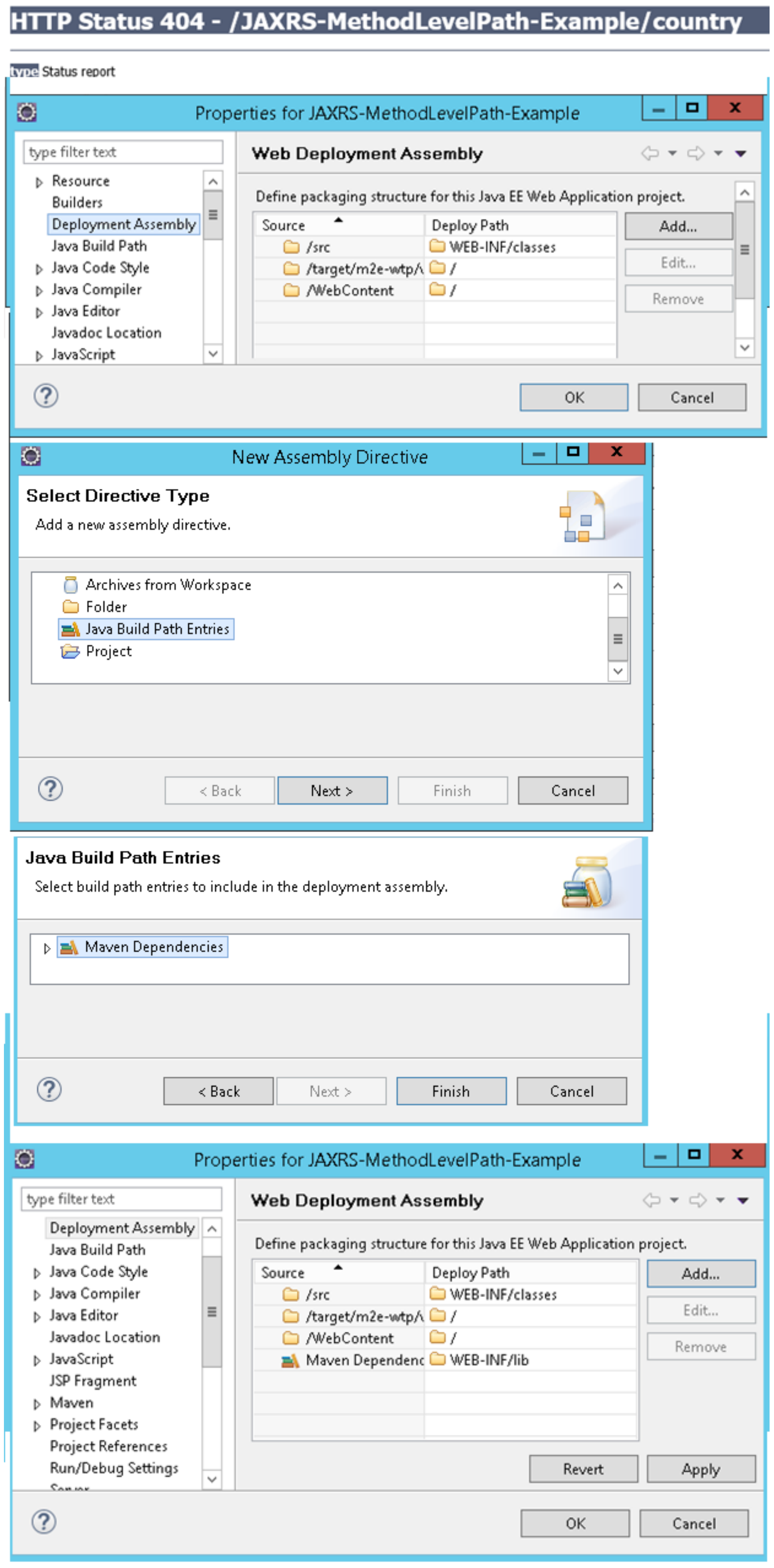
Hello Jersey HTML

We can write The HelloworldClientTest.java file is created inside the server application. But you can run client code by other application also by having service interface and jersey jar file.

```
package client;

import java.net.URI;
import javax.ws.rs.client.Client;
import javax.ws.rs.client.ClientBuilder;
import javax.ws.rs.client.WebTarget;
import javax.ws.rs.core.MediaType;
import javax.ws.rs.core.UriBuilder;
import org.glassfish.jersey.client.ClientConfig;

public class HelloworldClientTest {
        public static void main(String[] args) {
                ClientConfig config = new ClientConfig();
                Client client = ClientBuilder.newClient(config);
                WebTarget target = client.target(getBaseURI());
                // Now printing the server code of different media type

        System.out.println(target.path("rest").path("hellojersey").request().accept(MediaType.TEXT_PLAIN).
get(String.class));

        System.out.println(target.path("rest").path("hellojersey").request().accept(MediaType.TEXT_HTML).g
et(String.class));
        }

        private static URI getBaseURI() {
                // here server is running on 4444 port number and project name is
                // restfuljersey
                return UriBuilder.fromUri("http://localhost:8080/JAXRS-Jersey-
HelloWorld/rest/hellojersey").build();
        }
}
```

If we got 404 error , follow below steps java.lang.ClassNotFoundException:
com.sun.jersey.spi.container.servlet.ServletContainer

Right click on Project → Properties → Deployment Assembly : add : Java BuildPath Entities → Maven Dependencies → Finish


HTTP Status 404 - /JAXRS-MethodLevelPath-Example/country

type Status report

Properties for JAXRS-MethodLevelPath-Example

Web Deployment Assembly

Define packaging structure for this Java EE Web Application project.

Source	Deploy Path
/src	WEB-INF/classes
/target/m2e-wtp/\	/
/WebContent	/

New Assembly Directive

Select Directive Type

Add a new assembly directive.

Java Build Path Entries

Select build path entries to include in the deployment assembly.

Properties for JAXRS-MethodLevelPath-Example

Web Deployment Assembly

Define packaging structure for this Java EE Web Application project.

Source	Deploy Path
/src	WEB-INF/classes
/target/m2e-wtp/\	/
/WebContent	/
Maven Dependenc	WEB-INF/lib

3.3 JAX-RS RESTEasy

RESTEasy, JBoss project, implementation of the **JAX-RS** specification. In this article, we show you how to use RESTEasy framework to create a simple REST style web application

Downlaod **RESTEasy** jars from here or add RESTEasy dependencies in POM.xml

Steps to Create RESTEasy Web Service Application

1. Create Dynamic web project in eclipse, convert that into Maven Project

2. Add RESTEasy jar files manually / through Maven by writing repo details in pom.xml

3. Create RESTFul webservice using RESTEasy

4. Configure `web.xml, Register` RESTEasy dependency class

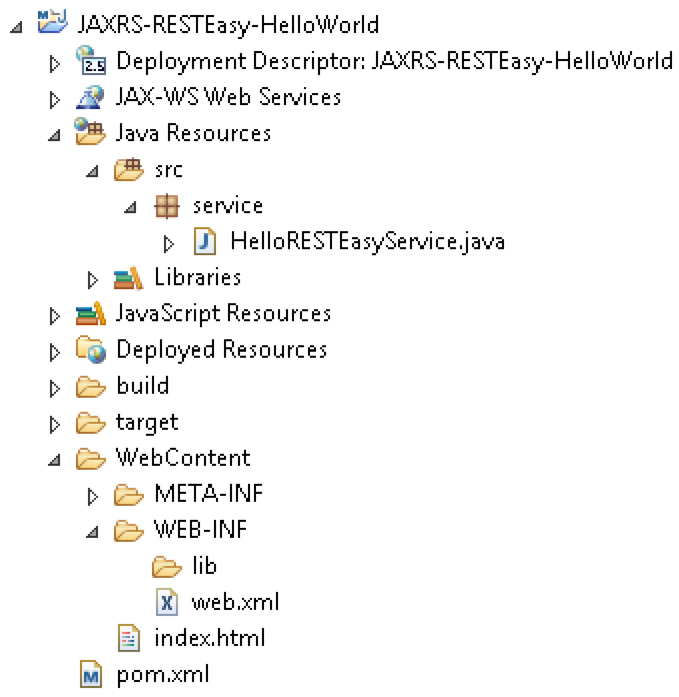
5. Test Webservice directly by using URL / writing webservice client

Example : JAXRS- RESTEasy –HelloWorld

1.Create Dynamic web project in eclipse, convert that into Maven Project

Create Dynamic Web Project : New → Dynamic web project → Provide project details → finish

Convert into Maven Project : Right-click on Project →Configure → Convert to Maven Project.



```
JAXRS-RESTEasy-HelloWorld
  Deployment Descriptor: JAXRS-RESTEasy-HelloWorld
  JAX-WS Web Services
  Java Resources
    src
      service
        HelloRESTEasyService.java
    Libraries
  JavaScript Resources
  Deployed Resources
  build
  target
  WebContent
    META-INF
    WEB-INF
      lib
      web.xml
    index.html
  pom.xml
```

2. Add RESTEasy jar files manually / through Maven by writing repo details in pom.xml

Declares JBoss public Maven repository and "**resteasy-jaxrs**" in your Maven pom.xml file. That's all you need to use **RESTEasy**.

```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>
  <groupId>JAXRS-RESTEasy-HelloWorld</groupId>
  <artifactId>JAXRS-RESTEasy-HelloWorld</artifactId>
  <version>0.0.1-SNAPSHOT</version>
  <packaging>war</packaging>
  <build>
    <sourceDirectory>src</sourceDirectory>
    <plugins>
      <plugin>
        <artifactId>maven-compiler-plugin</artifactId>
        <version>3.5.1</version>
        <configuration>
          <source>1.8</source>
          <target>1.8</target>
        </configuration>
      </plugin>
      <plugin>
        <artifactId>maven-war-plugin</artifactId>
        <version>3.0.0</version>
        <configuration>
          <warSourceDirectory>WebContent</warSourceDirectory>
        </configuration>
      </plugin>
    </plugins>
  </build>

  <repositories>
           <repository>
                  <id>JBoss repository</id>
                  <url>https://repository.jboss.org/nexus/content/groups/public-jboss/</url>
           </repository>
        </repositories>

        <dependencies>
                <dependency>
                        <groupId>org.jboss.resteasy</groupId>
                        <artifactId>resteasy-jaxrs</artifactId>
                        <version>2.2.1.GA</version>
                </dependency>
        </dependencies>
</project>
```

3.Create RESTFul webservice using RESTEasy

```
package service;

import javax.ws.rs.GET;
import javax.ws.rs.Path;
import javax.ws.rs.Produces;
import javax.ws.rs.core.MediaType;

@Path("/helloresteasy")
public class HelloRESTEasyService {
        @GET
        @Produces(MediaType.TEXT_HTML)
        public String sayHtmlHello() {
                return "<h1>" + "Hello RESTEasy Service" + "</h1>";
        }
}
```

4. Configure `web.xml, Register` RESTEasy dependency class

Now, configure listener and servlet to support RESTEasy. Read this JBoss documentation for details

```
<web-app id="WebApp_ID" version="2.4"
        xmlns="http://java.sun.com/xml/ns/j2ee"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee
        http://java.sun.com/xml/ns/j2ee/web-app_2_4.xsd">
        <display-name>Restful Web Application</display-name>

        <!-- Auto scan REST service -->
```

```xml
	<context-param>
		<param-name>resteasy.scan</param-name>
		<param-value>true</param-value>
	</context-param>

	<!-- this need same with resteasy servlet url-pattern -->
	<context-param>
		<param-name>resteasy.servlet.mapping.prefix</param-name>
		<param-value>/rest</param-value>
	</context-param>

	<listener>
		<listener-class>
			org.jboss.resteasy.plugins.server.servlet.ResteasyBootstrap
		</listener-class>
	</listener>

	<servlet>
		<servlet-name>resteasy-servlet</servlet-name>
		<servlet-class>
			org.jboss.resteasy.plugins.server.servlet.HttpServletDispatcher
		</servlet-class>
	</servlet>

	<servlet-mapping>
		<servlet-name>resteasy-servlet</servlet-name>
		<url-pattern>/rest/*</url-pattern>
	</servlet-mapping>

</web-app>
```

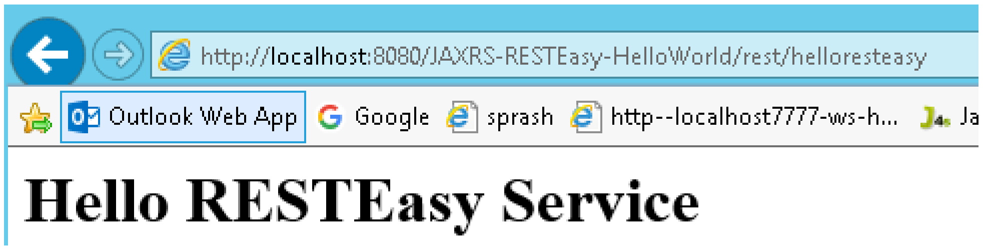
You need to set the "resteasy.servlet.mapping.prefix" if your servlet-mapping for the resteasy servlet has a url-pattern other than "/*".

In above example, the resteasy servlet url-pattern is "/rest/*", so you have to set the "resteasy.servlet.mapping.prefix" to "/rest" as well, otherwise, you will hit resource not found error message.

Remember to set "resteasy.scan" to true, so that RESTEasy will find and register your REST service automatically.

