EXPERIMENT NO. 01

AIM: Modeling using xADL 2.0

THEORY:

Software architecture can help people to better understand the total structure of the system (Software). In recent years software size and complexity has enormously increasing. This made the description of their architecture more complicate. So to describe these architectures many methods are invented. These are called as Architecture Descriptive languages. But many of these are not succeeded. Since these are devised for a particular style of architecture. This made the invention of an eXtensible Architecture Description language. Research and experimentation in the field of software architecture yielded invention of many ADLs (Architecture Description Languages). xADL 2.0 (pronounced as "zay-dul") is one ADL which is designed to suit that type of problems. This can be used to describe the architecture of the various types of systems. It is developed in that way to adapt the changes in the architecture styles.

Architecture Description Language

Architectural Description language or architectural definition language (or an ADL) is an abstract level description of the software system using the components, connectors, links etc., in a formal language or notations. Actually there is no concrete definition for the ADL so far now. An ADL will provide its users concrete syntax, formal semantics, conceptual framework. These are helpful for explicitly modeling software systems. All these ADLs should have some properties they are components, connectors, interfaces, links and interconnection between the components.

Introduction to xADL

The core of the xADL consists of common modules to describe components, connectors, interfaces, links (configurations). These modules are developed as XML schemas. The idea behind using XML is, it is very good for interchange of structures data exchange, extendible and it is a modular language. To maximize the reusability of these schemas these are made as generic as possible. That is one instance is written to represent components and connectors, but their behavior and communication are represented in another schema. Thus, aspects of elements like behaviors and constraints on how elements may be arranged are not specified. Such aspects are meant to be defined in extension schemas. The important features of the ADL which are extended from the xADL2.0 are:

1. Separation between design time schemas and runtime schemas.
2. Implementation mappings that map the ADL specifications into code.
3. The ability to model the architecture of product line architectures and configuration management systems.

Advantages of xADL over other ADLs

Actually xADL takes its ides from the ACME and on the survey about the ADLs about the commonalities in the ADLs. The advantages of the xADL over the other ADLs are

- It can be used to represent many architecture domains.
- If any new Architecture domain comes it can be made to describe that domain easily by extending the core of this xADL with other schemas particular to that domain.
- Although it is not used as architecture interchange language it can be used to interchange between the architectural description languages
- It can be used combining two existing domains.
- It serves as basis for experimenting with newer domains. ie., we can check the architecture of the domains for which the architecture is not specified.

Advantages of xADL over the UML

1. UML is vulnerable to changes.
2. UML diagrams are not easy to extend or modify.
3. We cannot model product line architectures efficiently with UML since their architecture changes from version to version.
4. UML encourages object diagrams than the component diagrams.

5. The main purpose of any ADL is to do prior design analysis. But UML does not have any good analysis tools.
6. Using UML diagrams we cannot generate the code which is main need of invention of ADLs. (we can do it UML2.0 through xml Schemas)
7. UML2.0 will not cover all the existing domains. And also if a domain comes it will not able to extend its features to accommodate the changes in its description.

Drawbacks of xADL2.0:

1. xADL 2.0 does not solve the feature interaction problem. Feature interaction problem: In a software system, a feature is an optional unit or increment of functionality. If the system specification is organized by features, then it probably takes the form B + F1 + F2 + F3 . . ., where B is a base specification, each Fi is a feature module, and + denotes some feature-composition operation. A feature interaction is some way in which a feature or features modify or influence another feature in defining overall system behavior. Feature interaction is necessary and inevitable in a feature-oriented specification, because so little can be accomplished by features that are completely independent. A bad feature interaction is one that causes the specification to be incomplete, inconsistent, or unimplementable, or that causes the overall system behavior to be undesirable. Non-associatively of feature composition can also be considered a feature-interaction problem, on the grounds that for features to be truly optional, their compositions must yield the same behavior when performed in any order. Some forms of nondeterministic behavior can also be considered feature-interaction problems. Using xADL we cannot find this feature interaction problem in the architecture of the system.
2. Also when presented with two different schemas xADL will not model the architecture. It will only choose one schema over the other.
3. Other drawback of this ADL is as it is developed recently it does not have much practical experience. And also the full documentation of the ADL is also not available from the homepage. So the information about the classes (java libraries are also not well documented on the site).

Architecture Modeling:

ArchStudio creates and manipulates architecture descriptions expressed in the xADL architecture description language (ADL). xADL is the first modularly-extensible architecture description language. Rather than having its syntax and semantics defined monolithically, in one huge chunk, xADL breaks up modeling features into modules using standard XML schemas. ArchStudio's integrated set of tools operates on xADL documents much the same way as a word processor operates on text documents. One major difference, however, is that ArchStudio tools integrate "live"—meaning that a change in any tool is reflected in all others immediately. As noted above, the xADL language can be extended by end-users through the addition of new XML schemas to support domain- or project-specific concerns and modeling needs. New modules are even added to the core xADL language from time to time as they are developed and contributed.

XML:

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>

<instance:xArch                xmlns:instance="http://www.ics.uci.edu/pub/arch/xArch/instance.xsd"
xmlns:changesets="http://www.ics.uci.edu/pub/arch/xArch/changesets.xsd"
xmlns:hints3="http://www.ics.uci.edu/pub/arch/xArch/hints3.xsd"
xmlns:rationale="http://www.ics.uci.edu/pub/arch/xArch/rationale.xsd"
xmlns:types="http://www.ics.uci.edu/pub/arch/xArch/types.xsd"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.ics.uci.edu/pub/arch/xArch/rationale.xsd
http://www.isr.uci.edu/projects/xarchuci/ext/rationale.xsd
http://www.ics.uci.edu/pub/arch/xArch/tracelink.xsd http://acts.ics.uci.edu/tracelink/tracelink.xsd
http://www.ics.uci.edu/pub/arch/xArch/hints3.xsd
http://www.isr.uci.edu/projects/xarchuci/ext/hints3.xsd
http://www.ics.uci.edu/pub/arch/xArch/instance.xsd
http://www.isr.uci.edu/projects/xarchuci/core/instance.xsd
```

```
http://www.ics.uci.edu/pub/arch/xArch/statecharts.xsd
http://www.isr.uci.edu/projects/xarchuci/ext/statecharts.xsd
http://www.ics.uci.edu/pub/arch/xArch/activitydiagrams.xsd
http://www.isr.uci.edu/projects/xarchuci/ext/activitydiagrams.xsd
http://www.ics.uci.edu/pub/arch/xArch/types.xsd
http://www.isr.uci.edu/projects/xarchuci/ext/types.xsd
http://www.ics.uci.edu/pub/arch/xArch/changesets.xsd
http://www.isr.uci.edu/projects/xarchuci/ext/changesets.xsd">

  <types:archStructure types:id="archStructureffff8901-db64025d-59bf6ad8-72080007" xsi:type="types:ArchStructure">

    <types:description xsi:type="instance:Description">ArchitecturePLA</types:description>

    <types:component types:id="componentffff8901-db652528-357426e2-7208000c" xsi:type="types:Component">

      <types:description xsi:type="instance:Description">Order</types:description>

      <types:interface types:id="interfaceffff8901-dbc52e03-f9f798ac-7208049d" xsi:type="types:Interface">

        <types:description xsi:type="instance:Description">[New Interface]</types:description>

        <types:direction xsi:type="instance:Direction">in</types:direction>

      </types:interface>

      <types:interface types:id="interfaceffff8901-dbc54dd2-226c4e66-720804bd" xsi:type="types:Interface">

        <types:description xsi:type="instance:Description">[New Interface]</types:description>
```

```
            <types:direction xsi:type="instance:Direction">out</types:direction>
          </types:interface>
        </types:component>
        <types:component types:id="componentffff8901-dbbcae95-e0728e57-720800d7"
xsi:type="types:Component">
          <types:description xsi:type="instance:Description">Product</types:description>
        </types:component>
        <types:component types:id="componentffff8901-dbbd979f-8b7a479f-720801b3"
xsi:type="types:Component">
          <types:description xsi:type="instance:Description">Customer</types:description>
        </types:component>
        <types:component types:id="componentffff8901-dbbdf269-2d6018b8-720801d6"
xsi:type="types:Component">
          <types:description xsi:type="instance:Description">Account</types:description>
          <types:interface types:id="interfaceffff8901-dbc74f1b-79af155f-720805a6"
xsi:type="types:Interface">
            <types:description xsi:type="instance:Description">[New
Interface]</types:description>
            <types:direction xsi:type="instance:Direction">in</types:direction>
          </types:interface>
          <types:interface types:id="interfaceffff8901-dbc789f2-7315f8ec-720805d0"
xsi:type="types:Interface">
```

```
<types:description xsi:type="instance:Description">[New Interface]</types:description>
<types:direction xsi:type="instance:Direction">out</types:direction>
</types:interface>
</types:component>
<types:connector types:id="connectorffff8901-dbbe32a3-7dc4500b-720801fb" xsi:type="types:Connector">
<types:description xsi:type="instance:Description">Account Details</types:description>
</types:connector>
<types:connector types:id="connectorffff8901-dbbfe6de-2b793632-720802cb" xsi:type="types:Connector">
<types:description xsi:type="instance:Description">Item code</types:description>
</types:connector>
<types:connector types:id="connectorffff8901-dbc0550f-3655703c-72080339"
<types:description xsi:type="instance:Description">Customer details</types:description>
</types:connector>
<types:connector types:id="connectorffff8901-dbc35ff3-69025a85-72080411" xsi:type="types:Connector">
<types:description xsi:type="instance:Description">Payment</types:description>
</types:connector>
<types:link types:id="linkffff8901-dbbf8e42-8a77b0a0-7208029c" xsi:type="types:Link">
```

