Java Networking

Subject Overview :Unit Mapping

Sr. No.	Unit	Reference Book	Chapter
1	Java Networking	The Complete Reference, Java (Seventh Edition), Herbert Schild - Osbrone.	20
2	JDBC Programming	Complete Reference J2EE by James Keogh mcgraw publication	6,7
3	Servlet API and Overview	Professional Java Server Programming by Subrahmanyam Allamaraju, Cedric Buest Wiley Publication	7,8
4	Java Server Pages		10,11
5	Java Server Faces	Black Book “ Java server programming” J2EE, 1st ed., Dream Tech Publishers, 2008. 3. Kathy walrath ”	11
6	Hibernate		15
7	Java Web Frameworks: Spring MVC		21

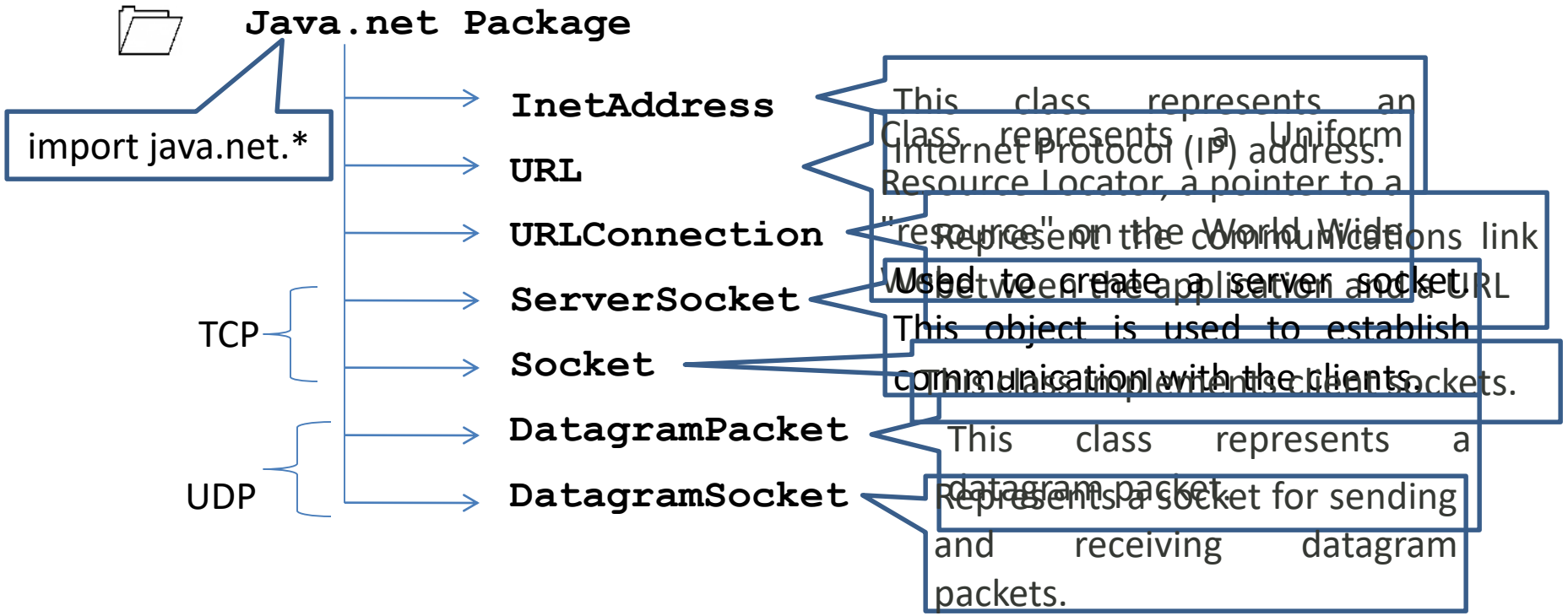
Unit-1: Java Networking

Topic

1. **Network Basics and Socket overview**
2. InetAddress
3. TCP/IP server sockets
4. TCP/IP client sockets
5. Datagrams
6. URL
7. URLConnection

Network Basics: java.net pacakage

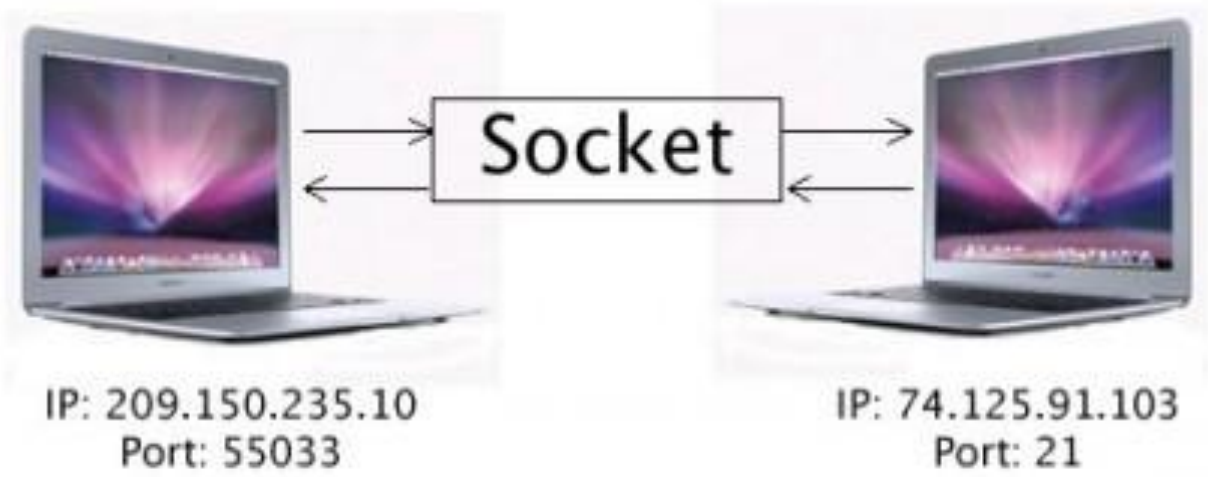
- The term *network programming* refers to writing programs that execute across multiple devices (computers), in which the devices are all connected to each other using a network.