5.Test Webservice directly by using URL / writing webservice client

http://localhost:8080/JAXRS-RESTEasy-HelloWorld/rest/helloresteasy


http://localhost:8080/JAXRS-RESTEasy-HelloWorld/rest/helloresteasy
Outlook Web App
Google
sprash
http--localhost7777-ws-h...
Ja

Hello RESTEasy Service

3.4 JAX-RS Examples

1: JAX-RS @Path annotation at Method Level Example

We can use `@Path` to bind URI pattern to a Java method

1. Create Dynamic web project in eclipse, convert that into Maven Project

2. Add Jersey jar files manually / through Maven by writing repo details in pom.xml

```xml
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
  <repositories>
		<repository>
			<id>maven2-repository.java.net</id>
			<name>Java.net Repository for Maven</name>
			<url>http://download.java.net/maven/2/</url>
			<layout>default</layout>
		</repository>
	</repositories>

	<dependencies>
		<!-- https://mvnrepository.com/artifact/com.sun.jersey/jersey-server -->
		<dependency>
			<groupId>com.sun.jersey</groupId>
			<artifactId>jersey-server</artifactId>
			<version>1.19.3</version>
		</dependency>


		<!-- https://mvnrepository.com/artifact/org.glassfish.jersey.core/jersey-client -->
		<dependency>
			<groupId>org.glassfish.jersey.core</groupId>
			<artifactId>jersey-client</artifactId>
			<version>2.25</version>
		</dependency>

		<!-- https://mvnrepository.com/artifact/javax.ws.rs/javax.ws.rs-api -->
		<dependency>
			<groupId>javax.ws.rs</groupId>
			<artifactId>javax.ws.rs-api</artifactId>
			<version>2.0</version>
		</dependency>
	</dependencies>
</project>
```

3. Create RESTFul webservice

```java
package service;

import javax.ws.rs.GET;
import javax.ws.rs.Path;
import javax.ws.rs.Produces;
import javax.ws.rs.core.Response;

@Path("/country")
public class PathMethodLevelService {

	@GET
	@Produces("text/html")
	public Response selectCountry() {
		String output = " Default Country : <h1>INDIA</h1>";
		return Response.status(200).entity(output).build();
	}

	@GET
	@Path("/usa")
	@Produces("text/html")
	public Response selectUSA() {
		String output = "Selected Country : <h1>United States of America(USA)</h1>";
		return Response.status(200).entity(output).build();
	}

	@GET
	@Path("/uk")
	@Produces("text/html")
	public Response selectUK() {
		String output = "Selected Country : <h1>UNITED KINGDOM(UK)</h1>";
		return Response.status(200).entity(output).build();
	}
}
```

4. Configure `web.xml`

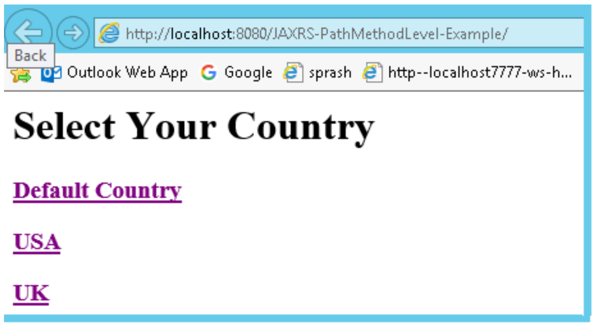
```xml
<?xml version="1.0" encoding="UTF-8"?>
<web-app xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://java.sun.com/xml/ns/j2ee"
xmlns:web="http://xmlns.jcp.org/xml/ns/javaee" xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee
http://java.sun.com/xml/ns/j2ee/web-app_2_4.xsd" id="WebApp_ID" version="2.4">
  <display-name>JAXRS-PathMethodLevel-Example</display-name>
  <servlet>
    <servlet-name>jersey-serlvet</servlet-name>
    <servlet-class>com.sun.jersey.spi.container.servlet.ServletContainer</servlet-class>
    <init-param>
      <param-name>com.sun.jersey.config.property.packages</param-name>
      <param-value>service</param-value>
    </init-param>
    <load-on-startup>1</load-on-startup>
  </servlet>
  <servlet-mapping>
    <servlet-name>jersey-serlvet</servlet-name>
    <url-pattern>/rest/*</url-pattern>
  </servlet-mapping>
</web-app>
```

5. Test Webservice directly by using URL / writing webservice client

http://localhost:8080/JAXRS-PathMethodLevel-Example/ for Default country request

http://localhost:8080/JAXRS-PathMethodLevel-Example/rest/country/usa for usa

http://localhost:8080/JAXRS-PathMethodLevel-Example/rest/country/uk for UK



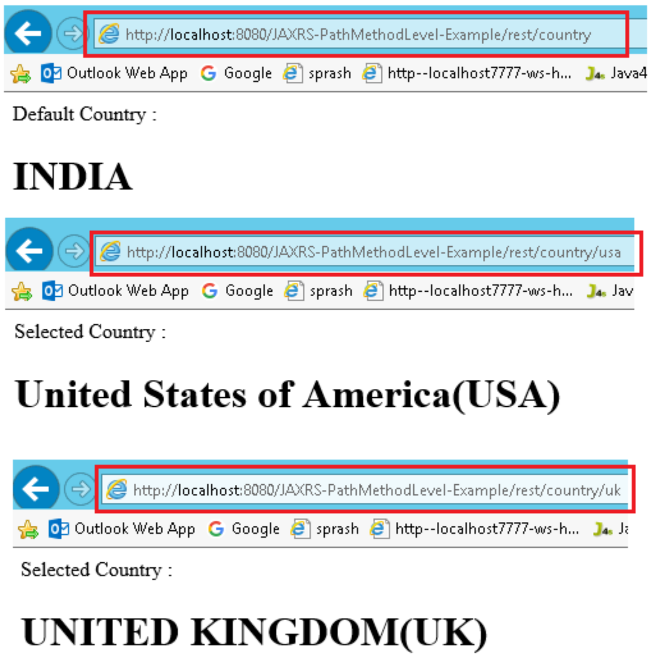
http://localhost:8080/JAXRS-PathMethodLevel-Example/

Select Your Country

Default Country

USA

UK



http://localhost:8080/JAXRS-PathMethodLevel-Example/rest/country

Default Country :

INDIA

http://localhost:8080/JAXRS-PathMethodLevel-Example/rest/country/usa

Selected Country :

United States of America(USA)

http://localhost:8080/JAXRS-PathMethodLevel-Example/rest/country/uk

Selected Country :

UNITED KINGDOM(UK)

Response Class in JAX-RS

javax.ws.rs.core.Response class is reserved for an extension by a JAX-RS implementation providers. An application should use one of the static methods to create a Response instance using a **ResponseBuilder**. An application class should not extend this class directly

We have following methods in Responnse classs which are used majorly

```
1. public abstract int getStatus()
2. public abstract MultivaluedMap<String,Object> getMetadata()
3. public static ResponseBuilder status(Response.StatusType status)
4. public static Response.ResponseBuilder ok()
```

2: JAX-RS @PathParam annotation Example

In RESTful (JAX-RS) web services **@PathParam** annotation will be used to bind RESTful URL parameter values with the method arguments

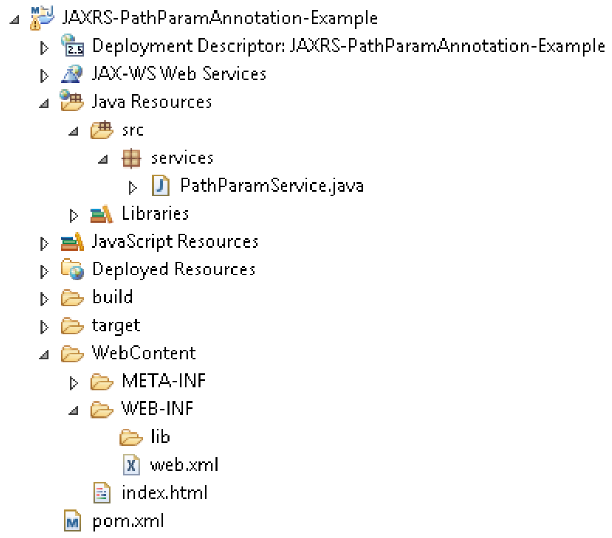
```
http://localhost:8001/<Rest Service Name>/rest/customers/100/Satya
```

Here the two parameters appear in the end of the above URL [100 & Satya], which are separated by forward slash **(/)** are called as **path parameters**

We will read those URL paramters in our webservice method using

```
@PathParam("paramname") String variablename
```

1. Create Dynamic web project in eclipse, convert that into Maven Project



```
JAXRS-PathParamAnnotation-Example
  Deployment Descriptor: JAXRS-PathParamAnnotation-Example
  JAX-WS Web Services
  Java Resources
    src
      services
        PathParamService.java
    Libraries
  JavaScript Resources
  Deployed Resources
  build
  target
  WebContent
    META-INF
    WEB-INF
      lib
      web.xml
    index.html
  pom.xml
```

2. **Add RESTEasy jar files manually / through Maven by writing repo details in pom.xml**

```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>
  <groupId>JAXRS-PathParamAnnotation-Example</groupId>
  <artifactId>JAXRS-PathParamAnnotation-Example</artifactId>
  <version>0.0.1-SNAPSHOT</version>
  <packaging>war</packaging>

  <repositories>
               <repository>
                       <id>maven2-repository.java.net</id>
                       <name>Java.net Repository for Maven</name>
```

```
                        <url>http://download.java.net/maven/2/</url>
                        <layout>default</layout>
                </repository>
        </repositories>

        <dependencies>
                        <dependency>
                        <groupId>com.sun.jersey</groupId>
                        <artifactId>jersey-server</artifactId>
                        <version>1.8</version>
                </dependency>
        </dependencies>

        <build>
                <finalName>JAXRS-PathParamAnnotation-Example</finalName>
                <plugins>
                        <plugin>
                                <artifactId>maven-compiler-plugin</artifactId>
                                <configuration>
                                        <compilerVersion>1.5</compilerVersion>
                                        <source>1.5</source>
                                        <target>1.5</target>
                                </configuration>
                        </plugin>
                </plugins>
        </build>

</project>
```

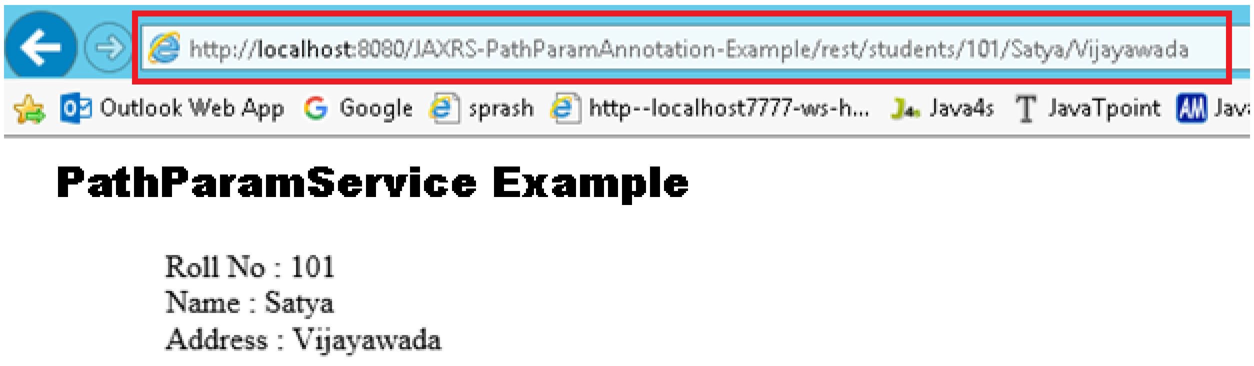
3. Create RESTFul webservice using RESTEasy

```
package services;


@Path("/students")
public class PathParamService {

        @GET
        @Path("{rollno}/{name}/{address}")
        @Produces("text/html")
        public Response getResultByPassingValue(
                        @PathParam("rollno") String rollno,
                                        @PathParam("name") String name,
                                        @PathParam("address") String address) {
                String output = "<h1>PathParamService Example</h1>";
                output = output+"<br>Roll No : "+rollno;
                output = output+"<br>Name : "+name;
                output = output+"<br>Address : "+address;
                return Response.status(200).entity(output).build();
        }
}
```

4. Configure `web.xml, Register` Jersey dependency class

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://java.sun.com/xml/ns/j2ee"
xmlns:web="http://xmlns.jcp.org/xml/ns/javaee" xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee
http://java.sun.com/xml/ns/j2ee/web-app_2_4.xsd" id="WebApp_ID" version="2.4">
  <display-name>JAXRS-PathParamAnnotation-Example</display-name>
  <servlet>
    <servlet-name>jersey-serlvet</servlet-name>
    <servlet-class>com.sun.jersey.spi.container.servlet.ServletContainer</servlet-class>
    <init-param>
      <param-name>com.sun.jersey.config.property.packages</param-name>
      <param-value>services</param-value>
    </init-param>
    <load-on-startup>1</load-on-startup>
  </servlet>
  <servlet-mapping>
    <servlet-name>jersey-serlvet</servlet-name>
    <url-pattern>/rest/*</url-pattern>
  </servlet-mapping>
</web-app>
```

5. Test Webservice directly by using URL / writing webservice client
http://localhost:8080/JAXRS-PathParamAnnotation-Example/rest/students/101/Satya/Vijayawada


http://localhost:8080/JAXRS-PathParamAnnotation-Example/rest/students/101/Satya/Vijayawada

PathParamService Example

Roll No : 101
Name : Satya
Address : Vijayawada

Note : In Upcomming Examples POM.XML , Web.xml are same for all applications. So iam skipping those. If any changes in those files I will mention don't worry ☺

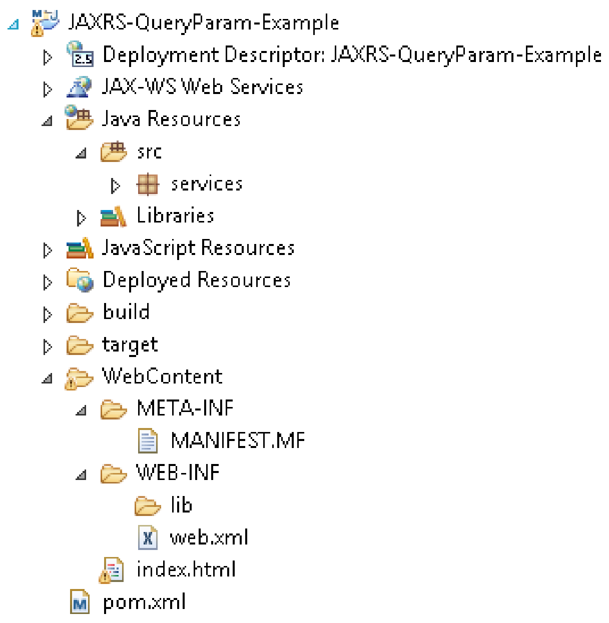
3: JAX-RS @QueryParam annotation Example

```
http://localhost:8001/…/rest/customers?custNo=100&custName=Satya
```

If the client sends an input in the form of query string in the URL, then those parameters are called as **Query Parameters**. If you observe the above syntax, client passing **custNo=100&custName=Satya** started after question mark **(?)** symbol and each parameter is separated by **&** symbol, those parameters are called as query parameters.

Steps to Implement this Web Service Application

1. Create Dynamic web project in eclipse, convert that into Maven Project