```
    <types:description xsi:type="instance:Description">[New Link]</types:description>
</types:link>
<types:link types:id="linkffff8901-dbc13d63-2b630fcf-720803cf" xsi:type="types:Link">
    <types:description xsi:type="instance:Description">[New Link]</types:description>
</types:link>
<types:link types:id="linkffff8901-dbc17391-45e95b6b-720803de" xsi:type="types:Link">
    <types:description xsi:type="instance:Description">[New Link]</types:description>
</types:link>
<types:link types:id="linkffff8901-dbc2ceb7-72252953-720803ec" xsi:type="types:Link">
    <types:description xsi:type="instance:Description">[New Link]</types:description>
</types:link>
<types:link types:id="linkffff8901-dbc3a7f0-7de8d761-7208044d" xsi:type="types:Link">
    <types:description xsi:type="instance:Description">[New Link]</types:description>
</types:link>
<types:link types:id="linkffff8901-dbc5f920-fe0714d9-7208051e" xsi:type="types:Link">
  <description></description>
  <point>
    <anchorOnInterface />
  </point>
    <types:description xsi:type="instance:Description">[New Link]</types:description>
```

```
</types:link>
```

Learning Outcomes: The student should have the ability to

LO1: identify problems during installation of Eclipse.

LO2: Write components and connectors in xADL

Course Outcomes: Upon completion of the course students will be able to write in xADL

Conclusion: In this experiment, Modeling using xADL 2.0 was implemented.

For Faculty Use

Correction Parameters	**Formative Assessment [40%]**	**Timely completion of Practical [40%]**	**Attendance / Learning Attitude [20%]**	
Marks Obtained				

EXPERIMENT NO. 02

AIM: Visualization using xADL2.0

THEORY:

Architecture is *the set of principal design decisions* made about a system. Recall also that models are artifacts that capture some or all of the design decisions that comprise an architecture. An architectural visualization defines how architectural models are depicted, and how stakeholders interact with those depictions. Two key aspects here:

- Depiction is a picture or other visual representation of design decisions
- Interaction mechanisms allow stakeholders to interact with design decisions in terms of the depiction

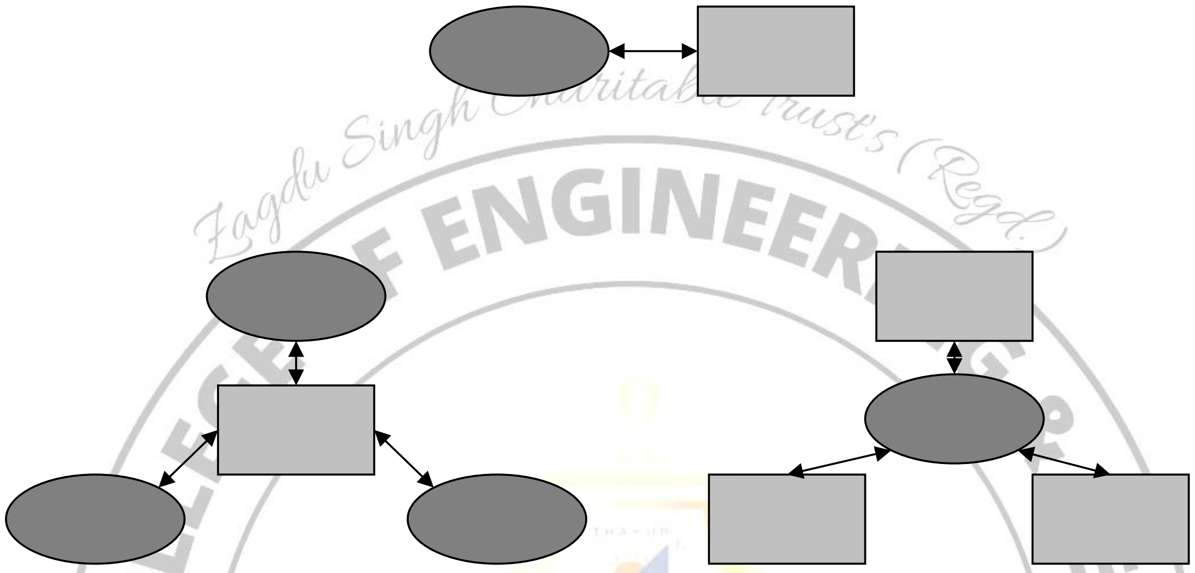
It is easy to confuse models and visualizations because they are very closely related. To make this distinction explicit:

- A model is just abstract information – a set of design decisions
- Visualizations give those design decisions form: they let us depict those design decisions and interact with them in different ways. Because of the interaction aspect, visualizations are often active – they are both pictures AND tools

Canonical Visualization:

Each modeling notation is associated with one or more canonical visualizations. This makes it easy to think of a notation and visualization as the same thing, even though they are not. Some notations are canonically textual eg Natural language, XML-based ADLs or graphical eg PowerPoint-style or a little of both eg UML or have multiple canonical visualizations eg Darwin

Different Relationships



Kinds of Visualizations

1. Textual Visualization: Depict architectures through ordinary text files. Generally conform to some syntactic format, like programs conform to a language. May be natural language, in which case the format is defined by the spelling and grammar rules of the language. Decorative options: Fonts, colors, bold/italics & Tables, bulleted lists/outlines.

   Advantages

   a. Depict entire architecture in a single file
   b. Good for linear or hierarchical structures
   c. Hundreds of available editors
   d. Substantial tool support if syntax is rigorous (e.g., defined in something like BNF)

Disadvantages

e. Can be overwhelming

f. Bad for graph like organizations of information

g. Difficult to reorganize information meaningfully

h. Learning curve for syntax/semantics

2. Graphical Visualizations: Depict architectures (primarily) as graphical symbols like Boxes, shapes, pictures, clip-art, Lines, arrows, other connectors, Photographic images, Regions, shading, 2D or 3D. Generally conform to a symbolic syntax but may also be 'free-form' and stylistic.

   Advantages

   a. Symbols, colors, and visual decorations more easily parsed by humans than structured text

   b. Handle non-hierarchical relationships well

   c. Diverse spatial interaction metaphors (scrolling, zooming) allow intuitive navigation

   Disadvantages

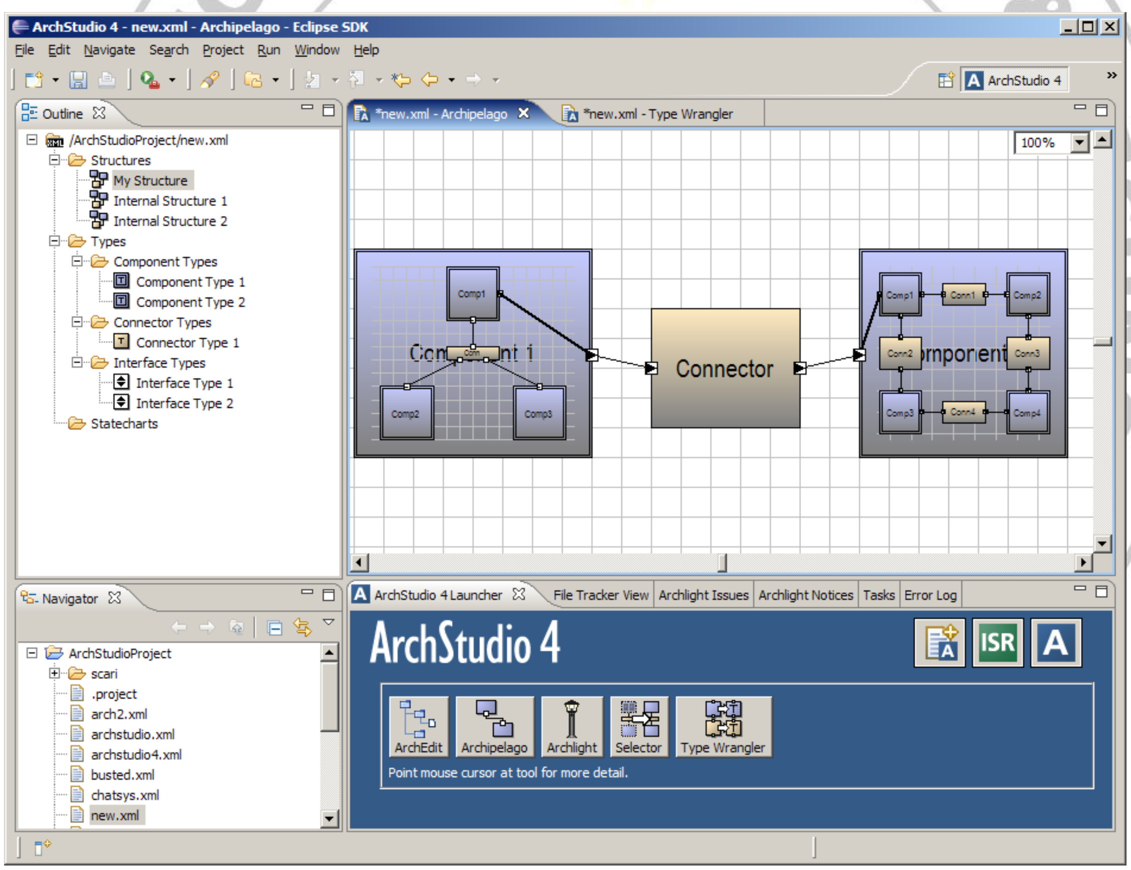
   a. Cost of building and maintaining tool support

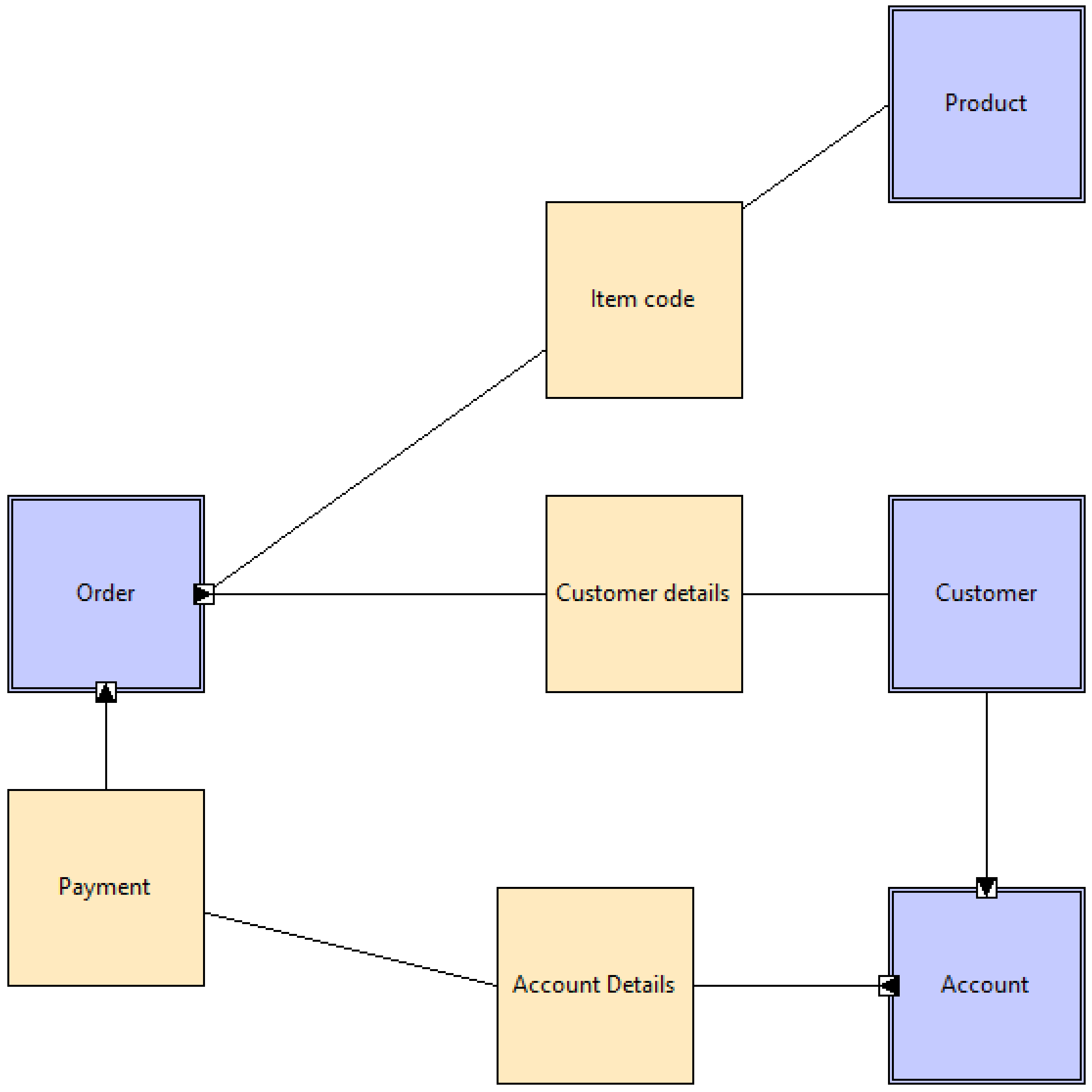
      i. Difficult to incorporate new semantics into existing tools

   b. Do not scale as well as text to very large models

3. Hybrid Visualizations: Many visualization are text-only few graphical notations are purely symbolic. Text labels, are at a minimum. Annotations are generally textual as well. Some notations incorporate substantial parts that are mostly graphical alongside substantial parts that are mostly or wholly textual.

Architecture Visualization: The xADL language defines the structure of architecture description data, but it can be depicted and manipulated in many ways. ArchStudio provides several different visualizations for xADL models. Archipelago, ArchStudio's graphical editor, provides visualizations as symbol graphs - the kind of box-and-arrow models common in tools like Microsoft Visio and OmniGraffle. However, unlike PowerPoint or OmniGraffle models, the graphical depictions in Archipelago aren't just pictures - they are a user-editable graphical projection of the underlying architecture model. ArchStudio includes other editors as well, including ArchEdit, a syntax-directed editors that adapts to new xADL schemas automatically with no recoding, and the Type Wrangler, which provides a custom view of an architectural model that makes it easier to achieve type consistency.





Learning Outcomes: The student should have the ability to

LO1: create project in ArchStudio.

LO2: Draw components and connectors in ArchStudio

Course Outcomes: Upon completion of the course students will be able to Draw design in ArchStudio

Conclusion: In this experiment, Visualization using xADL2.0 was completed.

For Faculty Use

Correction Parameters	Formative Assessment [40%]	Timely completion of Practical [40%]	Attendance / Learning Attitude [20%]	
Marks Obtained				

EXPERIMENT NO. 03

AIM: Creating web services

Theory :

Web services are client and server applications that communicate over the World Wide Web's (WWW) HyperText Transfer Protocol (HTTP)

Web services are open standard (XML, SOAP, HTTP etc.) based Web applications that interact with other web applications for the purpose of exchanging data

Web Services can convert your existing applications into Web-applications.

There are two types of webservices

1. "Big" Web Services

Big web services use XML messages that follow the Simple Object Access Protocol (SOAP) standard, an XML language defining a message architecture and message formats.

Such systems often contain a machine-readable description of the operations offered by the service, written in the Web Services Description Language (WSDL), an XML language for defining interfaces syntactically.

The architecture needs to handle asynchronous processing and invocation. In such cases, the infrastructure provided by standards, such as Web Services Reliable Messaging (WSRM), and APIs, such as JAX-WS, with their client-side asynchronous invocation support, can be leveraged out of the box.

2. RESTful Web Services

RESTful web services, often better integrated with HTTP than SOAP-based services are, do not require XML messages or WSDL service–API definitions.

A RESTful design may be appropriate when the following conditions are met.

The web services are completely stateless. A good test is to consider whether the interaction can survive a restart of the server.

A caching infrastructure can be leveraged for performance.

The service producer and service consumer have a mutual understanding of the context and content being passed along.

Bandwidth is particularly important and needs to be limited. REST is particularly useful for limited-profile devices, such as PDAs and mobile phones, for which the overhead of headers and additional layers of SOAP elements on the XML payload must be restricted.

Web service delivery or aggregation into existing web sites can be enabled easily with a RESTful style.

Example of web service

Following is Web Service example which works as a service provider and exposes two methods (add and SayHello) as Web Services to be used by applications. This is a standard template for a Web Service. .NET Web Services use the .asmx extension. Note that a method exposed as a Web Service has the WebMethod attribute. Save this file as FirstService.asmx in the IIS virtual directory.

FirstService.asmx