Socket overview

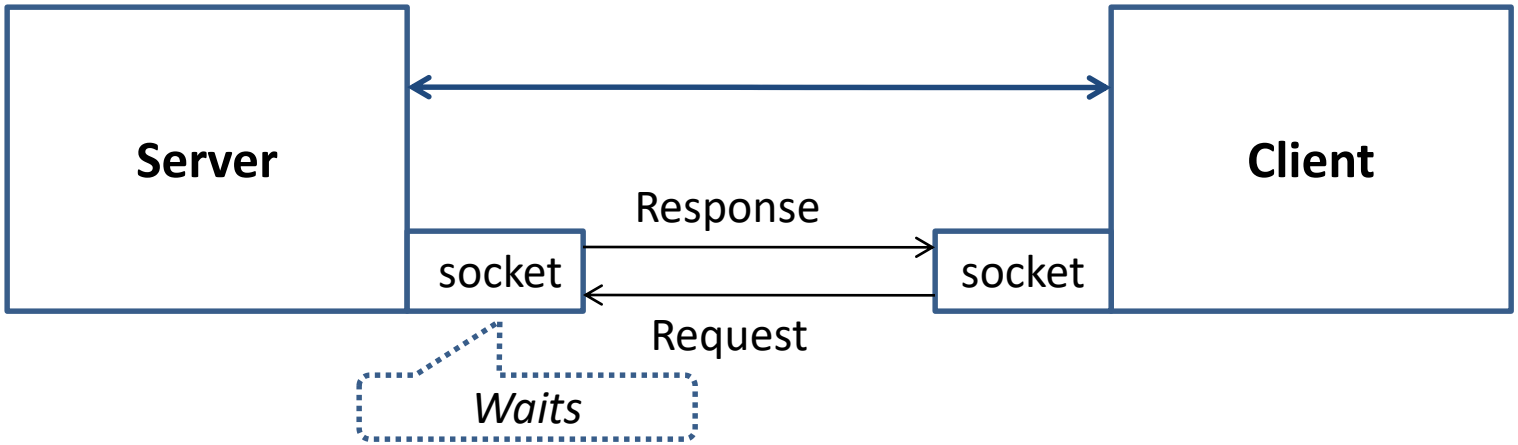
Socket

- *"A **socket** is one endpoint of a two-way communication link between two programs running on the network."*
- A Socket is combination of an IP address and a port number.