```
JAXRS-QueryParam-Example
  Deployment Descriptor: JAXRS-QueryParam-Example
  JAX-WS Web Services
  Java Resources
    src
      services
    Libraries
  JavaScript Resources
  Deployed Resources
  build
  target
  WebContent
    META-INF
      MANIFEST.MF
    WEB-INF
      lib
      web.xml
    index.html
  pom.xml
```

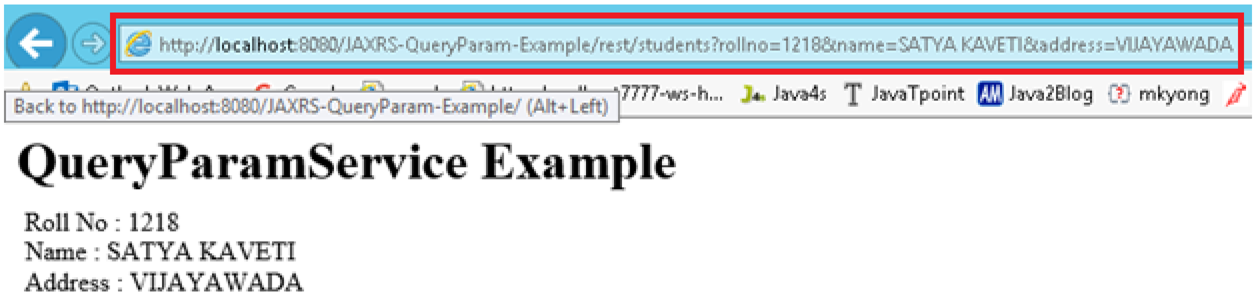
2. Add RESTEasy jar files manually / through Maven by writing repo details in **pom.xml(skip)**

3. Create RESTFul webservice using Jersy

```
package services;

@Path("/students")
public class QueryParamService {
        @GET
        @Produces("text/html")
        public Response getResultByPassingValue(
                                        @QueryParam("rollno") String rollno,
                                        @QueryParam("name") String name,
                                        @QueryParam("address") String address) {
                String output = "<h1>QueryParamService Example</h1>";
                output = output+"<br>Roll No : "+rollno;
                output = output+"<br>Name : "+name;
                output = output+"<br>Address : "+address;
                return Response.status(200).entity(output).build();
        }
}
```

4. Configure `web.xml` **(SKIPING)**

5. Test Webservice directly by using URL / writing webservice client
http://localhost:8080/JAXRS-QueryParam-Example/rest/students?rollno=1218&name=SATYA KAVETI&address=VIJAYAWADA


http://localhost:8080/JAXRS-QueryParam-Example/rest/students?rollno=1218&name=SATYA KAVETI&address=VIJAYAWADA
Back to http://localhost:8080/JAXRS-QueryParam-Example/ (Alt+Left)
7777-ws-h...
Java4s
JavaTpoint
Java2Blog
mkyong

```
QueryParamService Example

Roll No : 1218
Name : SATYA KAVETI
Address : VIJAYAWADA
```

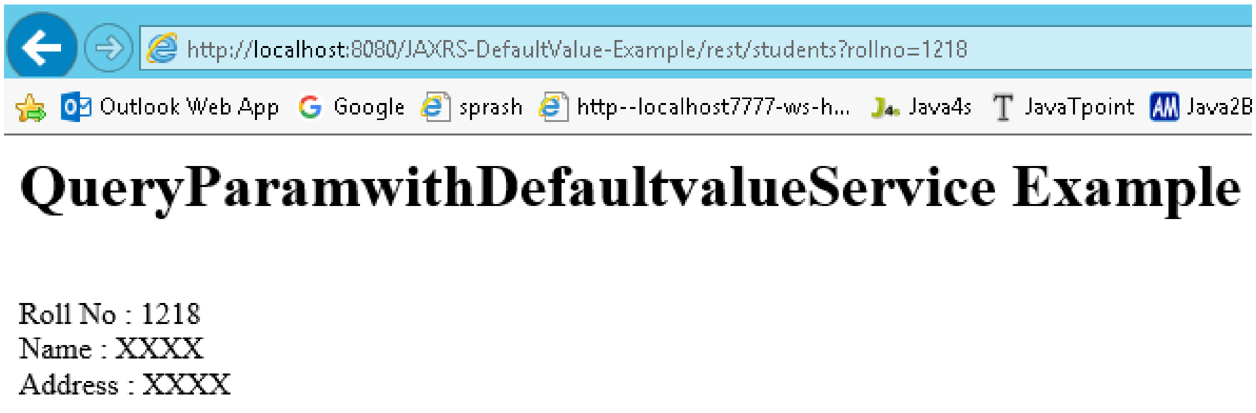
4. JAX-RS @DefaultValue Annotation

Sometimes URL doesn't contain the values which are expected the methods. In that situation we can use `@DefaultValue` for passing default values to method parameters. `@DefaultValue` is good for optional parameter.

```
package services;

import javax.ws.rs.DefaultValue;
import javax.ws.rs.GET;
import javax.ws.rs.Path;

@Path("/students")
public class QueryParamwithDefaultvalueService {
        @GET
        @Produces("text/html")
        public Response getResultByPassingValue(@DefaultValue("1000") @QueryParam("rollno") String rollno,
                        @DefaultValue("XXXX") @QueryParam("name") String name,
                        @DefaultValue("XXXX") @QueryParam("address") String address) {
                String output = "<h1>QueryParamwithDefaultvalueService Example</h1>";
                output = output + "<br>Roll No : " + rollno;
                output = output + "<br>Name : " + name;
                output = output + "<br>Address : " + address;
                return Response.status(200).entity(output).build();
        }
}
```

http://localhost:8080/JAXRS-DefaultValue-Example/rest/students?rollno=1218

in Above URL we are not passing Name, Address paramaeter values. So it will take Default values passed in @DefaultValue("XXXX") annotation


http://localhost:8080/JAXRS-DefaultValue-Example/rest/students?rollno=1218
Outlook Web App
Google
sprash
http--localhost7777-ws-h...
Java4s
JavaTpoint
Java2B

QueryParamwithDefaultvalueService Example

Roll No : 1218
Name : XXXX
Address : XXXX

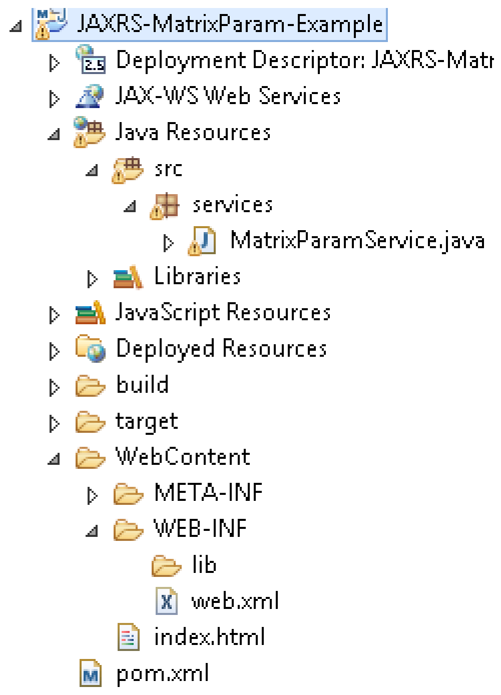
5: JAX-RS @MatrixParam annotation Example

```
http://localhost:8001/…/rest/customers;custNo=100;custName=Satya
```

Matrix parameters are another way defining the parameters to be added to URL. If you observe the above syntax, client is passing two parameters each are separated by **semicolon(;),** these parameters are called as matrix parameters. **Remember these parameters may appear any where in the path**

Steps to Implement this Web Service Application

1. Create Dynamic web project in eclipse, convert that into Maven Project


JAXRS-MatrixParam-Example
Deployment Descriptor: JAXRS-Matr
JAX-WS Web Services
Java Resources
src
services
MatrixParamService.java
Libraries
JavaScript Resources
Deployed Resources
build
target
WebContent
META-INF
WEB-INF
lib
web.xml
index.html
pom.xml

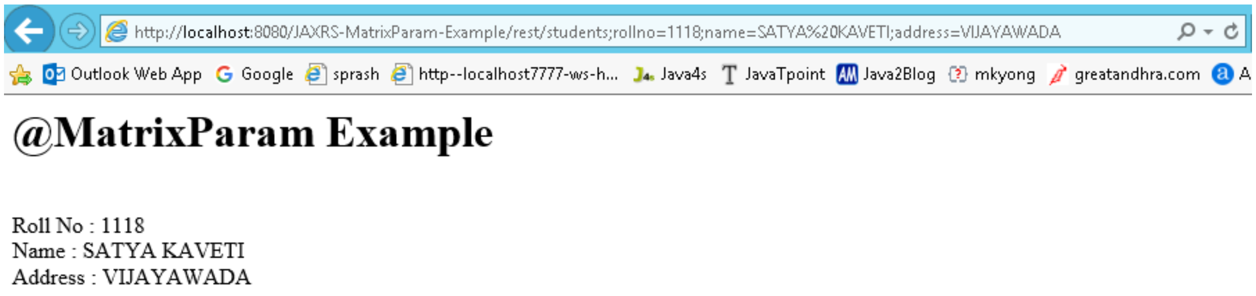
2. Add RESTEasy jar files manually / through Maven by writing repo details in **pom.xml(Skipping)**

3. Create RESTFul webservice using Jersey

```
package services;
import javax.ws.rs.*;
import javax.ws.rs.core.Response;

@Path("/students")
public class MatrixParamService{
        @GET
        @Produces("text/html")
        public Response getResultByPassingValue(
                        @MatrixParam("rollno") String rollno,
                        @MatrixParam("name") String name,
                        @MatrixParam("address") String address) {

                String output = "<h1>@MatrixParam Example</h1>";
                output = output+"<br>Roll No : "+rollno;
                output = output+"<br>Name : "+name;
                output = output+"<br>Address : "+address;
                return Response.status(200).entity(output).build();
        }
}
```

4. Configure web.xml, Register RESTEasy dependency class **(Skipping)**

5. Test Webservice directly by using URL / writing webservice client
http://localhost:8080/JAXRS-MatrixParam-Example/rest/students;rollno=1118;name=SATYA%20KAVETI;address=VIJAYAWADA


http://localhost:8080/JAXRS-MatrixParam-Example/rest/students;rollno=1118;name=SATYA%20KAVETI;address=VIJAYAWADA

@MatrixParam Example

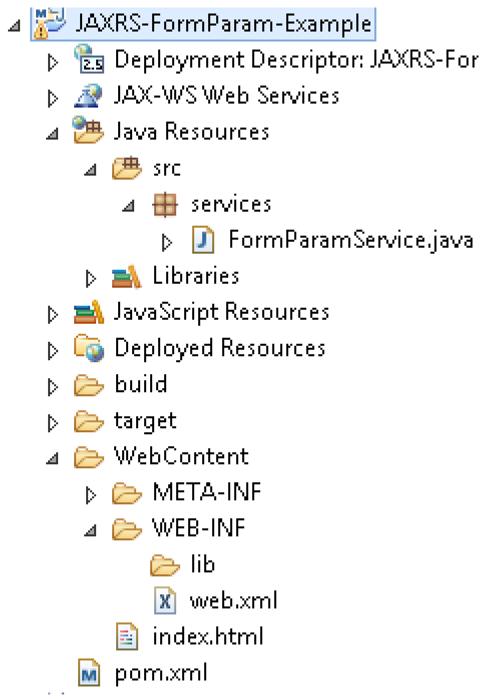
Roll No : 1118
Name : SATYA KAVETI
Address : VIJAYAWADA

6: JAX-RS @FormParam annotation Example

If we have a HTML form having two input fields and submit button. Lets client enter those details and submit to the RESTful web service. Then the rest service will extract those details by using this **@FormParam** annotation.we can use `@FormParam` annotation to bind HTML form parameters value to a Java method

Steps to Implement this Web Service Application

1. Create Dynamic web project in eclipse, convert that into Maven Project


```
JAXRS-FormParam-Example
  Deployment Descriptor: JAXRS-For
  JAX-WS Web Services
  Java Resources
    src
      services
        FormParamService.java
    Libraries
  JavaScript Resources
  Deployed Resources
  build
  target
  WebContent
    META-INF
    WEB-INF
      lib
      web.xml
    index.html
  pom.xml
```

2. Configure **pom.xml, web.xml (Skipping)**

3. Create RESTFul webservice Jersey

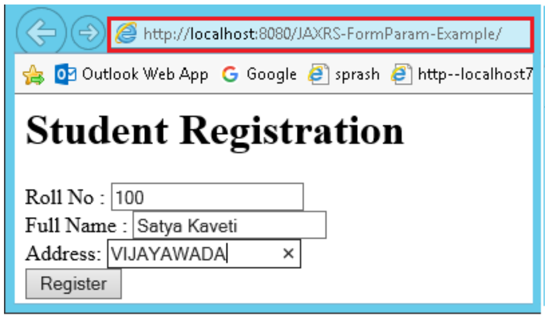
```
package services;
import javax.ws.rs.FormParam;
import javax.ws.rs.POST;
import javax.ws.rs.Path;
import javax.ws.rs.Produces;
import javax.ws.rs.core.Response;
```

```
@Path("/students")
public class FormParamService {

        @POST
        @Path("/registerStudent")
        @Produces("text/html")
        public Response getResultByPassingValue(
                        @FormParam("rollno") String rollno,
                        @FormParam("name") String name,
                        @FormParam("address") String address) {