```
<%@ WebService language="C" class="FirstService" %>

using System;
using System.Web.Services;
using System.Xml.Serialization;

[WebService(Namespace="http://localhost/MyWebServices/")]
public class FirstService : WebService
{
   [WebMethod]
   public int Add(int a, int b)
   {
      return a + b;
   }

   [WebMethod]
   public String SayHello()
   {
      return "Hello World";
   }
}
```

To test a Web Service, it must be published. A Web Service can be published either on an intranet or the Internet. We will publish this Web Service on IIS running on a local machine. Let's start with configuring the IIS.

- Open Start->Settings->Control Panel->Administrative tools->Internet Services Manager.
- Expand and right-click on [Default Web Site]; select New ->Virtual Directory.
- The Virtual Directory Creation Wizard opens. Click Next.
- The "Virtual Directory Alias" screen opens. Type the virtual directory name and click Next.
- The "Web Site Content Directory" screen opens. Here, enter the directory path name for the virtual directory—for example, c:\MyWebServices—and click Next.
- The "Access Permission" screen opens. Change the settings as per your requirements. Let's keep the default settings for this exercise. Click the Next button. It completes the IIS configuration. Click Finish to complete the configuration.

To test that IIS has been configured properly, copy an HTML file (for example, x.html) in the virtual directory (C:\MyWebServices) created above. Now, open Internet Explorer and type http://localhost/MyWebServices/x.html. It should open the x.html file. If it does not work, try replacing localhost with the IP address of your machine. If it still does not work, check whether IIS is running; you may need to reconfigure IIS and Virtual Directory.

To test our Web Service, copy FirstService.asmx in the IIS virtual directory created above (C:\MyWebServices). Open the Web Service in Internet Explorer (http://localhost/MyWebServices/FirstService.asmx). It should open your Web Service page. The page should have links to two methods exposed as Web Services by our application.

Testing the Web Service

Let's write our first Web Service consumer.

Web-Based Service Consumer

Write a Web-based consumer as given below. Call it WebApp.aspx. Note that it is an ASP.NET application. Save this in the virtual directory of the Web Service (c:\MyWebServices\WebApp.axpx).

This application has two text fields that are used to get numbers from the user to be added. It has one button, Execute, that, when clicked, gets the Add and SayHello Web Services.

WebApp.axpx

```
<%@ Page Language="C#" %>
<script runat="server">
void runSrvice_Click(Object sender, EventArgs e)
{
   FirstService mySvc = new FirstService();
```

```
    Label1.Text = mySvc.SayHello();
    Label2.Text = mySvc.Add(Int32.Parse(txtNum1.Text),
                  Int32.Parse(txtNum2.Text)).ToString();
}
</script>
<html>
<head>
</head>
<body>
<form runat="server">
  <p>
     <em>First Number to Add </em>:
     <asp:TextBox id="txtNum1" runat="server"
        Width="43px">4</asp:TextBox>
  </p>
  <p>
     <em>Second Number To Add </em>:
     <asp:TextBox id="txtNum2" runat="server"
        Width="44px">5</asp:TextBox>
  </p>
  <p>
     <strong><u>Web Service Result -</u></strong>
  </p>
  <p>
     <em>Hello world Service</em> :
     <asp:Label id="Label1" runat="server"
        Font-Underline="True">Label</asp:Label>
  </p>

  <p>
     <em>Add Service</em> :
     & <asp:Label id="Label2" runat="server"
          Font-Underline="True">Label</asp:Label>
  </p>
  <p align="left">
     <asp:Button id="runSrvice" onclick="runSrvice_Click"
        runat="server" Text="Execute"></asp:Button>
  </p>
</form>
</body>
</html>
```

After the consumer is created, we need to create a proxy for the Web Service to be consumed. This work is done automatically by Visual Studio .NET for us when referencing a Web Service that has been added. Here are the steps to be followed:

- Create a proxy for the Web Service to be consumed. The proxy is created using the wsdl utility supplied with the .NET SDK. This utility extracts information from the Web Service and creates a proxy. Thus, the proxy created is valid only for a particular Web Service. If you need to consume other Web Services, you need to create a proxy for this service as well. VS .NET creates a proxy automatically for you when the reference for the Web Service is added. Create a proxy for the Web Service using the wsdl utility supplied with the .NET SDK. It will create FirstSevice.cs in the current directory. We need to compile it to create FirstService.dll (proxy) for the Web Service.