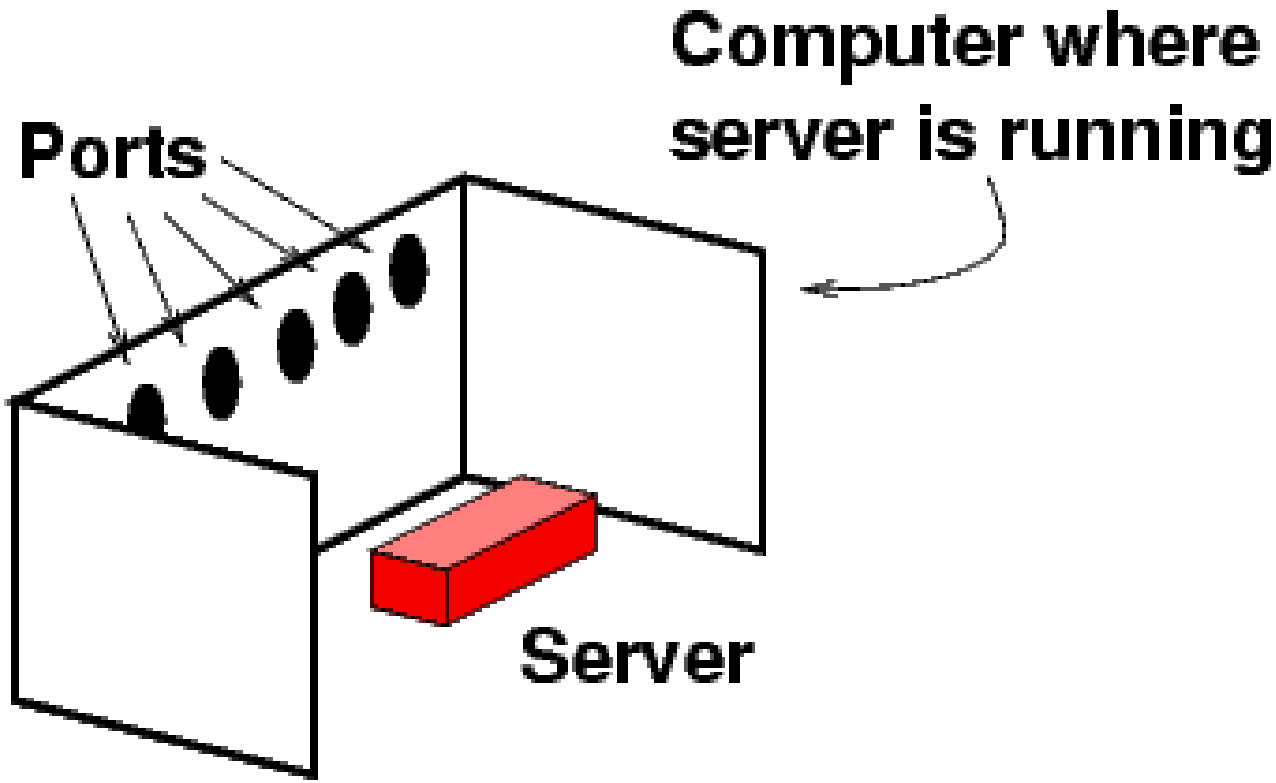
Client – Server Communication

- Two machines must connect
- Server waits for connection
- Client initiates connection
- Server responds to the client request



Socket overview

- The server is just like any ordinary program running in a computer.
- Each computer is equipped with some ports.

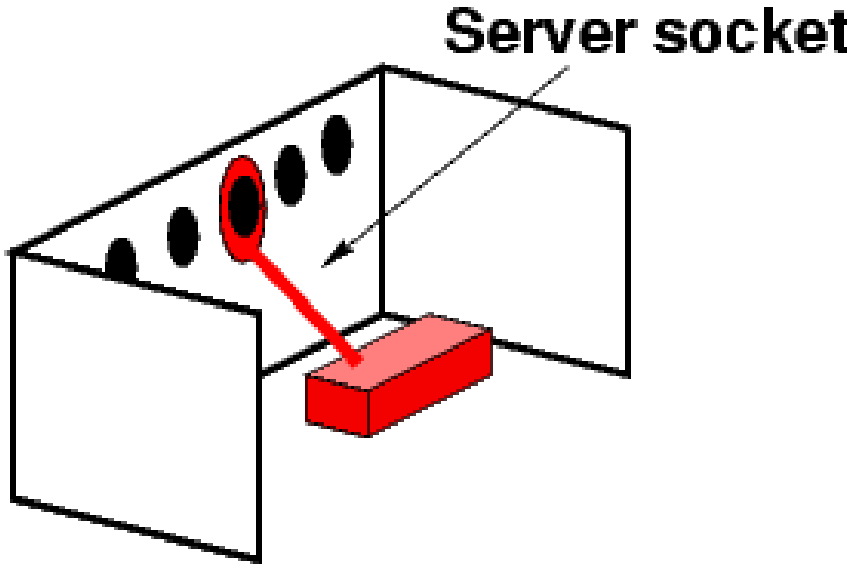


Socket overview

- The server connects to one of the ports.
- This process is called **binding** to a port.
- The connection is called a server socket.

The Java server code that does this is:

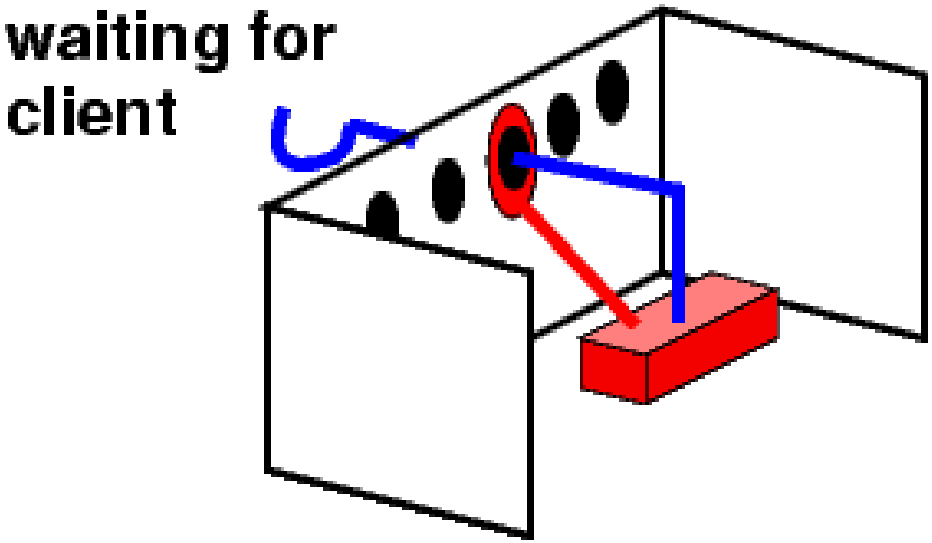
```
ServerSocket ss = new ServerSocket(1234);//1234 is port number
```



Reference: isinotes/javatut/net

Socket overview

- Server is waiting for client machine to connect.