                String output = "<h1>@FormParam Example - REGISTRATION COMPLETED!!!</h1>";
                output = output+"<br>Roll No : "+rollno;
                output = output+"<br>Name : "+name;
                output = output+"<br>Address : "+address;
                return Response.status(200).entity(output).build();
        }
}
```

5. Test Webservice directly by using URL / writing webservice client

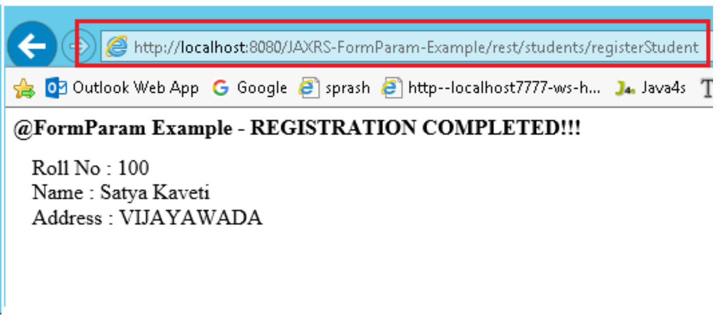
i. http://localhost:8080/JAXRS-FormParam-Example/

ii. http://localhost:8080/JAXRS-FormParam-Example/rest/students/registerStudent



Student Registration

Roll No : 100
Full Name : Satya Kaveti
Address: VIJAYAWADA
Register

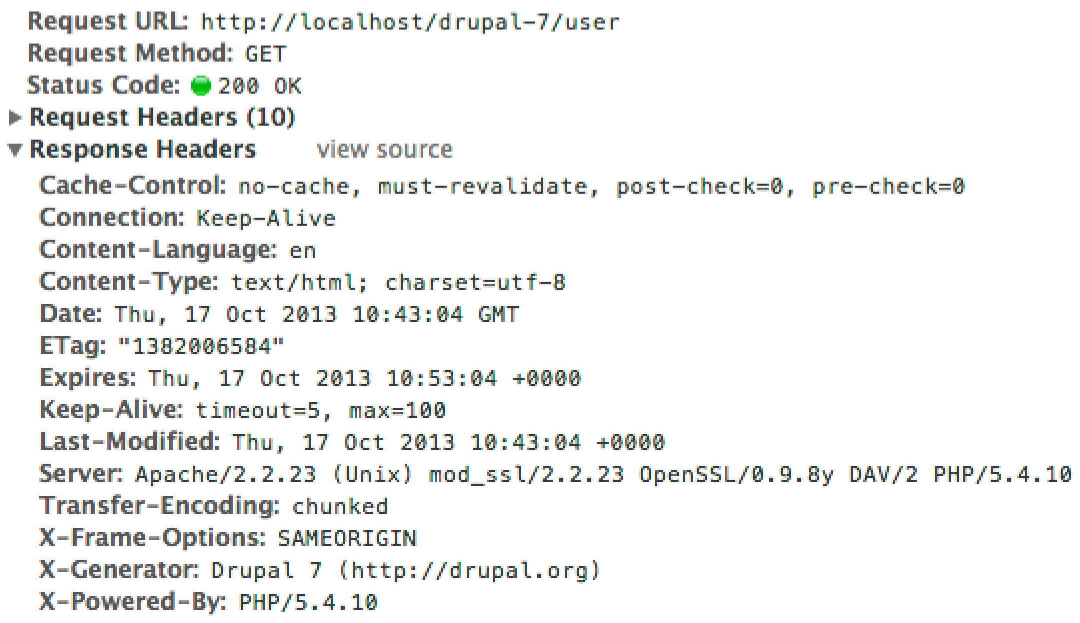

http://localhost:8080/JAXRS-FormParam-Example/rest/students/registerStudent
Outlook Web App
Google
sprash
http--localhost7777-ws-h...
Java4s

@FormParam Example - REGISTRATION COMPLETED!!!

Roll No : 100
Name : Satya Kaveti
Address : VIJAYAWADA

7: JAX-RS @HeaderParam Example

We can get the HTTP header details using JAXRS. HTTP headers like below formate



```
Request URL: http://localhost/drupal-7/user
Request Method: GET
Status Code: ● 200 OK
▶ Request Headers (10)
▼ Response Headers      view source
  Cache-Control: no-cache, must-revalidate, post-check=0, pre-check=0
  Connection: Keep-Alive
  Content-Language: en
  Content-Type: text/html; charset=utf-8
  Date: Thu, 17 Oct 2013 10:43:04 GMT
  ETag: "1382006584"
  Expires: Thu, 17 Oct 2013 10:53:04 +0000
  Keep-Alive: timeout=5, max=100
  Last-Modified: Thu, 17 Oct 2013 10:43:04 +0000
  Server: Apache/2.2.23 (Unix) mod_ssl/2.2.23 OpenSSL/0.9.8y DAV/2 PHP/5.4.10
  Transfer-Encoding: chunked
  X-Frame-Options: SAMEORIGIN
  X-Generator: Drupal 7 (http://drupal.org)
  X-Powered-By: PHP/5.4.10
```

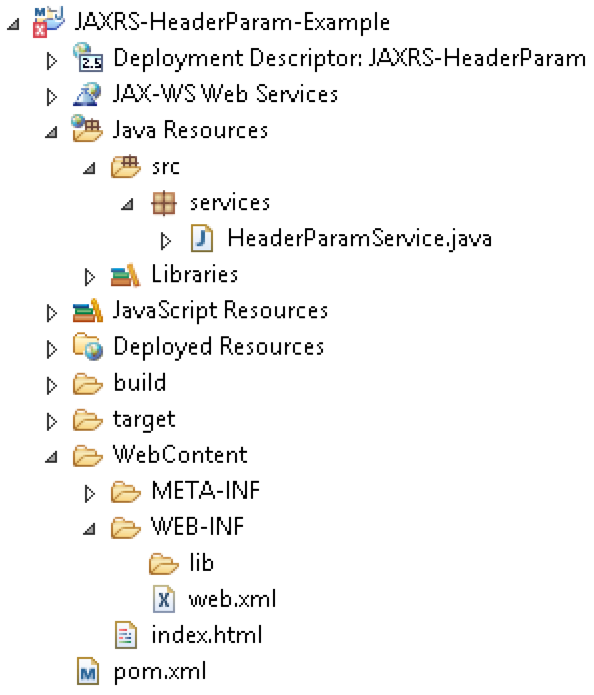
We have two ways to get HTTP request header in JAX-RS :

1. Inject directly with `@HeaderParam`

2. Pragmatically via `@Context`

JAX-RS @HeaderParam Example

1. Create Dynamic web project in eclipse, convert that into Maven Project



```
◢ JAXRS-HeaderParam-Example
  ▷ Deployment Descriptor: JAXRS-HeaderParam
  ▷ JAX-WS Web Services
  ◢ Java Resources
    ◢ src
      ◢ services
        ▷ HeaderParamService.java
    ▷ Libraries
  ▷ JavaScript Resources
  ▷ Deployed Resources
  ▷ build
  ▷ target
  ◢ WebContent
    ▷ META-INF
    ◢ WEB-INF
        lib
        web.xml
      index.html
    pom.xml
```

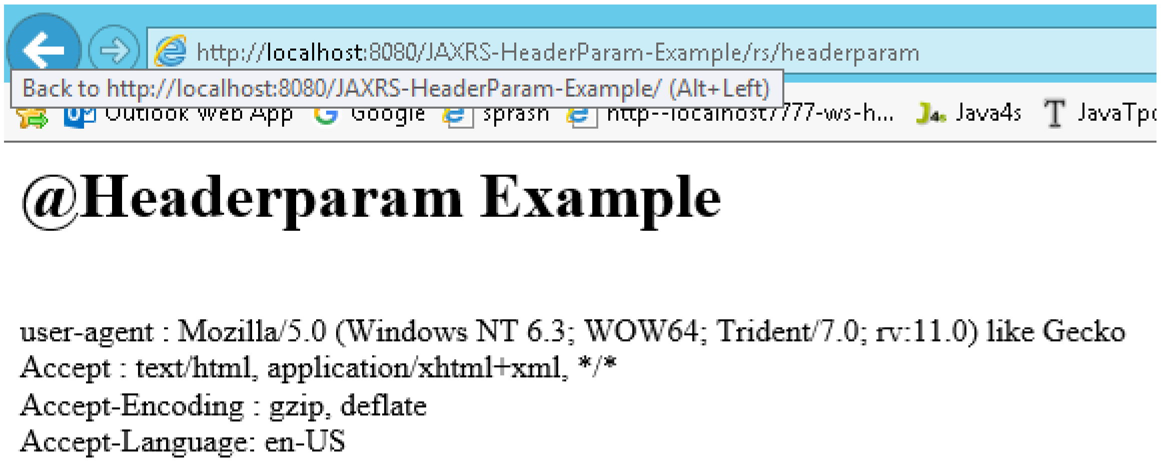
2. Configure **pom.xml, web.xml (Skipping)**

3. Create RESTFul webservice

```
package services;

import javax.ws.rs.GET;
import javax.ws.rs.HeaderParam;
import javax.ws.rs.Path;
import javax.ws.rs.core.Response;

@Path("/rs")
public class HeaderParamService {

        @GET
        @Path("/headerparam")
        public Response getHeader(
                        @HeaderParam("user-agent") String userAgent,
                        @HeaderParam("Accept") String accept,
            @HeaderParam("Accept-Encoding") String encoding,
            @HeaderParam("Accept-Language") String lang) {

                String output = "<h1>@Headerparam Example</h1>";
                output = output+"<br>user-agent : "+userAgent;
                output = output+"<br>Accept : "+accept;
                output = output+"<br>Accept-Encoding : "+encoding;
                output = output+"<br>Accept-Language: "+lang;

                return Response.status(200)
                        .entity(output)
                        .build();

        }
}
```

5. Test Webservice directly by using URL / writing webservice client

http://localhost:8080/JAXRS-HeaderParam-Example/rs/headerparam


http://localhost:8080/JAXRS-HeaderParam-Example/rs/headerparam
Back to http://localhost:8080/JAXRS-HeaderParam-Example/ (Alt+Left)
Outlook Web App
Google
sprash
http--localhost:7777-ws-h...
Java4s
JavaTpo

@Headerparam Example

user-agent : Mozilla/5.0 (Windows NT 6.3; WOW64; Trident/7.0; rv:11.0) like Gecko
Accept : text/html, application/xhtml+xml, */*
Accept-Encoding : gzip, deflate
Accept-Language: en-US

8: JAX-RS @Context Example

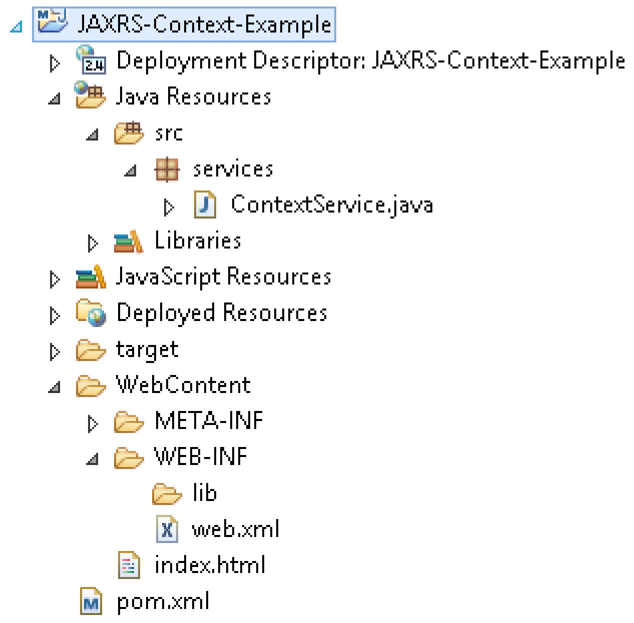
JAX-RS provides the **@Context** annotation to inject a variety of resources in your RESTful services. Some of the most commonly injected components are HTTP headers, HTTP URI related information

- ***HTTP headers***

- ***HTTP URI details***
- ***Security Context***
- ***Resource Context***
- ***Request***
- ***Configuration***
- ***Application***
- ***Providers***

JAX-RS @Context Example

1. Create Dynamic web project in eclipse, convert that into Maven Project



```
JAXRS-Context-Example
    Deployment Descriptor: JAXRS-Context-Example
    Java Resources
        src
            services
                ContextService.java
        Libraries
    JavaScript Resources
    Deployed Resources
    target
    WebContent
        META-INF
        WEB-INF
            lib
            web.xml
        index.html
    pom.xml
```

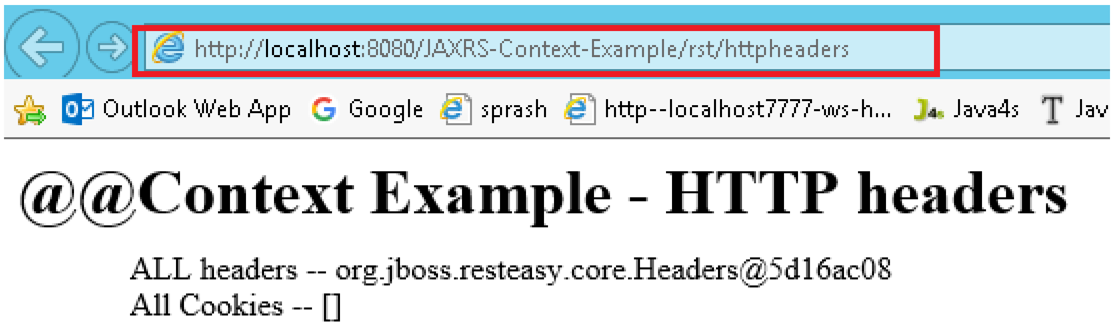
2. Configure **pom.xml, web.xml (Skipping)**

3. Create RESTFul webservice

```
package services;

import javax.ws.rs.GET;

import javax.ws.rs.Path;
import javax.ws.rs.core.Context;
import javax.ws.rs.core.HttpHeaders;
import javax.ws.rs.core.Response;
import javax.ws.rs.core.SecurityContext;
import javax.ws.rs.core.UriInfo;

@Path("/rst")
public class ContextService {

        @GET
    @Path("httpheaders")
        public Response getHttpheaders(@Context HttpHeaders headers){
                String output = "<h1>@@Context Example - HTTP headers</h1>";
                 output =  output+"<br>ALL headers -- "+ headers.getRequestHeaders().toString();
                 output =  output+"<br>All Cookies -- "+ headers.getCookies().values();
                 return Response.status(200)
```

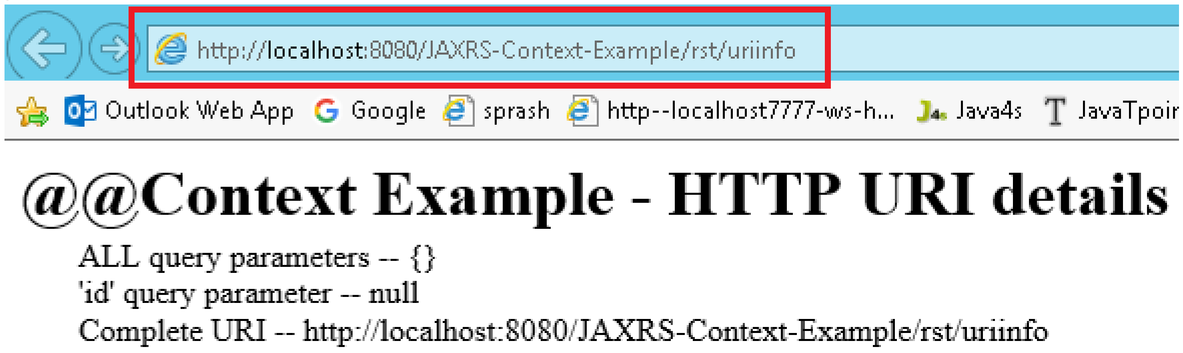
```
                                        .entity(output)
                                        .build();
    }


        @GET
          @Path("uriinfo")
          public Response test(@Context UriInfo uriDetails){
                String output = "<h1>@@Context Example - HTTP URI details</h1>";
        output =  output+"<br>ALL query parameters -- "+ uriDetails.getQueryParameters().toString();
        output =  output+"<br>'id' query parameter -- "+ uriDetails.getQueryParameters().get("id");
        output =  output+"<br>Complete URI -- "+ uriDetails.getRequestUri();
                 return Response.status(200)
                                        .entity(output)
                                        .build();
          }