```
c:> WSDL http://localhost/MyWebServices/FirstService.asmx?WSDL
c:> csc /t:library FirstService.cs
```

- Put the compiled proxy in the bin directory of the virtual directory of the Web Service (c:\MyWebServices\bin). IIS looks for the proxy in this directory.
- Create the service consumer, which we have already done. Note that I have instantiated an object of the Web Service proxy in the consumer. This proxy takes care of interacting with the service.
- Type the URL of the consumer in IE to test it (for example, http://localhost/MyWebServices/WebApp.aspx).

Windows Application-Based Web Service Consumer

Writing a Windows application-based Web Service consumer is the same as writing any other Windows application. The only work to be done is to create the proxy (which we have already done) and reference this proxy when compiling the application. Following is our Windows application that uses the Web Service. This application creates a Web Service object (of course, proxy) and calls the SayHello and Add methods on it.

WinApp.cs

```
using System;
using System.IO;

namespace SvcConsumer{
class SvcEater
{
    public static void Main(String[] args)
    {
        FirstService mySvc = new FirstService();

        Console.WriteLine("Calling Hello World Service: " +
                    mySvc.SayHello());
        Console.WriteLine("Calling Add(2, 3) Service: " +
                    mySvc.Add(2, 3).ToString());
    }
}
```

```
  }
```

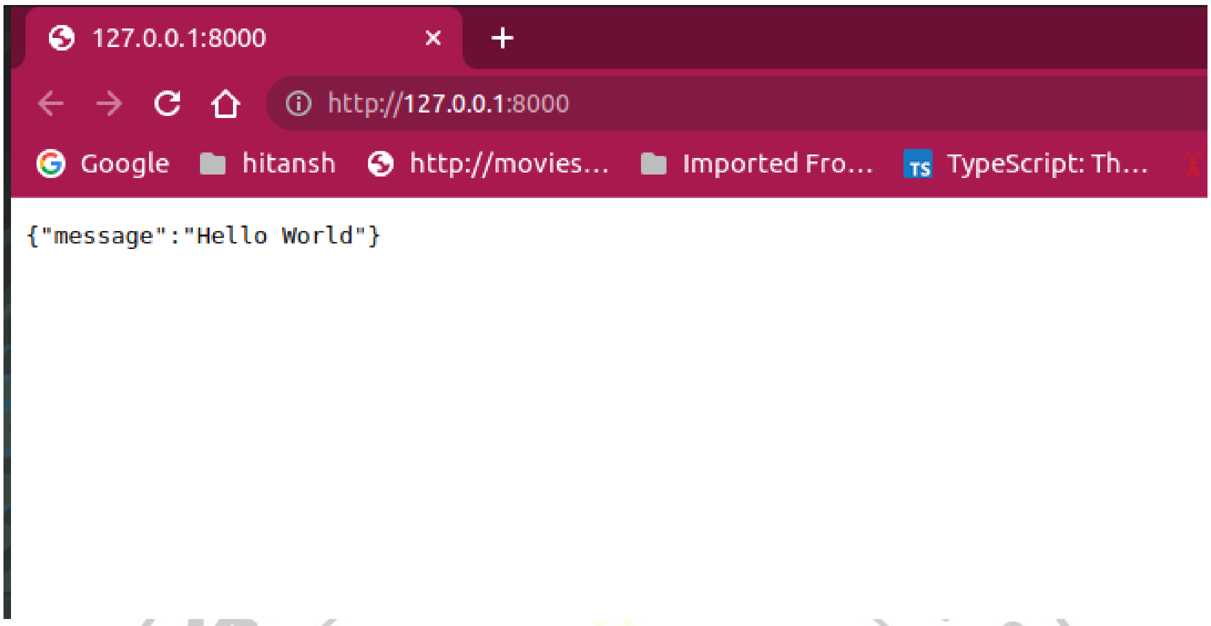
Compile it using c:>csc /r:FirstService.dll WinApp.cs. It will create WinApp.exe. Run it to test the application and the Web Service

Implementation:

```
from fastapi import FastAPI
app = FastAPI()

@app.get("/")
async def root():
    return {"message": "Hello World"}
```

Output:

```
:~/Downloads/temp$ uvicorn server:app --reload

INFO:     Uvicorn running on http://127.0.0.1:8000 (Press CTRL+C to quit)

INFO:     Started reloader process [8196] using watchgod

INFO:     Started server process [8200]

INFO:     Waiting for application startup.

INFO:     Application startup complete.
```



```
{"message":"Hello World"}
```

Learning Outcomes: The student should have the ability to

LO1: create web services.

LO2: understand use of web services

Course Outcomes: Upon completion of the course students will be able to develop web services

Conclusion:

I Learned about web services. Implemented simple webservice in python using library fastAPI and uvicorn as WSGI.

For Faculty Use

Correction Parameters	Formative Assessment [40%]	Timely completion of Practical [40%]	Attendance / Learning Attitude [20%]	
Marks Obtained				

EXPERIMENT NO. 04

AIM: To integrate software components using a middleware

THEORY:

Software architectures promote development focused on modular building blocks and their interconnections. Since architecture-level components often contain complex functionality, it is reasonable to expect that their interactions will also be complex. Modeling and implementing software connectors thus becomes a key aspect of architecture-based development. Software interconnection and middleware technologies such as RMI, CORBA, ILU, and ActiveX provide a valuable service in building applications from components. We have to understand the tradeoffs among these technologies with respect to architectures. Several off-the-shelf middleware technologies are used in implementing software connectors.

The Role of Middleware

Middleware is a potentially useful tool when building software connectors. First, it can be used to bridge thread, process and network boundaries. Second, it can provide pre-built protocols for exchanging data among software components or connectors. Finally, some middleware packages include features of software connectors such as filtering, routing, and broadcast of messages or other data.

Java's Remote Method Invocation (RMI) [24] is a technology developed by Sun Microsystems to allow Java objects to invoke methods of other objects across process and machine boundaries. RMI supports several standard distributed application concepts, namely registration, remote method calls, and distributed objects. Currently, RMI only supports Java applications, but there is indication of a forthcoming link between RMI and CORBA that would remedy this. Each RMI object that is to be shared in an application defines a public interface (a set of methods) that can be called remotely. This is similar to the RPC mechanism. These methods are the only means of communication across a process boundary via RMI. Because RMI is not a software bus, it has no concept of routing, filtering, or messages. However, Java's RMI built-in serialization and deserialization capabilities handle marshalling of basic and moderately complex Java objects, including C2 messages. RMI is fully compatible with the multithreading capabilities built into the Java language, and is therefore well suited for a multithreaded application. It allows communication among objects running in different processes which may be on different machines. Communication occurs exclusively over the TCP/IP networking protocol. RMI supports application modification at run-time, a capability enabled by Java's dynamic class loading.

Addition of 2 numbers using JAVA RMI:

Define an interface that declares remote methods.

The first file AddServerIntf.java that defines the remote interface remains the same.

```
import java.rmi.*;

public interface AddServerIntf extends Remote {
  double add(double d1, double d2) throws RemoteException;
}
```

Implement the remote interface and the server

The second source file AddServerImpl.java (it implements the remote interface) also remains the same, with one minor variation: it calls the super-class constructor explicitly.

```
import java.rmi.*;
import java.rmi.server.*;

public class AddServerImpl extends UnicastRemoteObject
  implements AddServerIntf {

  public AddServerImpl() throws RemoteException {
  super();
  }

  public double add(double d1, double d2) throws RemoteException {
    return d1 + d2;
  }
}
```

The revised version of the third source file AddServer.java includes the security manager, assumes that you will run the server on jupiter using the port 56789, and uses a slightly modified name "MyAddServer" for registration purposes.

```
import java.net.*;
import java.rmi.*;
public class AddServer {
  public static void main(String args[]) {

    // Create and install a security manager

    if (System.getSecurityManager() == null) {
           System.setSecurityManager(new RMISecurityManager());
    }
    try {
      AddServerImpl addServerImpl = new AddServerImpl();

        // You want to run your AddServer on jupiter using the port 56789
        // and you want to use rmi to connect to jupiter from your local
machine
        // Note that to accomplish this you have to start on jupiter
        // rmiregistry 56789 &
        // in the directory that contains NO classes related to this server
!!!

      Naming.rebind("rmi://jupiter.scs.ryerson.ca:56789/MyAddServer",
addServerImpl);
    }
    catch (Exception e) {
            System.out.println("Exception: " + e.getMessage());
            e.printStackTrace();
    }
  }
}
```

Copy files **AddServerIntf.java**, **AddServerImpl.java**, and **AddServer.java** to your directory on jupiter and compile them as usual using javac.

Develop a client (an application or an applet) that uses the remote interface

The revised version of the fourth source file AddClient.java has a few new features.

- It includes also the security manager;

- it requires 4 command-line arguments: the name of the remote server, the port where the naming **rmiregistry** will be running, and two numbers;
- it prints the URL that will be used to connect to the server.