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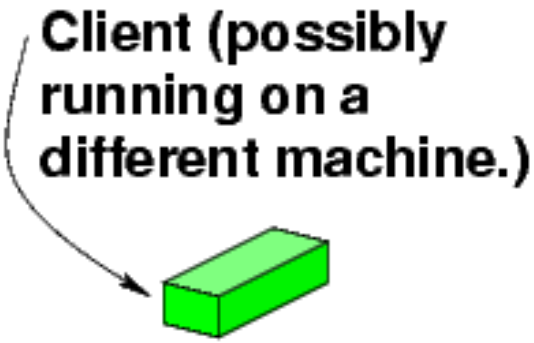
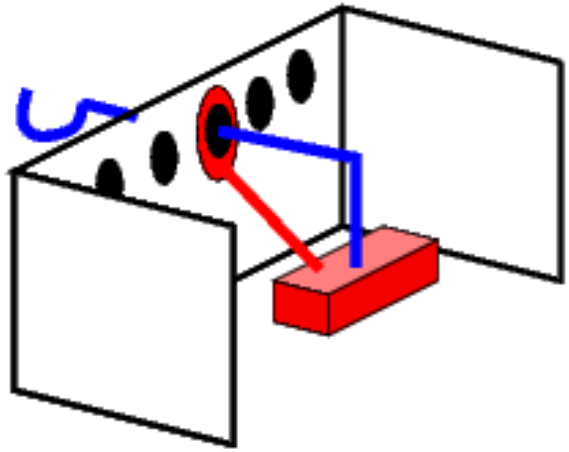
Socket overview



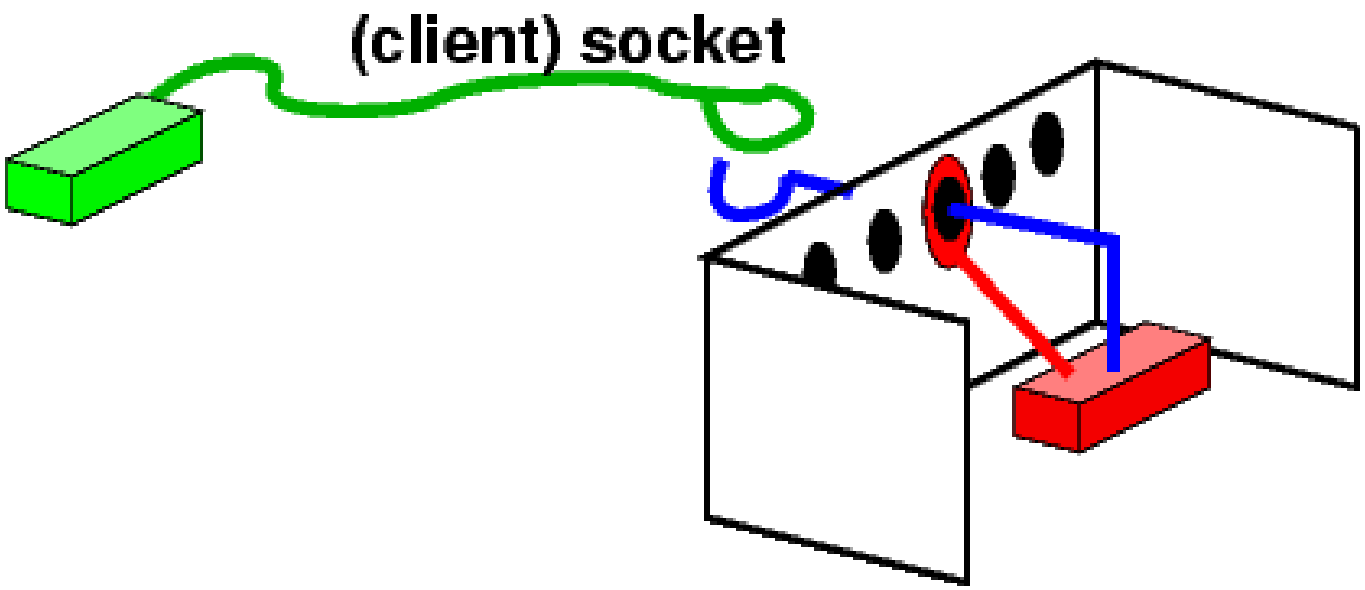


Reference: isinotes/javatut/net

Socket overview

- In the next step the client connects to this port of the server's computer.
- The connection is called a (client) socket.