        @GET
          @Path("securitycontext")
          public Response test(@Context SecurityContext secContext){
                String output = "<h1>@@Context Example - Security Context</h1>";
                //output =  output+"<br>Caller -- "+ secContext.getUserPrincipal().getName();
                output =  output+"<br>Authentication Scheme -- "+ secContext.getAuthenticationScheme();
                output =  output+"<br>Over HTTPS ? -- "+ secContext.isSecure();
                output =  output+"<br>Belongs to 'admin' role? -- "+ secContext.isUserInRole("admin");
              return Response.status(200)
                                        .entity(output)
                                        .build();
          }


}
```

5. Test Webservice directly by using URL / writing webservice client
http://localhost:8080/JAXRS-Context-Example/rst/httpheaders
http://localhost:8080/JAXRS-Context-Example/rst/uriinfo
http://localhost:8080/JAXRS-Context-Example/rst/securitycontext


http://localhost:8080/JAXRS-Context-Example/rst/httpheaders
Outlook Web App
Google
sprash
http--localhost7777-ws-h...
Java4s
Jav

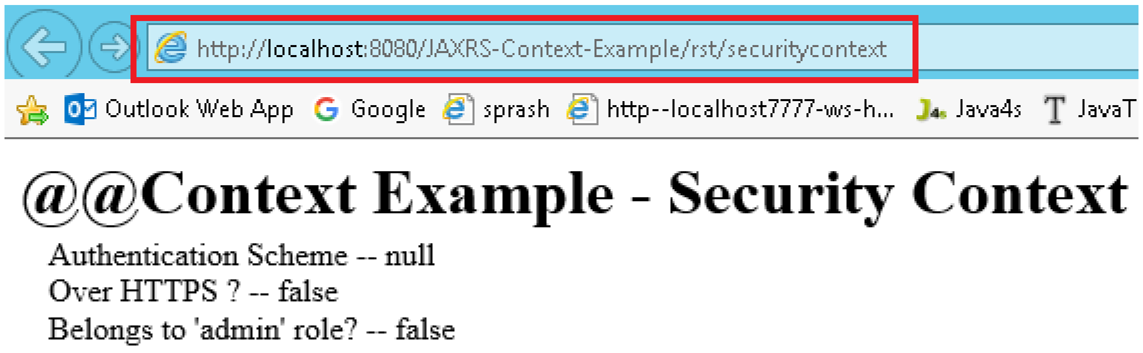
@@Context Example - HTTP headers

ALL headers -- org.jboss.resteasy.core.Headers@5d16ac08
All Cookies -- []


http://localhost:8080/JAXRS-Context-Example/rst/uriinfo
Outlook Web App
Google
sprash
http--localhost7777-ws-h...
Java4s
JavaTpoir

@@Context Example - HTTP URI details

ALL query parameters -- {}
'id' query parameter -- null
Complete URI -- http://localhost:8080/JAXRS-Context-Example/rst/uriinfo


http://localhost:8080/JAXRS-Context-Example/rst/securitycontext
Outlook Web App
Google
sprash
http--localhost7777-ws-h...
Java4s
JavaT

@@Context Example - Security Context

Authentication Scheme -- null
Over HTTPS ? -- false
Belongs to 'admin' role? -- false

9: JAX-RS Download files (text/image/pdf/execel) Example

We can download any type of files from the RESTful web services, **@produces** annotation

We should annotate our method with

- **@Produces("text/plain")** If you are expecting Text file as response
- **@Produces("image/your image type[.jpg/.png/.gif]")** for downloading any Image files
- **@Produces("application/pdf")** for downloading PDF files

Steps to Implement this Web Service Application

1. Create **Dynamic web project in eclipse**, **pom.xml, web.xml (Skipping)**

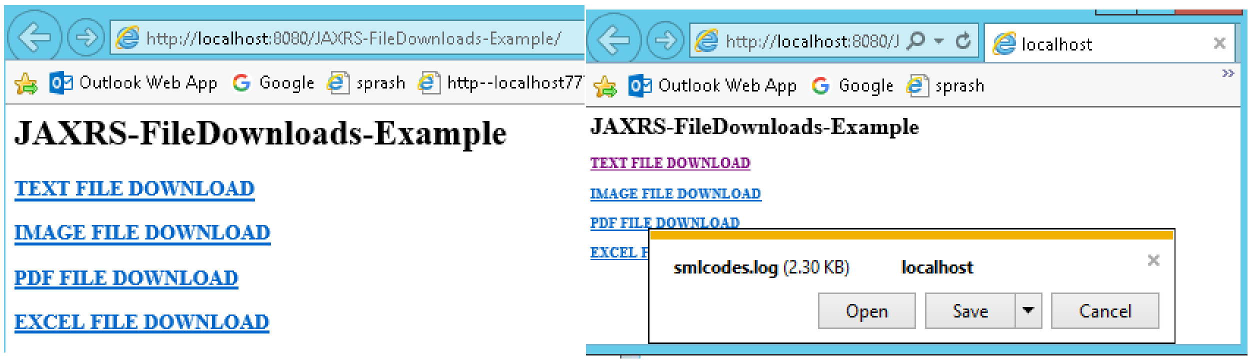
2. Create RESTFul webservice Jersey

```java
package service;
import java.io.File;
import javax.ws.rs*;

@Path("/download")
public class FileDownloadService {
        private static final String TEXT_FILE_PATH = "C:\\Users\\kaveti_s\\textfile.txt";
        private static final String IMG_FILE_PATH = "C:\\Users\\kaveti_s\\img.jpg";
        private static final String PDF_FILE_PATH = "C:\\Users\\kaveti_s\\pdffile.pdf";
        private static final String XLS_FILE_PATH = "C:\\Users\\kaveti_s\\excel.xlsx";

        //TEXTFILE DOWNLOAD
        @GET
        @Path("/textfile")
        @Produces("text/plain")
        public Response downloadTextFile() {
                File file = new File(TEXT_FILE_PATH);
                ResponseBuilder response = Response.ok((Object) file);
                response.header("Content-Disposition",
                        "attachment; filename=\"SatyaCodes.log\"");
                return response.build();
        }

        //IMAGE DOWNLOAD
        @GET
        @Path("/image")
        @Produces("image/jpg")
        public Response downloadImage() {
                File file = new File(IMG_FILE_PATH);
                ResponseBuilder response = Response.ok((Object) file);
                response.header("Content-Disposition",
                        "attachment; filename=SatyaCodes.jpg");
                return response.build();
        }

        //PDF DOWNLOAD
        @GET
        @Path("/pdf")
        @Produces("application/pdf")
        public Response downloadPDF() {
                File file = new File(PDF_FILE_PATH);
                ResponseBuilder response = Response.ok((Object) file);
                response.header("Content-Disposition",
                                "attachment; filename=SatyaCodes.pdf");
                return response.build();
        }


        //XLS DOWNLOAD
        @GET
        @Path("/xls")
        @Produces("application/vnd.ms-excel")
        public Response downloadXLS() {
                File file = new File(XLS_FILE_PATH);
                ResponseBuilder response = Response.ok((Object) file);
                response.header("Content-Disposition",
                        "attachment; filename=new-SatyaCodes.xls");
                return response.build();

        }
}
```

```html
//index.html
<h1>JAXRS-FileDownloads-Example</h1>

<h3><a href="download/textfile">TEXT FILE DOWNLOAD</a></h3>
 <h3><a href="download/image">IMAGE FILE DOWNLOAD</a></h3>
 <h3><a href="download/pdf">PDF FILE DOWNLOAD</a></h3>
 <h3><a href="download/xls">EXCEL FILE DOWNLOAD</a></h3>
```

5. Test Webservice directly by using URL / writing webservice client

http://localhost:8080/JAXRS-FileDownloads-Example/


http://localhost:8080/JAXRS-FileDownloads-Example/

JAXRS-FileDownloads-Example

TEXT FILE DOWNLOAD

IMAGE FILE DOWNLOAD

PDF FILE DOWNLOAD

EXCEL FILE DOWNLOAD

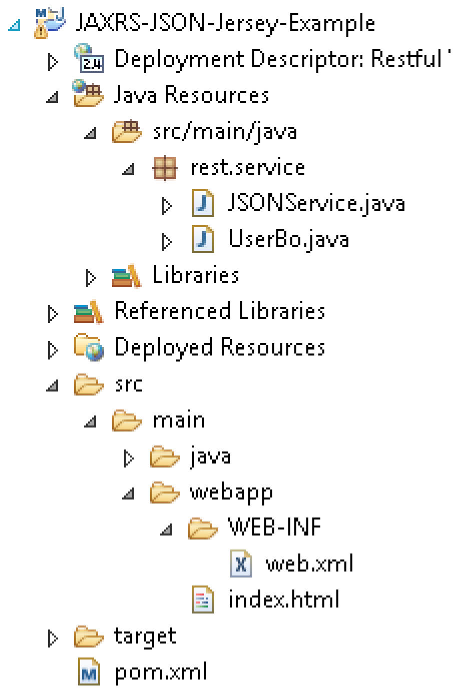
smlcodes.log (2.30 KB) localhost

10. JAX-RS JSON Example Using Jersey

Jersey uses Jackson to convert **object to / form JSON**. In this example, we show you how to convert a "user" object into JSON format, and return it back to user

Steps to Implement this Web Service Application

1. Create Dynamic web project in eclipse, convert that into Maven Project


```
JAXRS-JSON-Jersey-Example
  Deployment Descriptor: Restful '
  Java Resources
    src/main/java
      rest.service
        JSONService.java
        UserBo.java
    Libraries
  Referenced Libraries
  Deployed Resources
  src
    main
      java
      webapp
        WEB-INF
          web.xml
        index.html
  target
  pom.xml
```

2. Configure pom.xml

To make Jersey support JSON mapping, declares “jersey-json.jar” in Maven `pom.xml` file.

```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>
  <groupId>JAX-RS-JSON_Example-Jersey</groupId>
  <artifactId>JAX-RS-JSON_Example-Jersey</artifactId>
  <version>0.0.1-SNAPSHOT</version>
  <packaging>war</packaging>
  <build>
    <sourceDirectory>src</sourceDirectory>
    <plugins>
      <plugin>
        <artifactId>maven-compiler-plugin</artifactId>
        <version>3.5.1</version>
        <configuration>
          <source>1.8</source>
          <target>1.8</target>
        </configuration>
      </plugin>
      <plugin>
        <artifactId>maven-war-plugin</artifactId>
        <version>3.0.0</version>
        <configuration>
          <warSourceDirectory>WebContent</warSourceDirectory>
        </configuration>
      </plugin>
    </plugins>
  </build>

  <repositories>
                <repository>
                        <id>maven2-repository.java.net</id>
                        <name>Java.net Repository for Maven</name>
                        <url>http://download.java.net/maven/2/</url>
                        <layout>default</layout>
                </repository>
        </repositories>

        <dependencies>


                <dependency>
                        <groupId>com.sun.jersey</groupId>
                        <artifactId>jersey-server</artifactId>
                        <version>1.8</version>
                </dependency>

                <dependency>
                        <groupId>com.sun.jersey</groupId>
                        <artifactId>jersey-json</artifactId>
                        <version>1.8</version>
                </dependency>

        </dependencies>
</project>
```

3. Configure **web.xml**

In `web.xml`, declares “`com.sun.jersey.api.json.POJOMappingFeature`” as “`init-param`” in Jersey mapped servlet. It will make Jersey support JSON/object mapping.

```
<web-app id="WebApp_ID" version="2.4"
        xmlns="http://java.sun.com/xml/ns/j2ee" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee
        http://java.sun.com/xml/ns/j2ee/web-app_2_4.xsd">
        <display-name>Restful Web Application</display-name>
        <servlet>
                <servlet-name>jersey-serlvet</servlet-name>
                <servlet-class>com.sun.jersey.spi.container.servlet.ServletContainer</servlet-class>
                <init-param>
                        <param-name>com.sun.jersey.config.property.packages</param-name>
                        <param-value>rest.service</param-value>
                </init-param>
                <init-param>
                        <param-name>com.sun.jersey.api.json.POJOMappingFeature</param-name>
                        <param-value>true</param-value>
                </init-param>
                <load-on-startup>1</load-on-startup>
        </servlet>

        <servlet-mapping>
                <servlet-name>jersey-serlvet</servlet-name>
                <url-pattern>/rest/*</url-pattern>
        </servlet-mapping>

</web-app>
```

4. Write "UserBo" class

Write "UserBo" class object, Jersey will convert this object into JSON format.

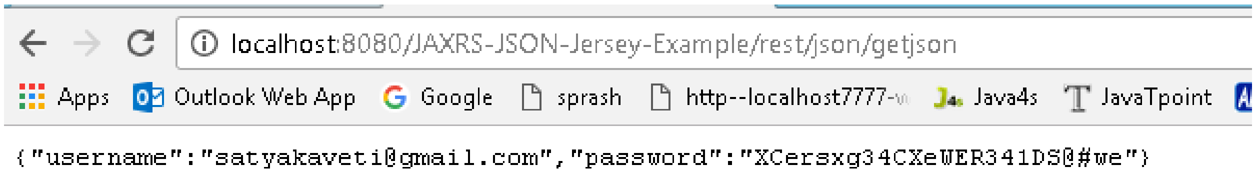
```
package services;

public class UserBo {
        String username;
        String password;

        public String getUsername() {
                return username;
        }

        public void setUsername(String username) {
                this.username = username;
        }

        public String getPassword() {
                return password;
        }

        public void setPassword(String password) {
                this.password = password;
        }

        @Override
        public String toString() {
                // TODO Auto-generated method stub
                return "User [username=" + username + ", password=" + password + "]";
        };
}
```

5. Create RESTFul webservice Jersey

Annotate the method with `@Produces(MediaType.APPLICATION_JSON)`. Jersey will use Jackson to handle the JSON conversion automatically.