```
import java.rmi.*;

   // USAGE: java AddClient firstNum secondNum

public class AddClient {
  public static void main(String args[]) {

    // The client will try to download code, in particular, it will
    // be downloading stub class from the server.
    // Any time code is downloaded by RMI, a security manager must be
present.

    if (System.getSecurityManager() == null) {
           System.setSecurityManager(new RMISecurityManager());
    }

    try {
      String addServerURL = "rmi://" + args[0] + ":" + args[1] +
"/MyAddServer";

     System.out.println("I will try to invoke the remote method from  " +
addServerURL);

      AddServerIntf remoteObj =
                   (AddServerIntf) Naming.lookup(addServerURL);

      System.out.println("The first number is: " + args[2]);

      double d1 = Double.valueOf(args[2]).doubleValue();

      System.out.println("The second number is: " + args[3]);

      double d2 = Double.valueOf(args[3]).doubleValue();

      // Now we invoke from a local machine the remote method "add"

      System.out.println("The sum is: " + remoteObj.add(d1, d2));
    }
    catch(Exception e) {
      System.out.println("Exception: " + e);
    }
  }
}
```

Keep this file on your local machine together with the remote interface and the **rmi.policy** file that controls access to your local machine:

```
grant {
  // The simplest (but uncarefull) policy is allow everything:
  //    permission java.security.AllPermission;
  // More secure policy is the following.
  //
  // jupiter.scs.ryerson.ca   This is the rmihost - RMI registry and the
server
  // www.scs.ryerson.ca       This is webhost - HTTP server for stub classes
  permission java.net.SocketPermission
    "jupiter.scs.ryerson.ca:1024-65535", "connect,accept";
  permission java.net.SocketPermission
    "www.scs.ryerson.ca:80", "connect";

};
```

You also have to copy this policy file to your directory on jupiter that contains all server-related files.

Generate stubs and skeletons

Next, go to the server (jupiter), and change into the directory that contains **AddServerIntf.class** (interface), **AddServerImpl.class** (its implementation), and **AddServer.class** (server itself) and **rmi.policy** file. In that directory, run **rmic** compiler:

rmic AddServerImpl

This command generates two new files: **AddServerImpl_Skel.class** (skeleton) and **AddServerImpl_Stub.class** (stub).

Start the RMI registry

Before you proceed, copy stub and interface classes to a directory, where the web server can access them, e.g. to the world-accessible sub-directory **JavaClasses** of your **public_html** directory:

```
ls -t -l ~mes/public_html/JavaClasses/
total 24
-rw-r--r--   1 mes      mes          205     AddServerIntf.class
-rw-r--r--   1 mes      mes         1612     AddServerImpl_Skel.class
-rw-r--r--   1 mes      mes         3171     AddServerImpl_Stub.class
```

Check that all these files are accessible, e.g., try to download them using Netscape or IE: if you succeeded, then they are accessible.

On jupiter in the directory that does NOT contain any server related classes and assuming that those classes are NOT on you CLASSPATH, start rmiregistry:

rmiregistry 56789 &

For example, create the temporary directory tmpTEST, go to that directory and start there **rmiregistry** naming system. By default, rmiregistry naming system loads stub and skeleton files from directories mentioned in your **CLASSPATH**. But because you want to load them dynamically from your web directory `JavaClasses`, you want to hide these files from **rmiregistry**: this way you force to load required files from the codebase given below as a command-line argument.

Start the server

In the directory that contains all server related classes:

```
-rw-r--r--   1 mes       mes          1075       AddServer.class
-rw-r--r--   1 mes       mes           363       AddServerImpl.class
-rw-r--r--   1 mes       mes          1612       AddServerImpl_Skel.class
-rw-r--r--   1 mes       mes          3171       AddServerImpl_Stub.class
-rw-r--r--   1 mes       mes           205       AddServerIntf.class
-rw-r--r--   1 mes       mes           511       rmi.policy
```

we can run the server:

```
java -Djava.security.policy=rmi.policy
  -Djava.rmi.server.codebase=http://www.scs.ryerson.ca/~mes/JavaClasses/
AddServer &
```

Note that the URL given to "codebase" ends with / and use your own login name, of course.

Run the client

Now, go to the directory of your **local computer** that contains only 3 files:

- **AddClient.class** (client),
- **AddServerIntf.class** (interface),
- **rmi.policy**: your policy file.

For example, you can create a new directory and copy there 3 files mentioned in this section.

This time, you would like to load the stub class dynamically from the server. Assume that the server side was developed by a different company, you are responsible only for the client application and you do not have access to the server-related files when you start your client. All you know is that the RMI server will be running on jupiter and you can connect to the registry at the port 56789 if you need to invoke remote methods on the server.

Finally, you can run the client application on your local machine:

Implementation:

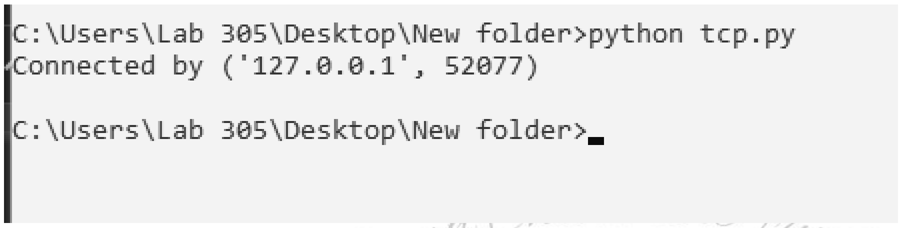
server.py

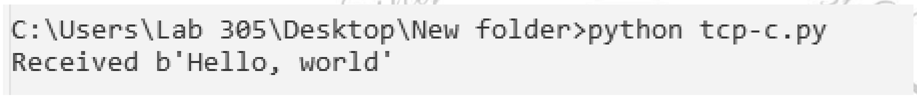
```
import socket

HOST = "127.0.0.1"
PORT = 65432
with socket.socket(socket.AF_INET, socket.SOCK_STREAM) as s:
    s.bind((HOST, PORT))
    s.listen()
    conn, addr = s.accept()
    with conn:
        print(f"Connected by {addr}")
        while True:
            data = conn.recv(1024)
            if not data:
                break
            conn.sendall(data)
```

Client.py

```
import socket

HOST = "127.0.0.1"
PORT = 65432

with socket.socket(socket.AF_INET, socket.SOCK_STREAM) as s:
    s.connect((HOST, PORT))
    s.sendall(b"Hello, world")
    data = s.recv(1024)

print(f"Received {data!r}")
```

Output:


```
C:\Users\Lab 305\Desktop\New folder>python tcp.py
Connected by ('127.0.0.1', 52077)

C:\Users\Lab 305\Desktop\New folder>
```


```
C:\Users\Lab 305\Desktop\New folder>python tcp-c.py
Received b'Hello, world'
```

Learning Outcomes: The student should have the ability to

LO1: understand middle wares

LO2: write middlewares

Course Outcomes: Upon completion of the course students will be able to develop middlewares

Conclusion:

I Learned about Middleware. Implemented simple Middleware in python using library sockets.

For Faculty Use

Correction Parameters	**Formative Assessment [40%]**	**Timely completion of Practical [40%]**	**Attendance / Learning Attitude [20%]**	
Marks Obtained				

EXPERIMENT NO. 5

AIM: Use middleware JAVA RMI to implement stream connectors

THEORY:

Software connectors have been embraced as a critical abstraction by software architecture researchers. Connectors remove from components the responsibility of knowing how they are interconnected. They also introduce a layer of indirection between components. The potential penalties paid due to this indirection (e.g., performance) should be outweighed by other benefits of connectors, such as their encapsulation of complex intercommunication protocols that can be reused relatively inexpensively across applications. Modeling and implementation of software connectors with potentially complex protocols thus becomes an important aspect of architecture-based development.

Because software connectors provide a uniform interface to other connectors and components within an architecture, architects need not be concerned with the properties of different middleware technologies as long as the technology can be encapsulated within a software connector. Internally, however, connectors based on different middleware technologies have different abilities. Implementers of a given architecture can use this knowledge to determine which middleware solutions are appropriate in a given implementation of an architecture. In this way, encapsulating middleware functionality within software connectors maintains the integrity of an architectural style by keeping it separate from implementation-dependent factors such as how to bridge process boundaries within a single architecture.

Introduction to Java RMI.

The Java RMI (Remote Method Invocation) is a package for writing and executing distributed Java programs. The Java RMI provides a framework for developing and running servers (server objects). The services (methods) provided by those server objects can be accessed by clients in a way similar to method invocation. I.e. Java RMI hides almost all aspects of the distribution and provides a uniform way by which objects (distributed or not) may be accessed.

Writing Java programs using RMI can be described by the following steps:

- write server interface(s),
- write server implementation,
- generate server skeleton and client stub,
- write client implementation.

Executing distributed Java programs using RMI can be described by the following steps:

- start the rmi registry,
- start the server object,
- run the client(s).

A server (RMIServer.java) will provide the methods String getString() and void setString(String s). A client (RMIClient.java) may use those two methods for retrieving and storing a string in the server, i.e. the client may modify and inspect the local state of the server object.

The following sections will develop this server and a corresponding client.

The server interface.

The server interface is used by the stub/skeleton compiler when generating the client stub and the server skeleton files. This interface thus defines the methods in the server, which may be invoked by the clients.

There are two issues to remember when writing such an interface. First, the interface has to be written as extending the java.rmi.Remote interface. Second, all methods in the interface must throw java.rmt.RemoteException. This exception must thus be caught when the clients are invoking any of the servers methods, thus the clients may have a way to determine if a method invocation was successful.

The complete source code for the server interface (ServerInterface.java) is included below.

```
package examples.rmi;
import java.rmi.*;

public interface ServerInterface extends Remote
{

   public String getString() throws RemoteException;
   public void setString(String s) throws RemoteException;

}
```

The interface is compiled by the javac compiler to generate the file `ServerInterface.class`.

Writing the server object.

The server must be written as a "regular" Java program, i.e. a program with a method public static void main(String argv[]). Through this main method, server objects may be instantiated and registered with the rmi registry.

Each distributed object is identified by a string, specifying the object name. This string is registered with the rmi registry and is used by the clients when requesting a reference to the server object. The following lines of code indicates how an instance of RMIServer can be registered with the rmi registry under the string name "RMIServer". The following code would typically appear in the main method of the server:

```
String name = "RMIServer";
RMIServer theServer = new RMIServer();
Naming.rebind(name,theServer);
```

Server objects must - of course - implement the defined interfaces and in addition typically extend java.rmi.server.UnicastRemoteObject. At the abstract level, this should potentially enable various kinds of distribution schemes (e.g. replication of objects, multicast groups of objects etc.) by extending different classes. However in current implementations of Java, only java.rmi.server.UnicastRemoteObject is available. The only practical advantage of inheriting from java.rmi.sever.UnicastRemoteObject is that it will preserve the usual semantics of the methods hashCode(), equals() and toString() in a distributed environment.