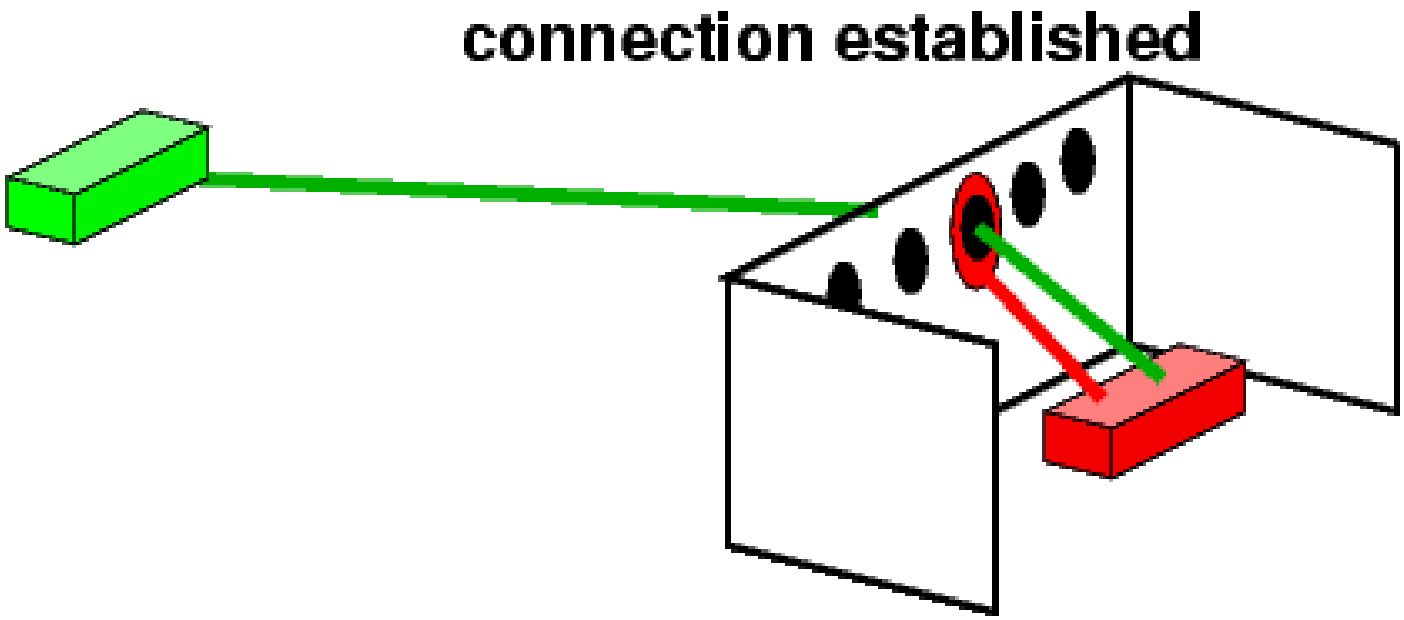
```
Socket sock = new Socket("www.google.com",80);
                    /* The client knows the number 80 */
```



Reference: isinotes/javatut/net

Socket overview

- Now, connection is established between client and server.



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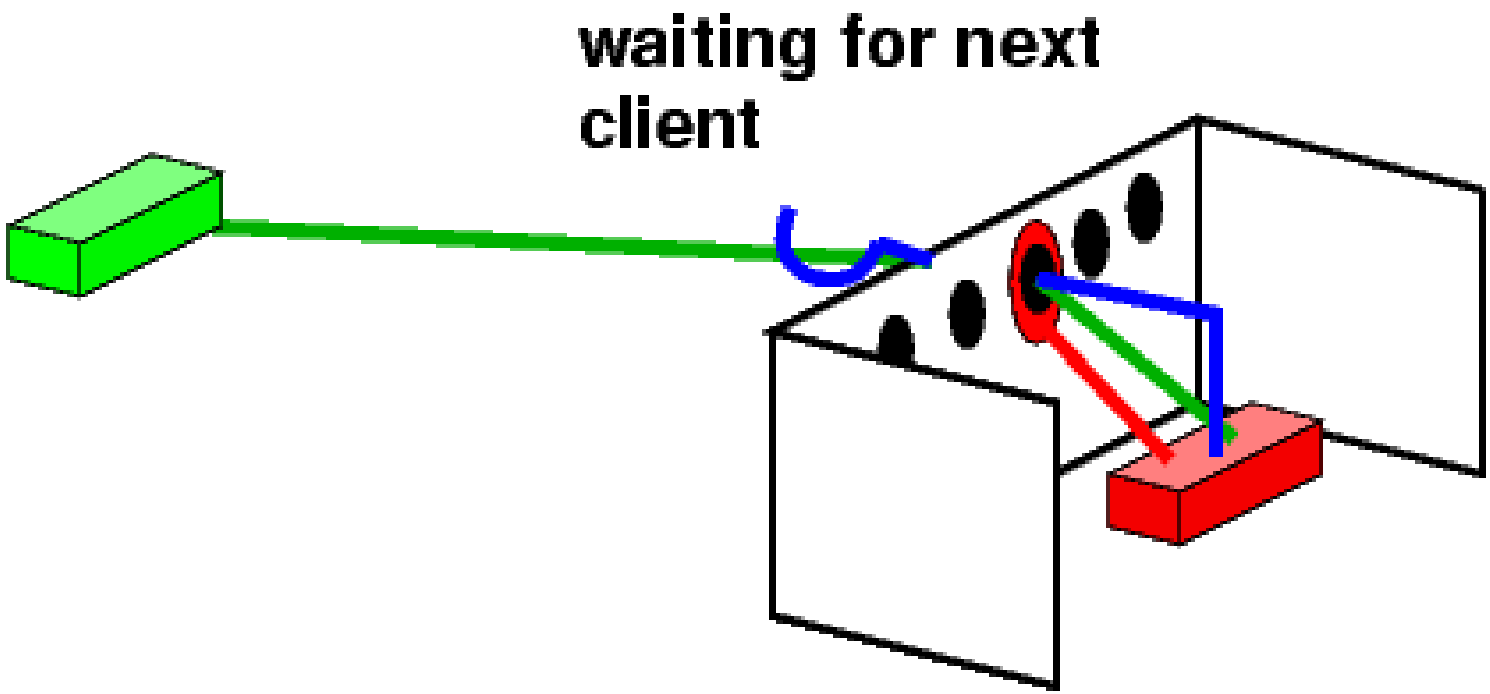
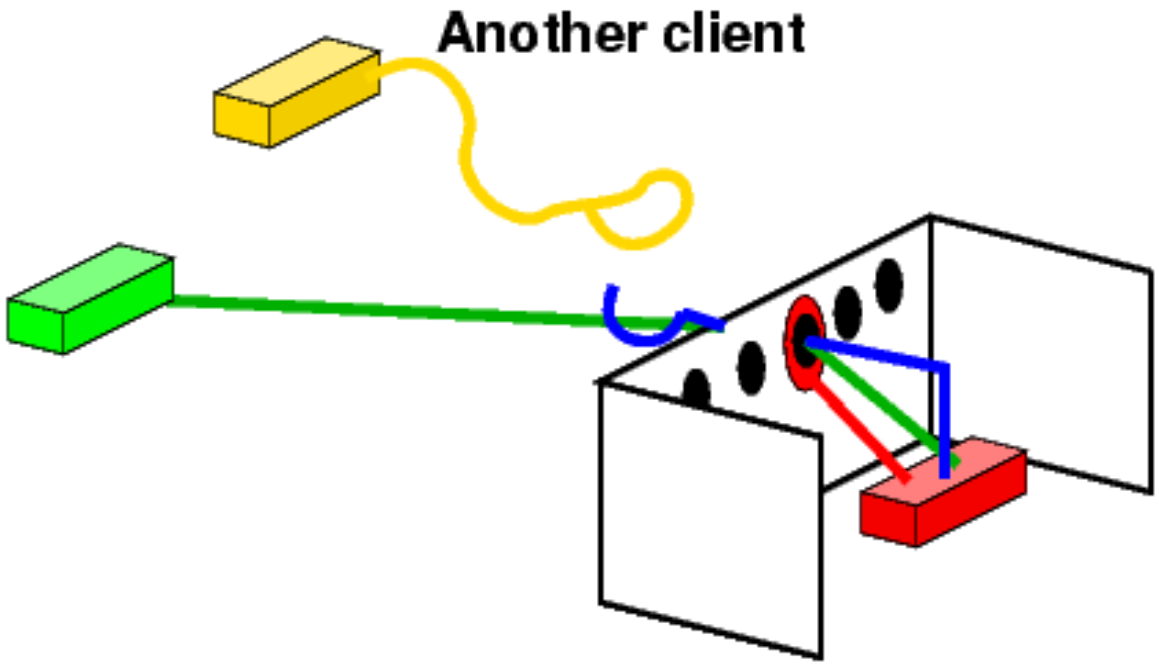
Socket overview