```
package rest.service;

@Path("/json")
public class JSONService {
        @GET
        @Path("/getjson")
        @Produces(MediaType.APPLICATION_JSON)
        public UserBo getboInJSON() {

                UserBo bo = new UserBo();
                bo.setUsername("satyakaveti@gmail.com");
                bo.setPassword("XCersxg34CXeWER341DS@#we");
                return bo;
        }

}
```

6. Test Webservice directly by using URL / writing webservice client
http://localhost:8080/JAX-RS-JSON_Example-Jersey/json/getjson

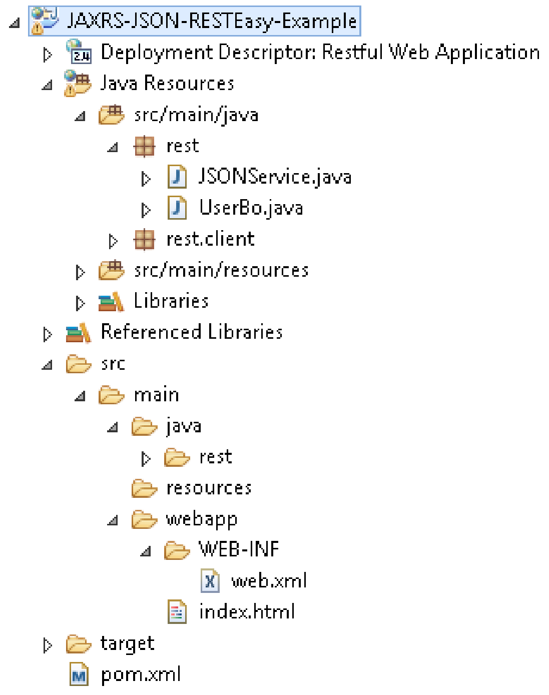


```
{"username":"satyakaveti@gmail.com","password":"XCersxg34CXeWER341DS@#we"}
```

11. JAX-RS JSON Example Using RESTEasy

To integrate Jackson with RESTEasy, you just need to include **"resteasy-jackson-provider.jar".**

1. Create Dynamic web project in eclipse, convert that into Maven Project



```
JAXRS-JSON-RESTEasy-Example
  Deployment Descriptor: Restful Web Application
  Java Resources
    src/main/java
      rest
        JSONService.java
        UserBo.java
      rest.client
    src/main/resources
    Libraries
  Referenced Libraries
  src
    main
      java
        rest
      resources
      webapp
        WEB-INF
          web.xml
        index.html
  target
  pom.xml
```

2. Configure pom.xml

```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/maven-v4_0_0.xsd">
        <modelVersion>4.0.0</modelVersion>
        <groupId>JAXRS-JSON-RESTEasy-Example</groupId>
        <artifactId>JAXRS-JSON-RESTEasy-Example</artifactId>
        <packaging>war</packaging>
        <version>1.0-SNAPSHOT</version>
        <name>JAXRS-JSON-RESTEasy-Example</name>
        <url>http://maven.apache.org</url>

        <repositories>
                <repository>
                        <id>JBoss repository</id>
                        <url>https://repository.jboss.org/nexus/content/groups/public-jboss/</url>
                </repository>
        </repositories>

        <dependencies>
                <dependency>
                        <groupId>junit</groupId>
                        <artifactId>junit</artifactId>
                        <version>4.8.2</version>
                        <scope>test</scope>
                </dependency>

                <dependency>
                        <groupId>org.jboss.resteasy</groupId>
                        <artifactId>resteasy-jaxrs</artifactId>
                        <version>2.2.1.GA</version>
                </dependency>

                <dependency>
                        <groupId>org.jboss.resteasy</groupId>
                        <artifactId>resteasy-jackson-provider</artifactId>
                        <version>2.2.1.GA</version>
                </dependency>

        </dependencies>

        <build>
                <finalName>JAXRS-JSON-RESTEasy-Example</finalName>
                <plugins>
                        <plugin>
                                <artifactId>maven-compiler-plugin</artifactId>
                                <configuration>
                                        <source>1.6</source>
                                        <target>1.6</target>
                                </configuration>
                        </plugin>
                </plugins>
        </build>

</project>
```

3. Configure web.xml

In web.xml Disable RESTEasy auto scanning and register your REST service manually, otherwise, you will get ***Illegal to inject a message body into a singleton into public.JacksonJsonProvider Error***

```
<web-app>
        <display-name>JAXRS-JSON-RESTEasy-Example</display-name>
        <context-param>
                <param-name>resteasy.resources</param-name>
                <param-value>rest.JSONService</param-value>
        </context-param>

        <listener>
                <listener-class>
                        org.jboss.resteasy.plugins.server.servlet.ResteasyBootstrap
                </listener-class>
        </listener>
        <servlet>
                <servlet-name>resteasy-servlet</servlet-name>
                <servlet-class>
                        org.jboss.resteasy.plugins.server.servlet.HttpServletDispatcher
                </servlet-class>
        </servlet>

        <servlet-mapping>
                <servlet-name>resteasy-servlet</servlet-name>
                <url-pattern>/rest/*</url-pattern>
        </servlet-mapping>

</web-app>
```

4. Write “UserBo” class

Write “UserBo” class object, Jersey will convert this object into JSON format.

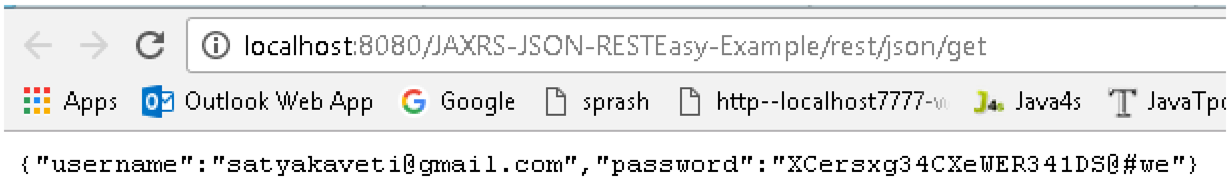
```
package rest;

public class UserBo {

        String username;
        String password;

        public String getUsername() {
                return username;
        }

        public void setUsername(String username) {
                this.username = username;
        }

        public String getPassword() {
                return password;
        }

        public void setPassword(String password) {
                this.password = password;
        }

        @Override
        public String toString() {
                return "USER [username=" + username + ", password=" + password + "]";
        }

}
```

5. Create RESTFul webservice

```
package rest;

import javax.ws.rs.Consumes;
import javax.ws.rs.GET;
import javax.ws.rs.POST;
import javax.ws.rs.Path;
import javax.ws.rs.Produces;
import javax.ws.rs.core.Response;


@Path("/rest/json")
public class JSONService {

        @GET
        @Path("/get")
        @Produces("application/json")
        public UserBo getUserBoInJSON() {
                UserBo bo = new UserBo();
                bo.setUsername("satyakaveti@gmail.com");
                bo.setPassword("XCersxg34CXeWER341DS@#we");

                return bo;

        }

        @POST
        @Path("/post")
        @Consumes("application/json")
        public Response createUserBoInJSON(UserBo UserBo) {

                String result = "UserBo created : " + UserBo;
                return Response.status(201).entity(result).build();

        }

}
```

6. Test Webservice directly by using URL / writing webservice client

http://localhost:8080/JAXRS-JSON-RESTEasy-Example/rest/json/get



```
{"username":"satyakaveti@gmail.com","password":"XCersxg34CXeWER341DS@#we"}
```

12. JAX-RS XML Example Using Jersey

JAX-RS supports conversion of java objects into XML with the help of JAXB. As Jersey it self contains JAXB libraries we no need to worry about JAXB-Jersey integration. Just include **"jersey-server.jar"**

Steps to Implement this Web Service Application

1. Create Dynamic web project in eclipse, convert that into Maven Project

2. Configure **pom.xml**

```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>
  <groupId>JAXRS-XML-Jersey-Example</groupId>
  <artifactId>JAXRS-XML-Jersey-Example</artifactId>
  <version>0.0.1-SNAPSHOT</version>
  <packaging>war</packaging>

  <repositories>
                <repository>
                        <id>maven2-repository.java.net</id>
                        <name>Java.net Repository for Maven</name>
                        <url>http://download.java.net/maven/2/</url>
                        <layout>default</layout>
                </repository>
        </repositories>

        <dependencies>
                <dependency>
                        <groupId>junit</groupId>
                        <artifactId>junit</artifactId>
                        <version>4.8.2</version>
                        <scope>test</scope>
                </dependency>

                <dependency>
                        <groupId>com.sun.jersey</groupId>
                        <artifactId>jersey-server</artifactId>
                        <version>1.8</version>
                </dependency>

        </dependencies>

        <build>
                <finalName>JAXRS-XML-Jersey-Example</finalName>
                <plugins>
                        <plugin>
                                <artifactId>maven-compiler-plugin</artifactId>
                                <configuration>
                                        <compilerVersion>1.5</compilerVersion>
                                        <source>1.5</source>
                                        <target>1.5</target>
                                </configuration>
                        </plugin>
                </plugins>
        </build>

</project>
```

3. Configure **web.xml**

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app>
  <display-name>RestPathAnnotationExample</display-name>
  <servlet>
    <servlet-name>jersey-serlvet</servlet-name>
    <servlet-class>com.sun.jersey.spi.container.servlet.ServletContainer</servlet-class>
    <init-param>
      <param-name>com.sun.jersey.config.property.packages</param-name>
      <param-value>rest.service</param-value>
    </init-param>
    <load-on-startup>1</load-on-startup>
  </servlet>
  <servlet-mapping>
    <servlet-name>jersey-serlvet</servlet-name>
    <url-pattern>/rest/*</url-pattern>
  </servlet-mapping>
</web-app>
```

4. write Customer POJO class

Write **Customer POJO class &** Annotate object with JAXB annotation, for conversion later.

```
package rest.service;

import javax.xml.bind.annotation.XmlAttribute;
import javax.xml.bind.annotation.XmlElement;
import javax.xml.bind.annotation.XmlRootElement;

@XmlRootElement(name = "customer")
public class Customer {

        String custName;
        String custCountry;
        int custId;

        @XmlElement
        public String getCustName() {
                return custName;
        }
        public void setCustName(String custName) {
                this.custName = custName;
        }

        @XmlElement
        public String getCustCountry() {
                return custCountry;
        }
        public void setCustCountry(String custCountry) {
                this.custCountry = custCountry;
        }

        @XmlAttribute
        public int getCustId() {
                return custId;
        }
        public void setCustId(int custId) {
                this.custId = custId;
        }
}
```

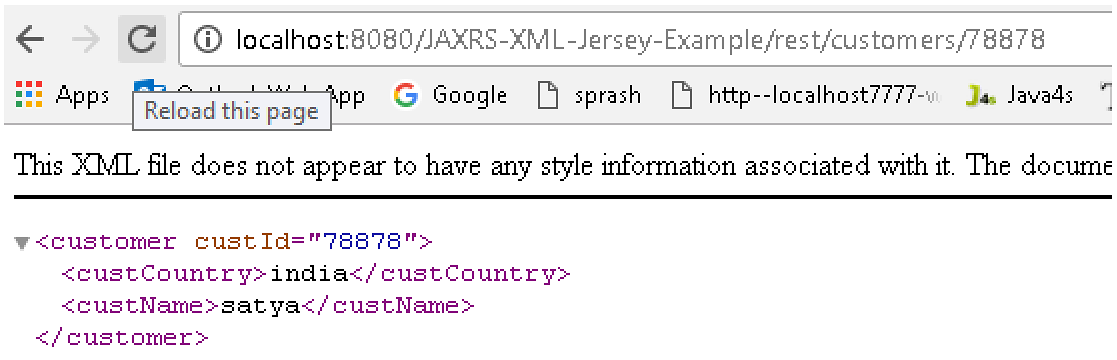
5. Create RESTFul webservice Jersey

To return a XML file, annotate the method with `@Produces(MediaType.APPLICATION_XML)`. Jersey will convert the JAXB annotated object into XML file automatically.

```
package rest.service;

import javax.ws.rs.GET;
import javax.ws.rs.Path;
import javax.ws.rs.PathParam;
import javax.ws.rs.Produces;
import javax.ws.rs.core.MediaType;

@Path("/customers")
public class RestfulXMLExample {

        @GET
        @Path("/{id}")
        @Produces(MediaType.APPLICATION_XML)
        public Customer getCustomerDetails(@PathParam("id") int custId) {

                // WRITE DATABASE LOGIC TO RETRIEVE THE CUSTOMER RECORD WITH 'custID'

                Customer cust = new Customer();
                cust.setCustName("satya");
                cust.setCustCountry("india");
                cust.setCustId(custId);
                return cust;
        }
}
```

6. Test Webservice directly by using URL / writing webservice client

http://localhost:8080/JAXRS-XML-Jersey-Example/rest/customers/78878


localhost:8080/JAXRS-XML-Jersey-Example/rest/customers/78878
Apps
Reload this page
Google
sprash
http--localhost7777-
Java4s

This XML file does not appear to have any style information associated with it. The docume

```
<customer custId="78878">
  <custCountry>india</custCountry>
  <custName>satya</custName>
</customer>
```

13. JAX-RS RESTFul Java Clinets

So far we used URL directly to Test our RESTful service. But in the real time we will call the services by writing some client application logic. We have different ways to write a RESTful client

They are

- **java.net.URL**
- **Apache HttpClient**
- **RESTEasy client**
- **Jersey client**

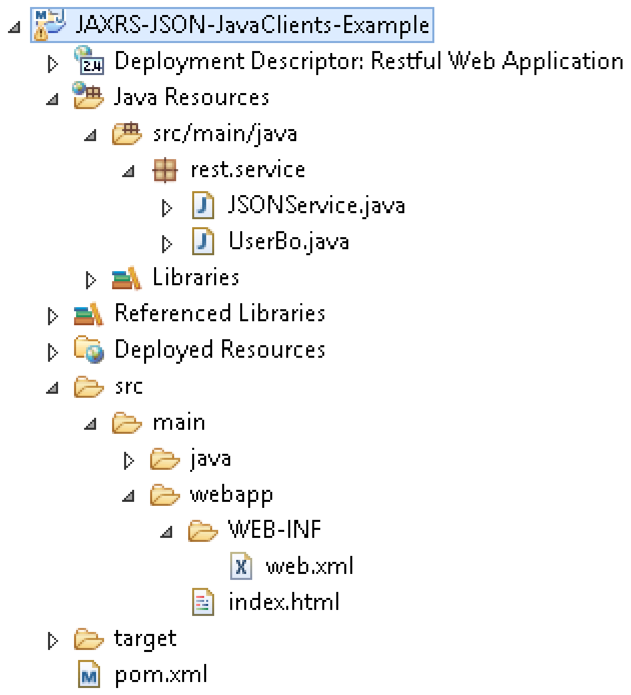
Every Java Clinet can send two types of requests

1. **GET**
2. **POST**

We will see one by one by Example. Here we are Taking JAXRS-JSON-Jersey-Example for writing clinets. For all webservices are same. Only difference in Java Clinets