```
package examples.rmi;
import java.rmi.server.UnicastRemoteObject;
import java.rmi.*;

public class RMIServer extends UnicastRemoteObject implements ServerInterface
{
   private String myString = "";

   // The default constructor
   public RMIServer() throws RemoteException
     {
       super();
     }

   // Implement the methods from the ServerInterface
   public void setString(String s) throws RemoteException
     {
       this.myString = s;
     }

  public String getString() throws RemoteException
     {
       return myString;
     }

   // The main method: instantiate and register an instance of the
   // RMIServer with the rmi registry.
   public static void main(String argv[])
     {
       try
         {
           String name = "RMIServer";
           System.out.println("Registering as: \""+name+"\"");
           RMIServer theServer = new RMIServer();
           Naming.rebind(name,theServer);
           System.out.println(name+" ready...");
          }
        catch(Exception e)
          {
           System.out.println("Exception while registering: "+e);
           }
     }
}
```

The RMIServer.java is compiled using the default javac to generate the file RMIServer.class.

Generating skeleton and stub.

Based on the compiled ServerInterface and RMIServer files, a client stub and a server skeleton can be generated. The server skeleton acts as interface between the rmi registry and the server objects residing on a host. Likewise, the client stub of the server is returned to the client when a reference to the remote object is requested. The exact details (using the skeleton and stub) are all taken care of by the runtime environment.

To generate the skeleton and the stub, the rmic compiler is used. Like the Java virtual machine, the rmic compiler requires fully qualified class names, i.e. to generate the server skeleton and the client stub for the RMIServer, the following command must be invoked:

```
rmic examples.rmi.RMIServer
```

This generates the files `RMIServer_Skel.class` and `RMIServer_Stub.class` .

Writing the client implementation.

When writing a client implementation, three things must be done. First, a "security manager" must be installed. Such a security manager specifies the security policy, i.e. decides which constraints are imposed on the server stubs. An appropriate security manager for these examples can be installed by the following code:

```
System.setSecurityManager(new java.rmi.RMISecurityManager());
```

Second, a reference to the remote object must be requested. To do so, the hostname of the host where the object resides as well as the string name, under which the object is registered, is required. In this example, the object was registered with the string name "RMIServer". Assuming that the server was started on the host "objecthost.domain.com", the following line of code may be used to get a reference to the object:

```
String name = "rmi://objecthost.domain.com/RMIServer"
server = (ServerInterface)Naming.lookup(name);
```

The code above contacts the rmi registry at "objecthost.domain.com" and asks for the stub for the object, registered under the name "RMIServer".

Thus in reality, Naming.lookup() returns an instance of the RMIServer_stub. However the available methods in the server object (and thus in the stub) are defined by ServerInterface. Thus whatever Naming.lookup() returns is typecast into a ServerInterface.

```
package examples.rmi;
import java.rmi.server.*;
import java.rmi.*;

public class RMIClient
{
   public static void main (String argv[])
     {
       // Parse the commandline to get the hostname where
       // the server object resides
       String host = "";

       if (argv.length == 1)
         {
           host = argv[0];
         }
      else
         {
           System.out.println("Usage: RMIClient server");
           System.exit(1);
         }

       // Install a security manager.
       System.setSecurityManager(new RMISecurityManager());

       // Request a reference to the server object
       String name = "rmi://"+host+"/RMIServer";
       System.out.println("Looking up: "+name);

       ServerInterface server = null;
       try
         {
           // In reality, Naming.lookup() will return an instance of
           // examples.rmi.RMIServer_stub.
           // This is typecast into the ServerInterface, which is what
           // specifies the available server methods.
           server = (ServerInterface)Naming.lookup(name);
         }
       catch(Exception e)
         {
           System.out.println("Exception " +e);
           System.exit(1);
         }

       // Given a reference to the server object, it is now
       // possible to invoke methods as usual:
      try
         {
           server.setString("Foobar");
           System.out.println("String in server: "
                      +server.getString());
        }
       catch(Exception e)
```

```
          {
            System.out.println("Exception " +e);
            System.exit(1);
          }
      }
}
```

Running the example.

The first thing to do when running Java programs using RMI is to start the rmi registry:

```
install:~> rmiregistry &
[1] 1449
install:~>
```

Next, the server must be started:

```
install:~> java examples.rmi.RMIServer
Registering as: "RMIServer"
RMIServer ready...
```

Finally, the client may be started and the setup tested:

```
install:~>        java        examples.rmi.RMIClient        install.cs.auc.dk
Looking                  up:              rmi://install.cs.auc.dk/RMIServer
String                   in                server:                   Foobar
install:~>
```

Learning Outcomes: The student should have the ability to

LO1: understand types of connectors

LO2: write connectors using middleware

Course Outcomes: Upon completion of the course students will be able to develop connectors using middlewares

Conclusion:

Thus a stream connector is implemented using middleware JAVA RMI.

For Faculty Use

Correction Parameters	**Formative Assessment [40%]**	**Timely completion of Practical [40%]**	**Attendance / Learning Attitude [20%]**	
Marks Obtained				

EXPERIMENT NO. 06

AIM: Wrappers to connect two applications with different architecture

Theory : Wrapper classes are used to convert any data type into an object.The primitive data types are not objects; they do not belong to any class; they are defined in the language itself. Sometimes, it is required to convert data types into objects in Java language. For example, upto JDK1.4, the data structures accept only objects to store. A data type is to be converted into an object and then added to a Stack or Vector etc.
a wrapper class wraps (encloses) around a data type and gives it an object appearance. Wherever, the data type is required as an object, this object can be used. Wrapper classes include methods to unwrap the object and give back the data type.

```
int k = 100;
Integer it1 = new Integer(k);
```

```
int m = it1.intValue();
System.out.println(m*m);
```

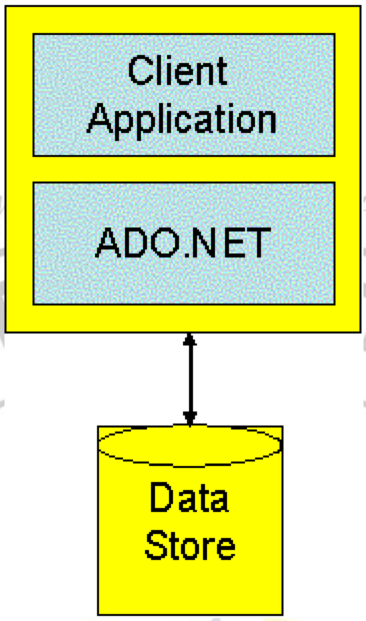
There are mainly two uses with wrapper classes.

1. To convert simple data types into objects, that is, to give object form to a data type; here constructors are used.
2. To convert strings into data types (known as parsing operations), here methods of type parseXXX() are used.
3. So that null values can be there.

Create wrapper classes for connecting two tier and three tier application.

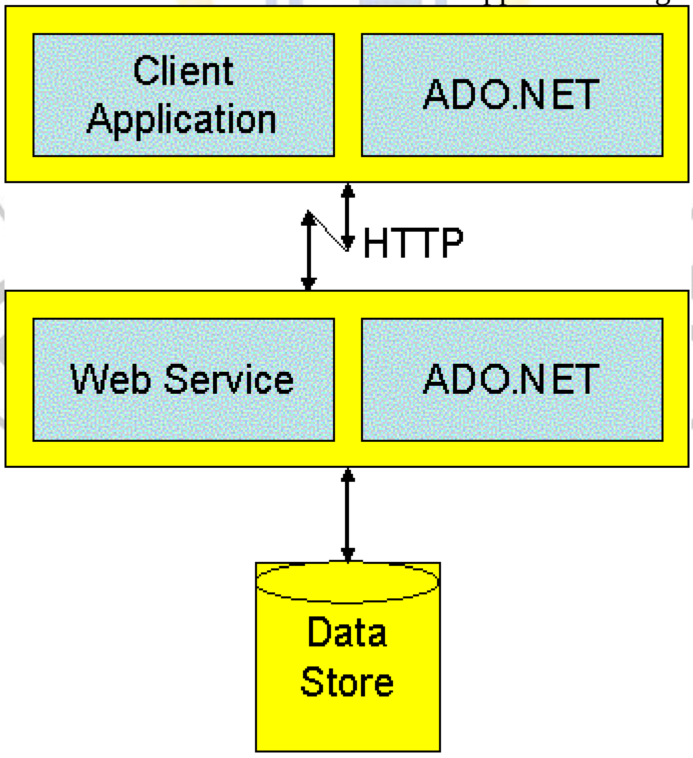
Two-Tier Application Architecture

A typical two-tier application is a client application using ADO.NET communicating directly with a database server, like Microsoft SQL Server™. There are no intervening layers between the client application and the database other than ADO.NET e.g. Client Server applications



Three-Tier Application Using an XML Web Service

Another design option is to use an XML Web service to separate the database's access to another component that returns the data to the front-end application. E.g. Web applications

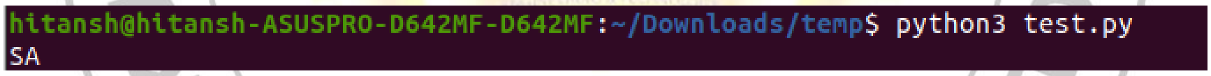


A three-tier application using an XML Web service is appropriate for either a Web-based or Microsoft Windows® application. This technique comes in handy when you need the richness of a desktop application, but users connect to it from many different locations and access the data across an HTTP interface.

Implementation:

```
def decorator(cls):
    class Wrapper:
        def __init__(self, x):
            self.wrap = cls(x)
        def get_name(self):
            return self.wrap.name
    return Wrapper

@decorator
class C:
    def __init__(self, y):
        self.name = y

x = C("SA")
print(x.get_name())
```

Output:



```
hitansh@hitansh-ASUSPRO-D642MF-D642MF:~/Downloads/temp$ python3 test.py
SA
```

Learning Outcomes: The student should have the ability to

LO1: understand wrappers

LO2: write wrappers to connect application

Course Outcomes: Upon completion of the course students will be able to develop wrappers to connect application

Conclusion:

I Learned about wrappers. Implemented simple wrapper in python using class.

For Faculty Use

Correction Parameters	**Formative Assessment [40%]**	**Timely completion of Practical [40%]**	**Attendance / Learning Attitude [20%]**	
Marks Obtained				

EXPERIMENT NO. 07

AIM: Architecture for any specific domain - DSSA for Library management system.

THEORY:

A Domain-Specific Software Architecture (DSSA) has been defined as:

• "an assemblage of software components, specialized for a particular type of task (domain), generalized for effective use across that domain, composed in a standardized structure (topology) effective for building successful applications"

• "a context for patterns of problem elements, solution elements, and situations that define mappings between them "

The first section describes the domain model 3 that was generated based on scenarios or "operational flows" that reflect the behavior of applications in the domain being analyzed - ticket sales. The domain model consists of:

1. scenarios,
2. domain dictionary,
3. context (block) diagram,
4. entity/relationship diagrams,
5. data flow models,
6. state transition models, and
7. object model.

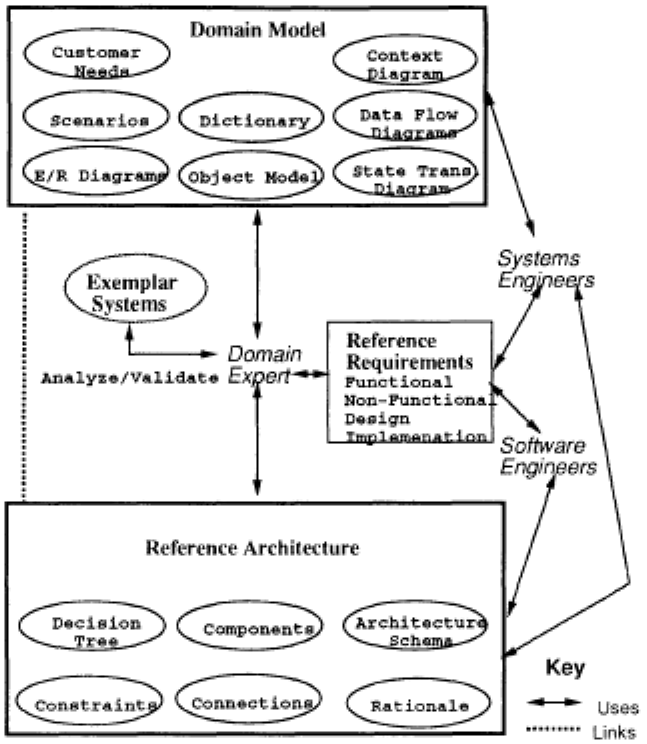
The second section focuses on the reference requirements. Besides specifying the functional requirements identified in the domain model, the reference requirements also contain:

1. non-functional requirements,
2. design requirements, and
3. implementation requirements.

The third section describes the resulting reference architecture consisting of:

1. reference architecture model,
2. configuration decision tree,
3. architecture schema or design record,
4. reference architecture dependency diagram (topology),
5. component interface descriptions,
6. constraints, and
7. rationale.

The final section provides an analysis of differences between "real world" problems and this "toy" example.



DOMAIN MODEL

One of the insights to be gained from this example is the separation of "problem space" from "solution space" or "design space." The domain model generally tries to characterize fully the former, while the reference architecture addresses a portion (for reasons of practicality) of the latter. Every DSSA starts with an analysis of the application domain. This domain analysis process often involves several domain "experts" who are intimately familiar with legacy systems of this kind or other aspects of the domain of interest. It also may involve customer inputs as well as inputs from others familiar with various aspects of the application.The purpose of a domain model is to provide to individuals who will develop or maintain applications in a domain an unambiguous understanding of various aspects of the domain.

One important difference between DSSA requirements analysis and traditional systems requirements analysis is the emphasis on the separation of functional requirements from design and implementation requirements. In the customer's mind, these are all "requirements."But from the DSSA perspective, the functional requirements define the (problem) domain, while the design and implementation requirements constrain the design/architecture.

SCENARIOS

The following scenarios consist of a list of numbered, labeled scenario steps or events followed by a brief description.

Ticket Purchase Scenario

1. Ask: The customer asks the agent what seats are available.

2. Look: The agent enters the appropriate command into his/her terminal and relates the results to the customer (cost, section, row number, and seat number).

3. Decide: The customer decides what seats are desired, if any, and tells the agent.

4. Buy: The customer pays the agent for the tickets.Agent gives the tickets to the customer.

5. Update: Tile agent records the transaction.

Ticket Return Scenario

1. Return: The customer gives the agent tickets that are no longer needed.

2. Refund: The agent gives the customer money back.

3. Update: The agent records the transaction.

Ticket Exchange Scenario

1. Ask: The customer asks the agent what seats are available.

2. Look: The agent enters the appropriate command into his/her terminal and relates the results to the customer (cost, section, row number, and seat number).

3. Decide: The customer decides what seats are desired, if any, and tells the agent.

4. Exchange: The customer gives the agent the old tickets, then the agent gives the customer the new tickets. Depending on the price of the new tickets, the agent either collects additional money from the customer or issues a refund.

5. Update: The agent records the transaction.

Ticket Sales Analysis Scenario

1. Stop Sales: The sales manager enters the command to stop the sale of tickets for a particular performance.

2. Tally: The ticket sales program generates a report listing total sales.

Theater Configuration Scenario

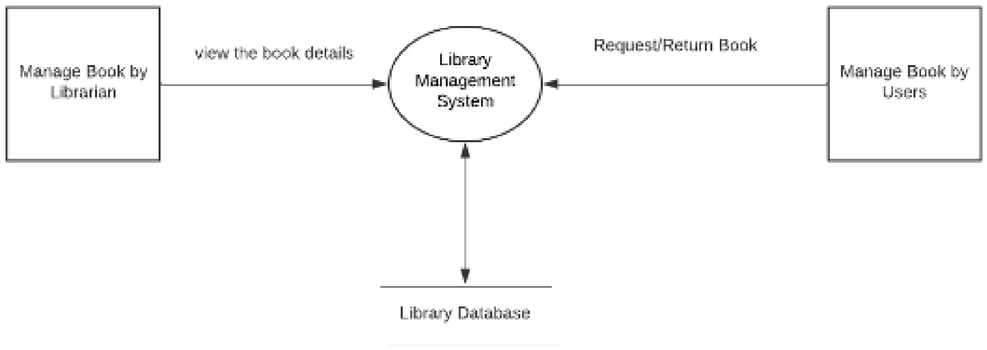
1. Performance Logistics: The sales manager enters in the name, time, location, and date of the performance. The following scenarios consist of a list of numbered, labeled scenario steps or events followed by a brief description.

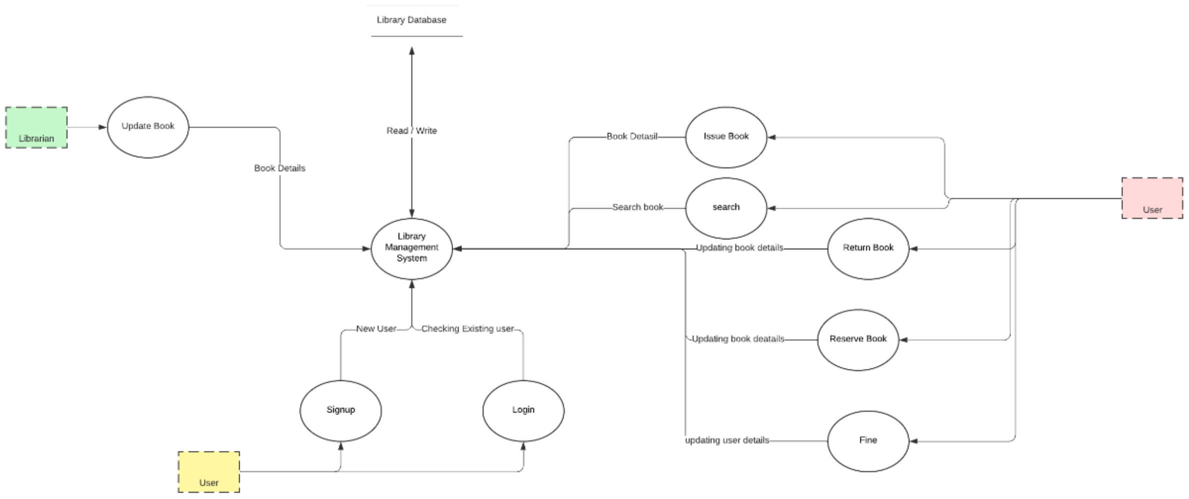
2. Seating Arrangement: The sales manager decides if the performance is "Reserved Seating" or "Open Seating."

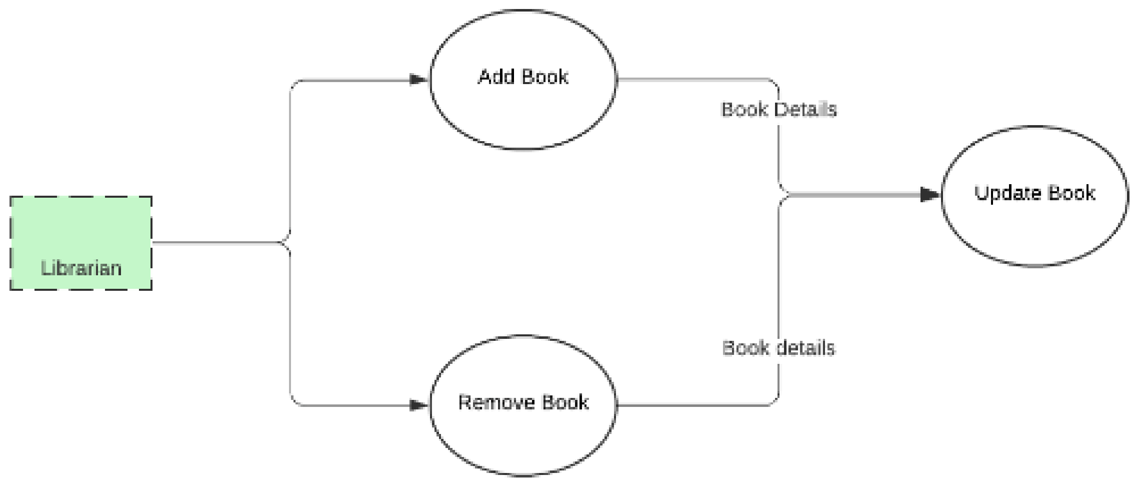
3. Theater Logistics: If this performance is reserved seating, then the sales manager enters the number and kind of sections in the theater, what rows are in what sections, and what seats are in what rows. If this performance is open seating, then the sales manager enters the total number of tickets to be sold.

4. Pricing: The sales manager enters in the price of each ticket, determined by section and seating style. Scenarios are not only a good way of eliciting functional requirements, data flow, and control

flow information from a customer but they also allow the analyst to get an idea of what kind of "look and feel" the system should have.







Learning Outcomes: The student should have the ability to

LO1: understand domains

LO2: write architecture for any domains

Course Outcomes: Upon completion of the course students will be able to develop architectures for specific domains

Conclusion:

I Learned about DSSA. Implemented simple dfd for Library management system.

For Faculty Use

Correction Parameters	Formative Assessment [40%]	Timely completion of Practical [40%]	Attendance / Learning Attitude [20%]	
Marks Obtained				

Experiment No.: 8

AIM: Identifying System requirements for Architecture for any specific domain.

Learning Objective: Students should be able to understand System requirements for an Architecture for any specific domain.

1. **Register:**
   - Description: First the user will have to register/sign up. There are two different types of users.