Reference: isinotes/javatut/net

Socket overview

Everytime a client is found, its Socket is extracted, and the loop again waits for the next client.



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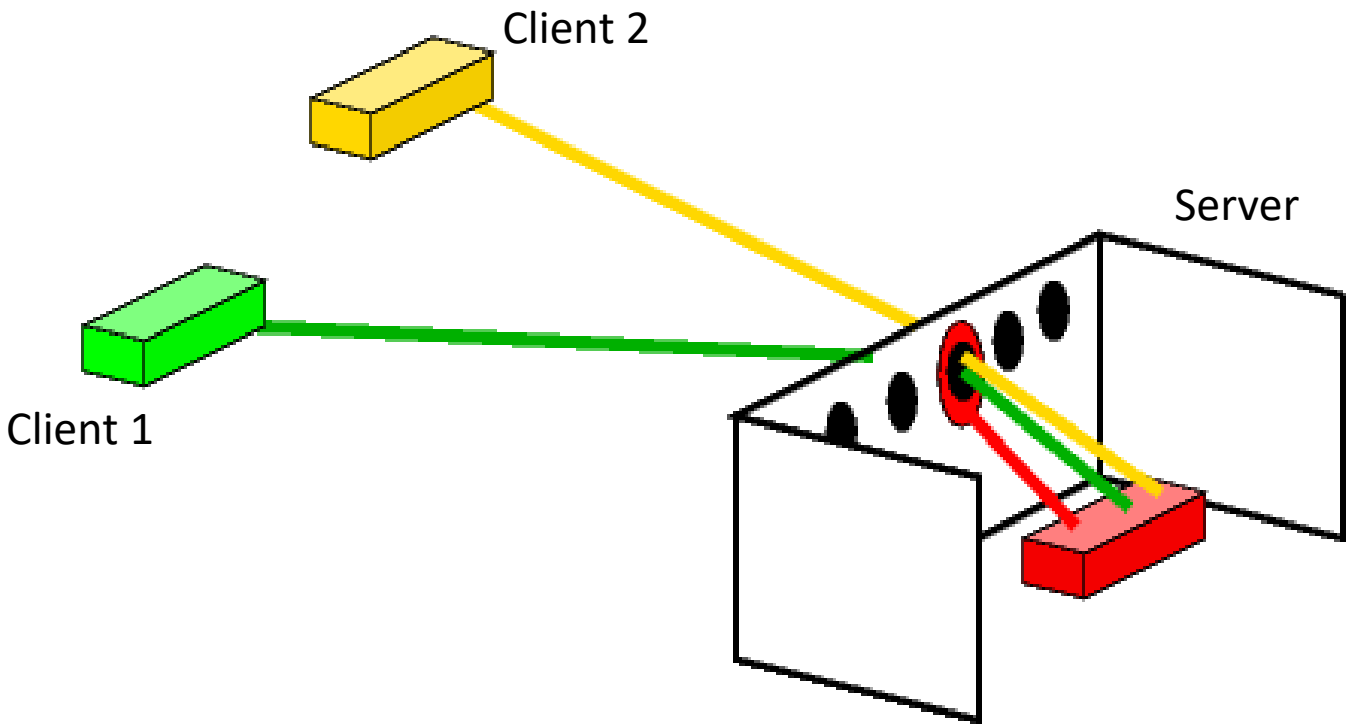
Socket overview



Reference: isinotes/javatut/net

Unit-1: Java Networking

Topic

1. Network Basics and Socket overview
2. **InetAddress**
3. TCP/IP server sockets
4. TCP/IP client sockets
5. Datagrams
6. URL
7. URLConnection

InetAddress

java.net package

- This class represents an Internet Protocol (IP) address.
- The **java.net.InetAddress** class provides methods to get an IP of host name.