JAXRS-JSON-Jersey-Example

1. Create Dynamic web project in eclipse, convert that into Maven Project



2. Configure **pom.xml, web.xml (May change for Every Java Clinet, please Observe)**

3. Craete UserBo for Converting Java Object to JSON data

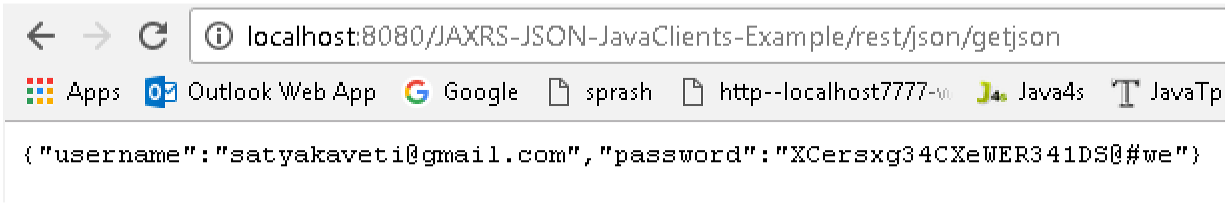
```
package rest.service;

public class UserBo {

        String username;
        String password;

        public String getUsername() {
                return username;
        }

        public void setUsername(String username) {
                this.username = username;
        }

        public String getPassword() {
                return password;
        }

        public void setPassword(String password) {
                this.password = password;
        }

        @Override
        public String toString() {
                return "USER [username=" + username + ", password=" + password + "]";
        }

}
```

4. Create Web Service having both @GET @POST for testing with Java Clinets

```java
package rest.service;

import javax.ws.rs.core.Response;

@Path("/json")
public class JSONService {
        @GET
        @Path("/getjson")
        @Produces(MediaType.APPLICATION_JSON)
        public UserBo getboInJSON() {

                UserBo bo = new UserBo();
                bo.setUsername("satyakaveti@gmail.com");
                bo.setPassword("XCersxg34CXeWER341DS@#we");
                return bo;
        }

        @POST
        @Path("/postjson")
        @Consumes(MediaType.APPLICATION_JSON)
        public Response createTrackInJSON(UserBo bo) {

                String result = "USER DATA SAVED!! " + bo;
                return Response.status(201).entity(result).build();

        }

}
```

5. Test Webservice directly by using URL / writing webservice client

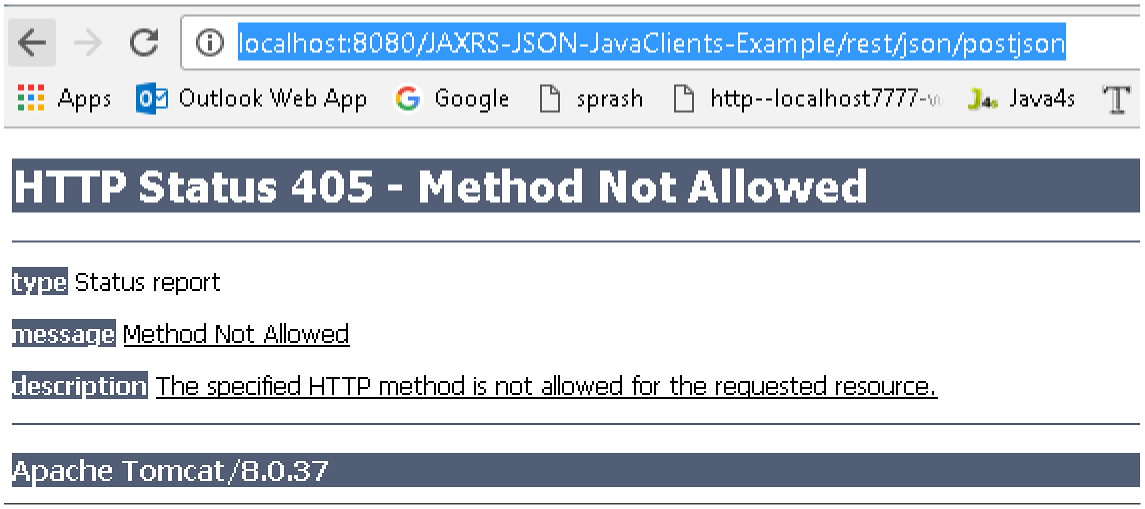
GET: http://localhost:8080/JAXRS-JSON-JavaClients-Example/rest/json/getjson



localhost:8080/JAXRS-JSON-JavaClients-Example/rest/json/getjson

```
{"username":"satyakaveti@gmail.com","password":"XCersxg34CXeWER341DS@#we"}
```

POST: http://localhost:8080/JAXRS-JSON-JavaClients-Example/rest/json/postjson



localhost:8080/JAXRS-JSON-JavaClients-Example/rest/json/postjson

HTTP Status 405 - Method Not Allowed

type Status report

message Method Not Allowed

description The specified HTTP method is not allowed for the requested resource.

Apache Tomcat/8.0.37

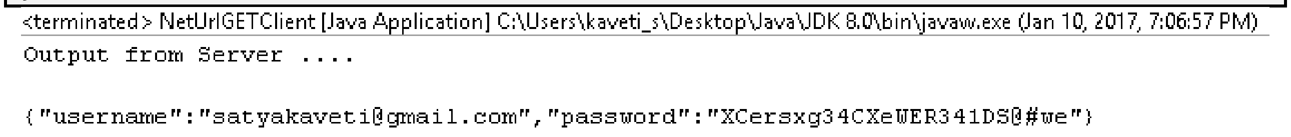
So far we are used above process to Test the Web Services. Now lets see how to test webservices with Java clinets.

1. java.net.URL

Here we will use “`java.net.URL`” and “`java.net.HttpURLConnection`” to create a simple Java client to send **“GET” and “POST”** request.

GET Request Example

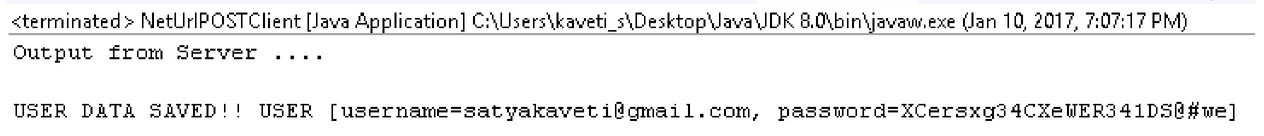
```
package rest.clients;

import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;
import java.net.HttpURLConnection;
import java.net.MalformedURLException;
import java.net.URL;

public class NetUrlGETClient {

        public static void main(String[] args) {

                try {

        URL url = new URL("http://localhost:8080/JAXRS-JSON-JavaClients-Example/rest/json/getjson");
                        HttpURLConnection conn = (HttpURLConnection) url.openConnection();
                        conn.setRequestMethod("GET");
                        conn.setRequestProperty("Accept", "application/json");

                        if (conn.getResponseCode() != 200) {
                throw new RuntimeException("Failed : HTTP error code : " + conn.getResponseCode());
                        }

                        BufferedReader br = new BufferedReader(new
InputStreamReader((conn.getInputStream())));

                        String output;
                        System.out.println("Output from Server .... \n");
                        while ((output = br.readLine()) != null) {
                                System.out.println(output);
                        }

                        conn.disconnect();

                } catch (MalformedURLException e) {

                        e.printStackTrace();

                } catch (IOException e) {

                        e.printStackTrace();

                }

        }
}
```



```
<terminated> NetUrlGETClient [Java Application] C:\Users\kaveti_s\Desktop\Java\JDK 8.0\bin\javaw.exe (Jan 10, 2017, 7:06:57 PM)
Output from Server ....

{"username":"satyakaveti@gmail.com","password":"XCersxg34CXeWER341DS@#we"}
```

POST Request Example

```java
package rest.clients;

import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;
import java.io.OutputStream;
import java.net.HttpURLConnection;
import java.net.MalformedURLException;
import java.net.URL;

public class NetUrlPOSTClient {
        public static void main(String[] args) {

                try {

        URL url = new URL("http://localhost:8080/JAXRS-JSON-JavaClients-Example/rest/json/postjson");
                        HttpURLConnection conn = (HttpURLConnection) url.openConnection();
                        conn.setDoOutput(true);
                        conn.setRequestMethod("POST");
                        conn.setRequestProperty("Content-Type", "application/json");

String input = "{\"username\":\"satyakaveti@gmail.com\",\"password\":\"XCersxg34CXeWER341DS@#we\"}";

                        OutputStream os = conn.getOutputStream();
                        os.write(input.getBytes());
                        os.flush();

                        if (conn.getResponseCode() != HttpURLConnection.HTTP_CREATED) {
                throw new RuntimeException("Failed : HTTP error code : " + conn.getResponseCode());
                        }

                        BufferedReader br = new BufferedReader(new
InputStreamReader((conn.getInputStream())));

                        String output;
                        System.out.println("Output from Server .... \n");
                        while ((output = br.readLine()) != null) {
                                System.out.println(output);
                        }

                        conn.disconnect();

                } catch (MalformedURLException e) {

                        e.printStackTrace();

                } catch (IOException e) {

                        e.printStackTrace();

                }

        }
}
```



```
<terminated> NetUrlPOSTClient [Java Application] C:\Users\kaveti_s\Desktop\Java\JDK 8.0\bin\javaw.exe (Jan 10, 2017, 7:07:17 PM)
Output from Server ....

USER DATA SAVED!! USER [username=satyakaveti@gmail.com, password=XCersxg34CXeWER341DS@#we]
```

2. Apache HttpClient

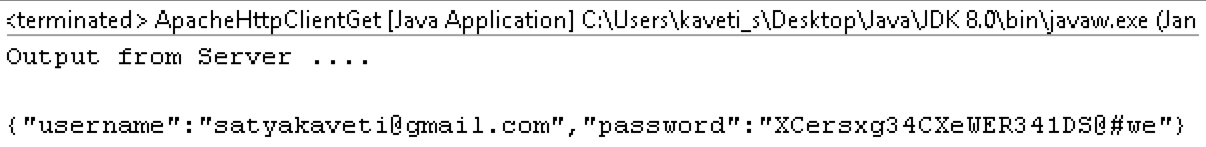
Apache HttpClient is available in Maven central repository, just declares it in your Maven pom.xml file.

1. Configure POM.xml with Apache HTTPClinet

```xml
<dependency>
        <groupId>org.apache.httpcomponents</groupId>
        <artifactId>httpclient</artifactId>
        <version>4.1.1</version>
</dependency>
```

2.GET Request Example

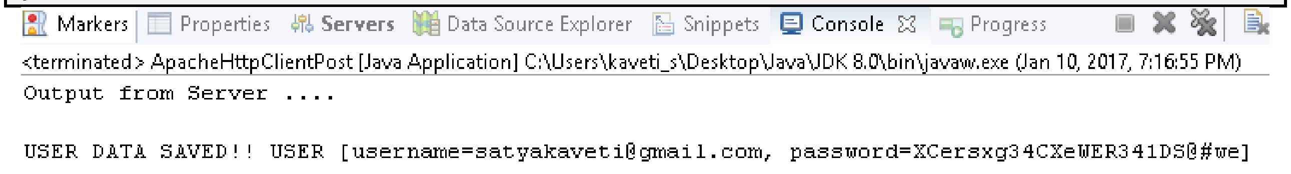
```java
package rest.clients;

import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;
import org.apache.http.HttpResponse;
import org.apache.http.client.ClientProtocolException;
import org.apache.http.client.methods.HttpGet;
import org.apache.http.impl.client.DefaultHttpClient;

public class ApacheHttpClientGet {

        public static void main(String[] args) {
                try {

                        DefaultHttpClient httpClient = new DefaultHttpClient();
                        HttpGet getRequest = new HttpGet("http://localhost:8080/JAXRS-JSON-JavaClients-
Example/rest/json/getjson");
                        getRequest.addHeader("accept", "application/json");
                        HttpResponse response = httpClient.execute(getRequest);

                        if (response.getStatusLine().getStatusCode() != 200) {
                                throw new RuntimeException("Failed : HTTP error code : " +
response.getStatusLine().getStatusCode());
                        }

                        BufferedReader br = new BufferedReader(new
InputStreamReader((response.getEntity().getContent())));

                        String output;
                        System.out.println("Output from Server .... \n");
                        while ((output = br.readLine()) != null) {
                                System.out.println(output);
                        }

                        httpClient.getConnectionManager().shutdown();

                }  catch (Exception e) {
                        e.printStackTrace();
                        }
                }
}
```



```
<terminated> ApacheHttpClientGet [Java Application] C:\Users\kaveti_s\Desktop\Java\JDK 8.0\bin\javaw.exe (Jan
Output from Server ....

{"username":"satyakaveti@gmail.com","password":"XCersxg34CXeWER341DS@#we"}
```

3.POST Request Example

```java
package rest.clients;

import java.io.BufferedReader;
import java.io.IOException;
import java.io.InputStreamReader;
import java.net.MalformedURLException;
import org.apache.http.HttpResponse;
import org.apache.http.client.methods.HttpPost;
import org.apache.http.entity.StringEntity;
import org.apache.http.impl.client.DefaultHttpClient;

public class ApacheHttpClientPost {

        public static void main(String[] args) {

                try {

                        DefaultHttpClient httpClient = new DefaultHttpClient();
                        HttpPost postRequest = new HttpPost("http://localhost:8080/JAXRS-JSON-
JavaClients-Example/rest/json/postjson");

                        StringEntity input = new
StringEntity("{\"username\":\"satyakaveti@gmail.com\",\"password\":\"XCersxg34CXeWER341DS@#we\"}");
                        input.setContentType("application/json");
                        postRequest.setEntity(input);

                        HttpResponse response = httpClient.execute(postRequest);

                        if (response.getStatusLine().getStatusCode() != 201) {
                                throw new RuntimeException("Failed : HTTP error code : " +
response.getStatusLine().getStatusCode());
                        }

                        BufferedReader br = new BufferedReader(new
InputStreamReader((response.getEntity().getContent())));

                        String output;
                        System.out.println("Output from Server .... \n");
                        while ((output = br.readLine()) != null) {
                                System.out.println(output);
                        }

                        httpClient.getConnectionManager().shutdown();

                } catch (MalformedURLException e) {

                        e.printStackTrace();

                } catch (IOException e) {

                        e.printStackTrace();

                }

        }

}
```



```
<terminated> ApacheHttpClientPost [Java Application] C:\Users\kaveti_s\Desktop\Java\JDK 8.0\bin\javaw.exe (Jan 10, 2017, 7:16:55 PM)
Output from Server ....

USER DATA SAVED!! USER [username=satyakaveti@gmail.com, password=XCersxg34CXeWER341DS@#we]
```

3.RESTEasy client

1. Configure POM.xml with

RESTEasy client framework is included in RESTEasy core module, so, you just need to declares the **"resteasy-jaxrs.jar"** in your pom.xml file

```xml
<dependency>
```

```
        <groupId>org.jboss.resteasy</groupId>
        <artifactId>resteasy-jaxrs</artifactId>
        <version>2.2.1.GA</version>
</dependency>
```