   - The library manager/head : The manager have to provide details about the name of library ,address, phone number, email id.
   - Regular person/student : The user has to provide details about his/her name of address, phone number, email id.

1.1) Sign up:

- Input: Detail about the user as mentioned in the description.
- Output: Confirmation of registration status and a membership number and password will be generated and mailed to the user.
- Processing: All details will be checked and if any errors are found then an error message is displayed else a membership number and password will be generated.

1.2) Login:

- Input: Enter the membership number and password provided.
- Output : Users will be able to use the features of software.

2. **Manage books by User:**

2.1) Book issue

- Description : List of books will be displaced along with data of return.

2.2) Search

- Input : Enter the name of the author's name of the books to be issued.
- Output : List of books related to the keyword.

2.3) Issue Book

- State : Searched the book the user wants to issues.
- Input : click the book the user wants.
- Output : confirmation for book issue and apology for failure in issue.
- Processing : if selected book is available then book will be issued else error will be displayed.

2.4) Renew Book

- State : Book is issued and is about to reach the date of return.
- Input : Select the book to be renewed.
- Output : confirmation message.
- Processing : If the issued book is already reserved by another user then an error message will be sent and if not then a confirmation message will be displayed.

2.5) Return

- Input ; Return the book to the library.
- Output : The issued list will be updated and the returned book will be listed out.

2.6) Reserve Book

- Input ; Enter the details of the book.
- Output : Book successfully reserved.

- Description : If a book is issued by someone then the user can reserve it ,so that later the user can issue it.

2.7) Fine

- Input : check for the fines.
- Output : Details about fines on different books issued by the user.
- Processing : The fine will be calculated, if it crossed the date of return and the user did not renew if then fine will be applied by Rs 10 per day.

3. **Manage books by Librarian:**

3.1) Update Details of Books:

3.1.1) Add books:

- Input : Enter the details of the books such as names, author, edition, quantity.
- Output : confirmation of addition.

3.1.2) Remove books:

- Input : Enter the name of the book and quantity of books.
- Output : Update the list of the books available

Learning Outcomes: The student should have the ability to

LO1: understand domains

LO2: write architecture for any domains

Course Outcomes: Upon completion of the course students will be able to develop architectures for specific domains

Conclusion:

I Learned about DSSA. gathered and documented system requirements for the Library management system.

For Faculty Use

Correction Parameters	Formative Assessment [40%]	Timely completion of Practical [40%]	Attendance / Learning Attitude [20%]	
Marks Obtained				

Experiment No.: 9

AIM: Mapping of non-functional components with system requirements.

Learning Objective: Students should be able to understand Mapping of non-functional components with system requirements..

1. **Performance Requirement**

   The proposed system that we are going to develop will be used as the Chief performance system within the different campuses of the university which interacts with the university staff and students. Therefore, it is expected that the database would perform Functionally all the requirements that are specified by the university.

   a. The performance of the system should be fast and accurate.
   b. Library Management System shall handle expected and unexpected errors in ways that prevent loss in information and long downtime period. Thus it should have inbuilt error testing to identify invalid username/password.
   c. The system should be able to handle large amounts of data. Thus it should accommodate a high number of books and users without any fault.

2. **Safety Requirement**

   The database may get crashed at any certain time due to virus or operating system failure. Therefore, it is required to take the database backup so that the database is not lost. Proper UPS/inverter facility should be there in case of power supply failure.

3. **Security Requirement**

   System will use a secured database. Normal users can just read information but they cannot edit or modify anything except their personal and some other information. System will have different types of users and every user has access constraints Proper user authentication should be provided No one should be able to hack users' password There should be separate accounts for admin and members such that no member can access the database and only admin has the rights to update the database.

4. **Software Quality Attributes:**

   There may be multiple admins creating the project, all of them will have the right to create changes to the system. But the members or other users cannot do changes The project should be open source The Quality of the database is maintained in such a way so that it can be very user friendly to all the users of the database The user be able to easily download and install the system

5. **Business Rules:**

A business rule is anything that captures and implements business policies and practices. A rule can enforce business policy, make a decision, or infer new data from existing data. This includes the rules and regulations that the System users should abide by. This includes the cost of the project and the discount offers provided. The users should avoid illegal rules and protocols. Neither admit nor member should cross the rules and regulations.

Learning Outcomes: The student should have the ability to

LO1: understand domains

LO2: write architecture for any domains

Course Outcomes: Upon completion of the course students will be able to develop architectures for specific domains

Conclusion:

I Learned about DSSA. mapped system requirements with non-functional requirements and documented the same for the Library management system.

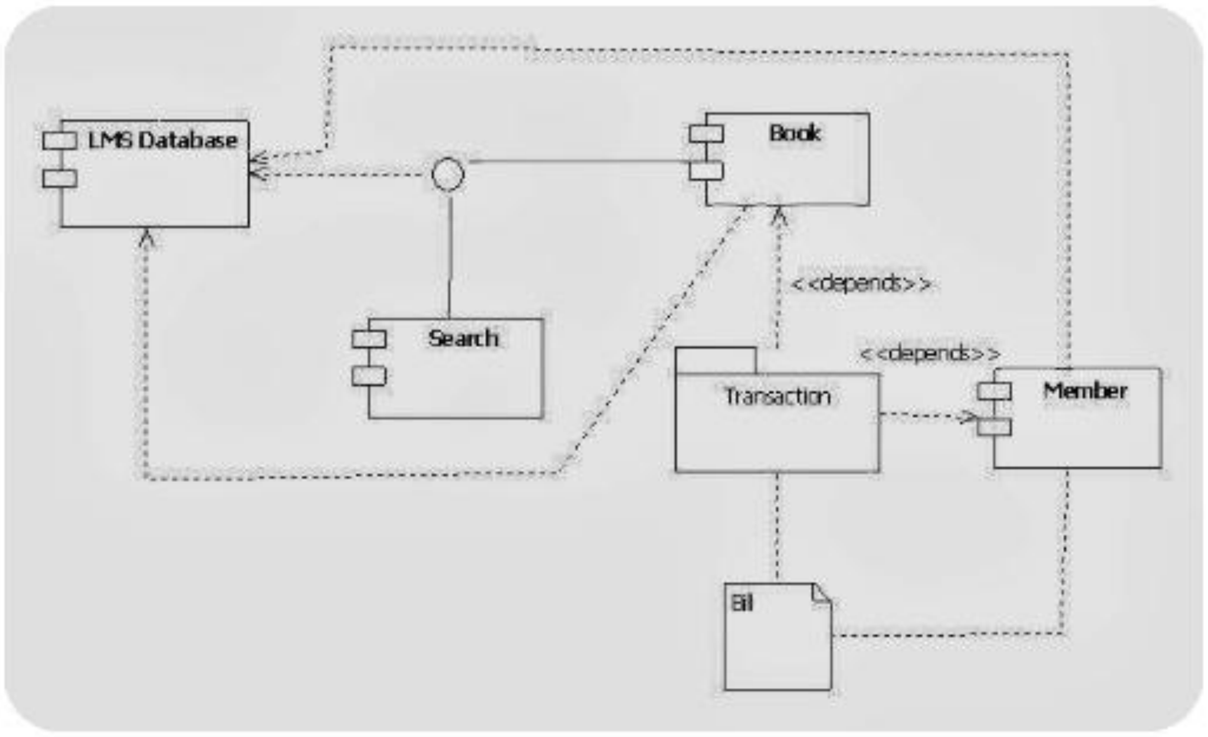
For Faculty Use

Correction Parameters	Formative Assessment [40%]	Timely completion of Practical [40%]	Attendance / Learning Attitude [20%]	
Marks Obtained				

Experiment No.: 10

AIM: Implementation of Software Architecture for identified system/application.

Learning Objective: Students should be able to Implementation of Software Architecture for the recognized system.



Learning Outcomes: The student should have the ability to

LO1: understand domains

LO2: write architecture for any domains

Course Outcomes: Upon completion of the course students will be able to develop architectures for specific domains

Conclusion:

I Learned about DSSA. Implementation of Software Architecture for Library management system and documented the same.

For Faculty Use

Correction Parameters	Formative Assessment [40%]	Timely completion of Practical [40%]	Attendance / Learning Attitude [20%]	
Marks Obtained				