Example

```
InetAddress ip
          =InetAddress.getByName("www.google.com");

System.out.println("ip:"+ ip);
```

Output:

```
ip: www.google.com/89.238.188.50
```

InetAddress : Method

Method	Description
public static InetAddress **getByName**(String host) throws UnknownHostException	Determines the IP address of a given host's name.

Example

```
InetAddress ip
            =InetAddress.getByName("www.darshan.ac.in");
      System.out.println("ip:"+ ip);
```

Output:

```
ip: www.google.com/89.238.188.50
```

InetAddress : Method

Method	Description
public static InetAddress **getLocalHost()** throws UnknownHostException	Returns the address of the local host.

Example

```
InetAddress ip=InetAddress.getLocalHost();
System.out.println("LocalHost:"+ip);
```

Output:

```
LocalHost:smith-PC/10.254.3.34
```

InetAddress : Method

Method	Description
public String **getHostName()**	it returns the host name of the IP address.

Example

```
InetAddress ip=InetAddress.getByName("10.254.3.34");
System.out.println("Hostname:"+ip.getHostName());
```

Output:

```
Hostname:smith-PC
```

InetAddress : Method

Method	Description
public String **getHostAddress**()	it returns the IP address in string format.

Example

```
InetAddress ip=InetAddress.getByName("www.google.com");
System.out.println("HostAddress:"+ip.getHostAddress());
```

Output:

```
HostAddress:89.238.188.50
```

InetAddress: Program

```
import java.net.*; //required for InetAddress Class
public class InetDemo{
        public static void main(String[] args){
        try{
        InetAddress ip
                =InetAddress.getByName("www.google.com ");

        System.out.println("Host Name: "+ip.getHostName());
        System.out.println("IP Address:"+ip.getHostAddress());
        }
        catch(Exception e){System.out.println(e);}
    }
}
```

Output:

```
Host Name: www.google.com

IP Address: 89.238.188.50
```

InetAddress: Method Summary

static InetAddress **getByName**(String host)	Determines the IP address of a given host's name.
static InetAddress **getLocalHost()**	Returns the address of the local host.
public String **getHostName()**	it returns the host name of the IP address.
public String **getHostAddress**()	it returns the IP address in string format.
String **toString()**	Converts this IP address to a String.
boolean **equals**(Object obj)	Compares this object against the specified object.
static InetAddress[] **getAllByName**(String host)	Returns an array of its IP addresses, based on the configured name service on the system.
static InetAddress **getLoopbackAddress**()	Returns the loopback address.

Unit-1: Java Networking

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4. **TCP/IP client sockets**
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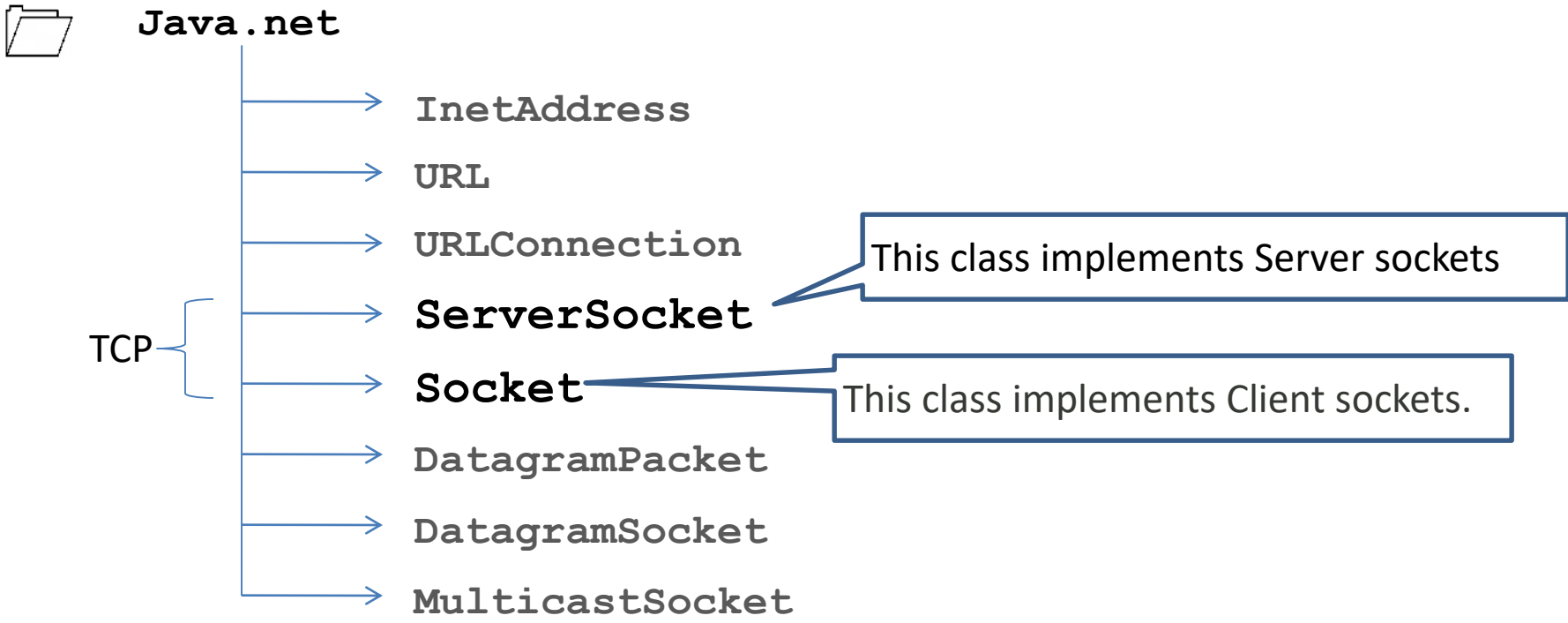
7. URLConnection