2.GET Request Example

```
package rest.clients;

import java.io.BufferedReader;
import java.io.ByteArrayInputStream;
import java.io.IOException;
import java.io.InputStreamReader;

public class RESTEasyClientGet {

        public static void main(String[] args) {
          try {

                ClientRequest request = new ClientRequest(
                                "http://localhost:8080/JAXRS-JSON-JavaClients-
Example/rest/json/getjson");
                request.accept("application/json");
                ClientResponse<String> response = request.get(String.class);

                if (response.getStatus() != 200) {
                        throw new RuntimeException("Failed : HTTP error code : "
                                + response.getStatus());
                }

                BufferedReader br = new BufferedReader(new InputStreamReader(
                        new ByteArrayInputStream(response.getEntity().getBytes())));

                String output;
                System.out.println("Output from Server .... \n");
                while ((output = br.readLine()) != null) {
                        System.out.println(output);
                }

          } catch (ClientProtocolException e) {

                e.printStackTrace();

          } catch (IOException e) {

                e.printStackTrace();

          } catch (Exception e) {

                e.printStackTrace();

          }

        }

}
```

3.POST Request Example

```
package rest.clients;

import java.io.InputStreamReader;
import java.net.MalformedURLException;
import org.jboss.resteasy.client.ClientRequest;
import org.jboss.resteasy.client.ClientResponse;

public class RESTEasyClientPost {
        public static void main(String[] args) {

          try {

                ClientRequest request = new ClientRequest(
                        "http://localhost:8080/JAXRS-JSON-JavaClients-Example/rest/json/postjson");
                request.accept("application/json");

                String input =
"{\"username\":\"satyakaveti@gmail.com\",\"password\":\"XCersxg34CXeWER341DS@#we\"}";
                request.body("application/json", input);

                ClientResponse<String> response = request.post(String.class);

                if (response.getStatus() != 201) {
                        throw new RuntimeException("Failed : HTTP error code : "
                                + response.getStatus());
                }

                BufferedReader br = new BufferedReader(new InputStreamReader(
                        new ByteArrayInputStream(response.getEntity().getBytes())));

                String output;
                System.out.println("Output from Server .... \n");
                while ((output = br.readLine()) != null) {
                        System.out.println(output);
                }

          } catch (MalformedURLException e) {

                e.printStackTrace();

          } catch (IOException e) {

                e.printStackTrace();

          } catch (Exception e) {

                e.printStackTrace();

          }

        }

}
```

4. Jersey client

1. Configure POM.xml with

To use Jersey client APIs, declares **"jersey-client.jar"** in your pom.xml file.

```
<dependency>
        <groupId>com.sun.jersey</groupId>
        <artifactId>jersey-client</artifactId>
        <version>1.8</version>
</dependency>
```

2.GET Request Example

```
package rest.clients;

import com.sun.jersey.api.client.Client;
import com.sun.jersey.api.client.ClientResponse;
import com.sun.jersey.api.client.WebResource;

public class JerseyClientGet {

        public static void main(String[] args) {
                try {

                        Client client = Client.create();

                        WebResource webResource = client
                                        .resource("http://localhost:8080/JAXRS-JSON-JavaClients-
Example/rest/json/getjson");

                        ClientResponse response =
webResource.accept("application/json").get(ClientResponse.class);

                        if (response.getStatus() != 200) {
                                throw new RuntimeException("Failed : HTTP error code : " +
response.getStatus());
                        }

                        String output = response.getEntity(String.class);

                        System.out.println("Output from Server .... \n");
                        System.out.println(output);

                } catch (Exception e) {

                        e.printStackTrace();

                }

        }
}
```

Output

```
Output from Server ....

{"username":"satyakaveti@gmail.com","password":"XCersxg34CXeWER341DS@#we"}
```

3.POST Request Example

```
package rest.clients;

import com.sun.jersey.api.client.Client;
import com.sun.jersey.api.client.ClientResponse;
import com.sun.jersey.api.client.WebResource;

public class JerseyClientPost {

        public static void main(String[] args) {

                try {

                        Client client = Client.create();
                        WebResource webResource = client
                                        .resource("http://localhost:8080/JAXRS-JSON-JavaClients-
Example/rest/json/postjson");

                        String input =
"{\"username\":\"satyakaveti@gmail.com\",\"password\":\"XCersxg34CXeWER341DS@#we\"}";

                        ClientResponse response =
webResource.type("application/json").post(ClientResponse.class, input);

                        if (response.getStatus() != 201) {
                                throw new RuntimeException("Failed : HTTP error code : " +
response.getStatus());
                        }

                        System.out.println("Output from Server .... \n");
                        String output = response.getEntity(String.class);
                        System.out.println(output);

                } catch (Exception e) {
                        e.printStackTrace();
                }
        }
}
```

Output

```
Output from Server ....

USER DATA SAVED!! USER [username=satyakaveti@gmail.com, password=XCersxg34CXeWER341DS@#we]
```

14.How to Test (JAX-RS) RESTful Web Services

in real time projects we will use different tools to test RESTful web services

1.Browser Addons

- Postman [Chrome Extension]
- REST Client [Chrome Extension]
- Advanced REST Client [Chrome Extension]
- Rest Client [Firefox Add-On]

2.JAX-RS Local System Tools

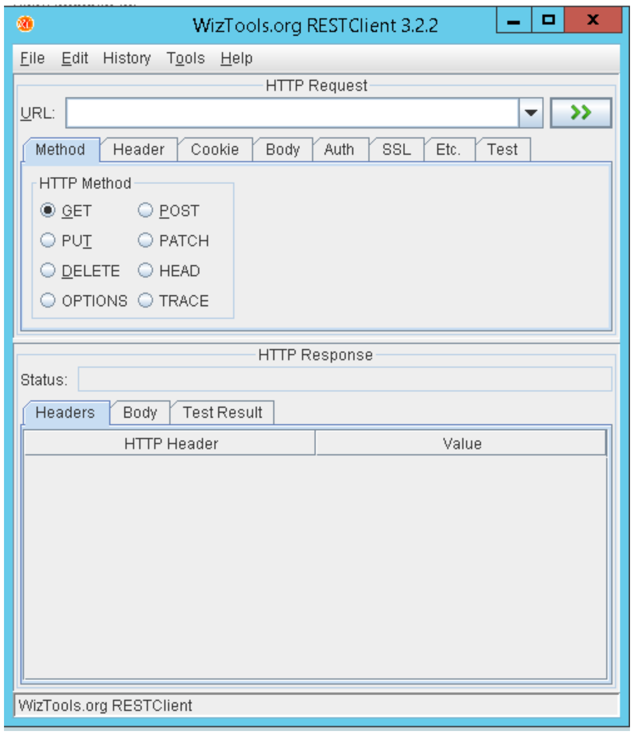
- RESTClient UI
- SoupUi

RESTClient UI

1. Download .jar file from here https://code.google.com/archive/p/rest-client/downloads

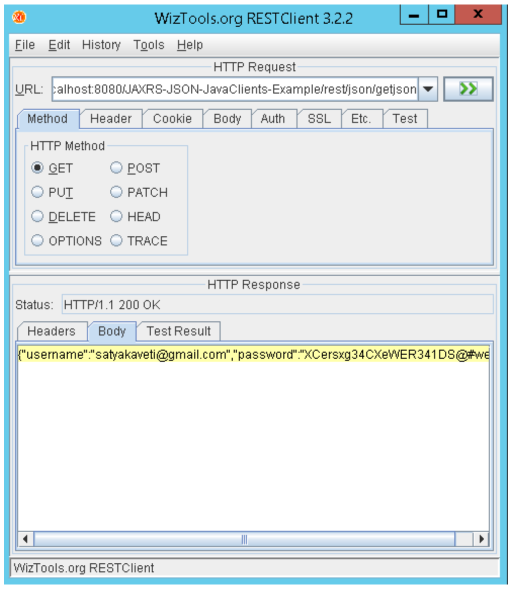
2.Run jar by giving >`java -jar restclient-ui-3.2.2-jar-with-dependencies.jar`

3.It will Opens the window as follows



4.Test Your application by proving any running web service URL

Ex: http://localhost:8080/JAXRS-JSON-JavaClients-Example/rest/json/getjson



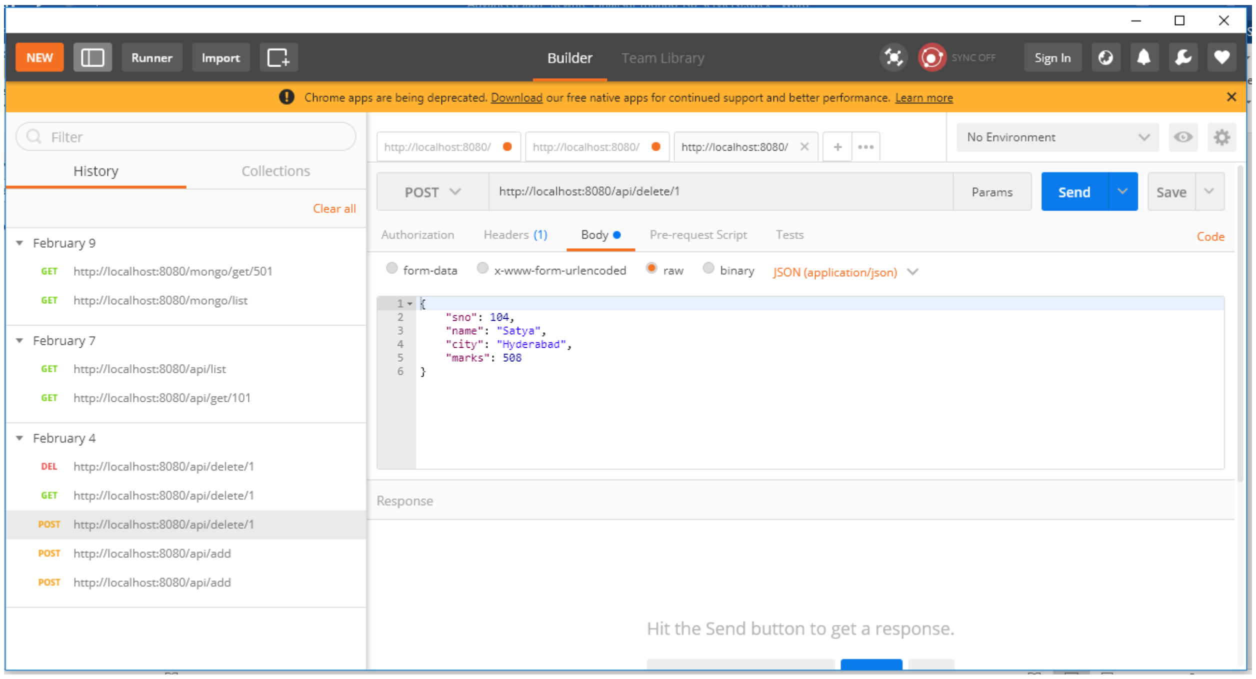
URL: :alhost:8080/JAXRS-JSON-JavaClients-Example/rest/json/getjson

HTTP Method: [✓ GET]

Status: HTTP/1.1 200 OK

```
{"username":"satyakaveti@gmail.com","password":"XCersxg34CXeWER341DS@#we
```

Postman



Chrome apps are being deprecated. Download our free native apps for continued support and better performance. Learn more

February 9
GET http://localhost:8080/mongo/get/501
GET http://localhost:8080/mongo/list

February 7
GET http://localhost:8080/api/list
GET http://localhost:8080/api/get/101

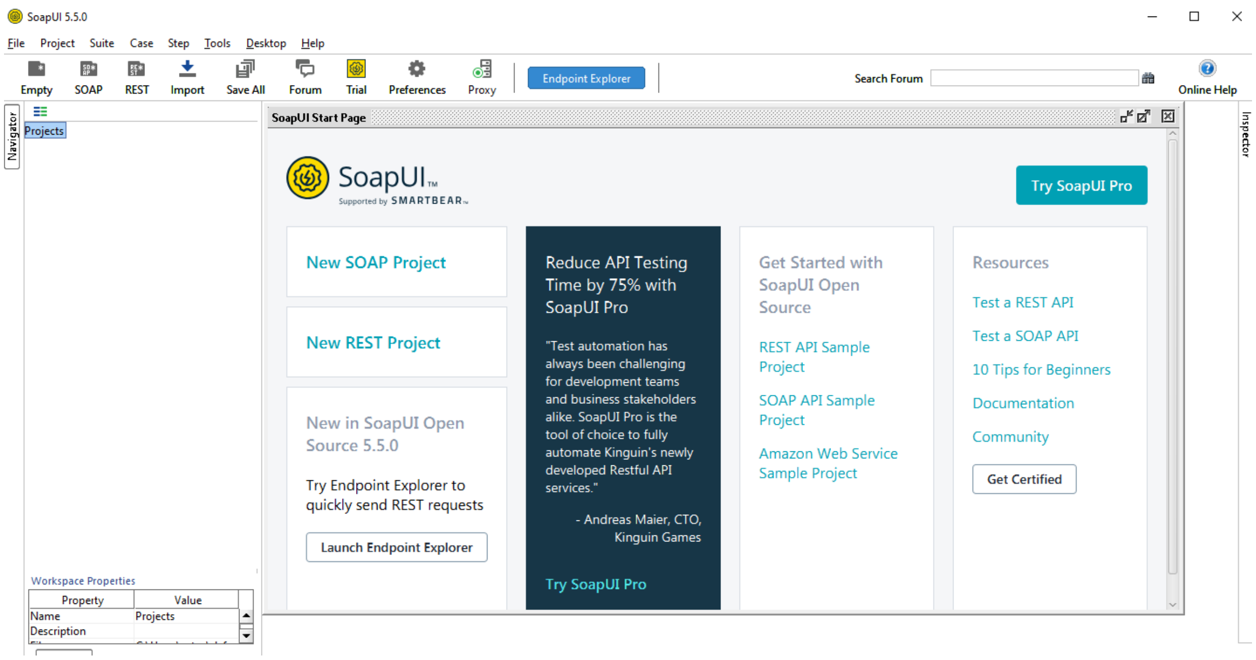
February 4
DEL http://localhost:8080/api/delete/1
GET http://localhost:8080/api/delete/1
POST http://localhost:8080/api/delete/1
POST http://localhost:8080/api/add
POST http://localhost:8080/api/add

POST http://localhost:8080/api/delete/1

```
{
    "sno": 104,
    "name": "Satya",
    "city": "Hyderabad",
    "marks": 508
}
```

Hit the Send button to get a response.

Similarly we can work with SoapUI also



New in SoapUI Open Source 5.5.0

Try Endpoint Explorer to quickly send REST requests

Reduce API Testing Time by 75% with SoapUI Pro

"Test automation has always been challenging for development teams and business stakeholders alike. SoapUI Pro is the tool of choice to fully automate Kinguin's newly developed Restful API services."

- Andreas Maier, CTO, Kinguin Games

Property	Value
Name	Projects
Description	

References

JAX-WS

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JAX-RS

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