TCP/IP Client-Server sockets



TCP/IP ServerSocket Class

- The ServerSocket class (java.net) can be used to create a server socket.
- This object is used to establish communication with the clients.

Constructor

ServerSocket(int port)	Creates a server socket, bound to the specified port.

Method

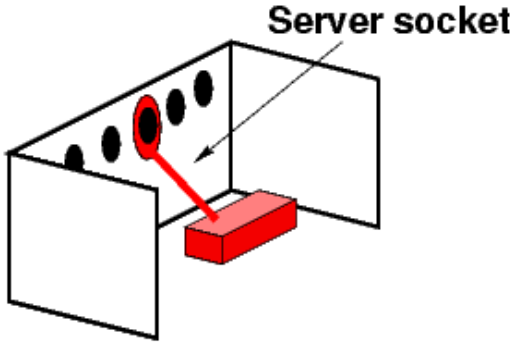
public Socket **accept**()	returns the socket and establish a connection between server and client.

TCP/IP Server Sockets

Syntax

```
ServerSocket ss;

ss=new ServerSocket(Port_no);
```



Example

```
ServerSocket ss=new ServerSocket(1111);
```

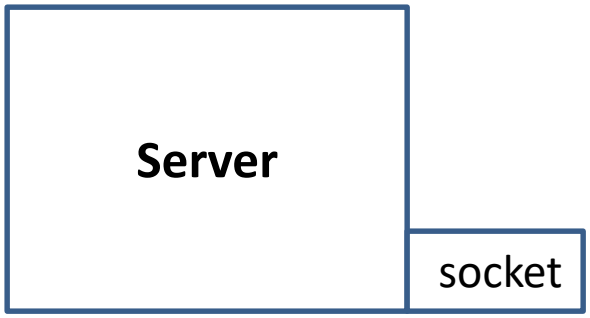
TCP/IP Server program

MyServer.java

```
1. import java.io.*;  // required data input/output stream
2. import java.net.*; //required for Socket Class
3.  public class MyServer {
4.      public static void main(String[] args){
5.      try{
6.            ServerSocket ss=new ServerSocket(1111);
7.               Socket s=ss.accept();//establishes connection
8.            DataInputStream dis=
9.                  new DataInputStream (s.getInputStream());
10.           String  str=(String)dis.readUTF();
11.           System.out.println("message= "+str);
12.           ss.close();
13.     }
14.     catch(Exception e){System.out.println(e);}
15.     }
16.}
```

Output

```
message= Hello Server
```



TCP/IP Client Sockets: Socket Class

The client in socket programming must know two information:

1. IP Address of Server
2. Port number.

Constructor

Method

TCP/IP Client Sockets

Syntax

```
Socket myClient; //Creates object of Socket Class
myClient = new Socket("Machine name", PortNumber);
```

DNS or IP Address

Port Number is the port (a number) on which the server you are trying to connect.

Example

```
Socket s;
s=new Socket("localhost",1111);
```

TCP/IP Client Sockets: Program

```
1. import java.net.*; //required for Socket Class
2. import java.io.*; // required data input/output stream
3. public class MyClient {
4.     public static void main(String[] args)
5.     {  try{
6.             Socket s = new Socket("localhost",1111);
7.             DataOutputStream dout= new
                   DataOutputStream(s.getOutputStream());
8.             dout.writeUTF("Hello Server");// Writes a
                       string to the underlying output stream
9.           }catch(Exception e)
10.          {System.out.println(e);}
11.    }
12.}
```

Object of Socket class

TCP/IP Client-Server program

MyServer.java

```
import java.io.*;
import java.net.*;

public class MyServer {
public static void main(String[] args){
try{
ServerSocket ss=new ServerSocket(1111);

Socket s=ss.accept();

DataInputStream dis=new DataInputStream
                  (s.getInputStream());
String  str=(String)dis.readUTF();

System.out.println("message= "+str);
ss.close();

}catch(Exception e)
{System.out.println(e);}
 }//psvm
}//class

Output
message= Hello Server
```

MyClient.java

```
import java.net.*;
import java.io.*;

public class MyClient {
public static void main(String[] args){
 try {
 Socket s=new Socket("localhost",1111);

 DataOutputStream dout=new
DataOutputStream(s.getOutputStream());

 dout.writeUTF("Hello Server");
 //Writes string to underlying o/p
                                stream
  }//try
  catch(Exception e)
  {System.out.println(e);}
 } //psvm
}//class
```

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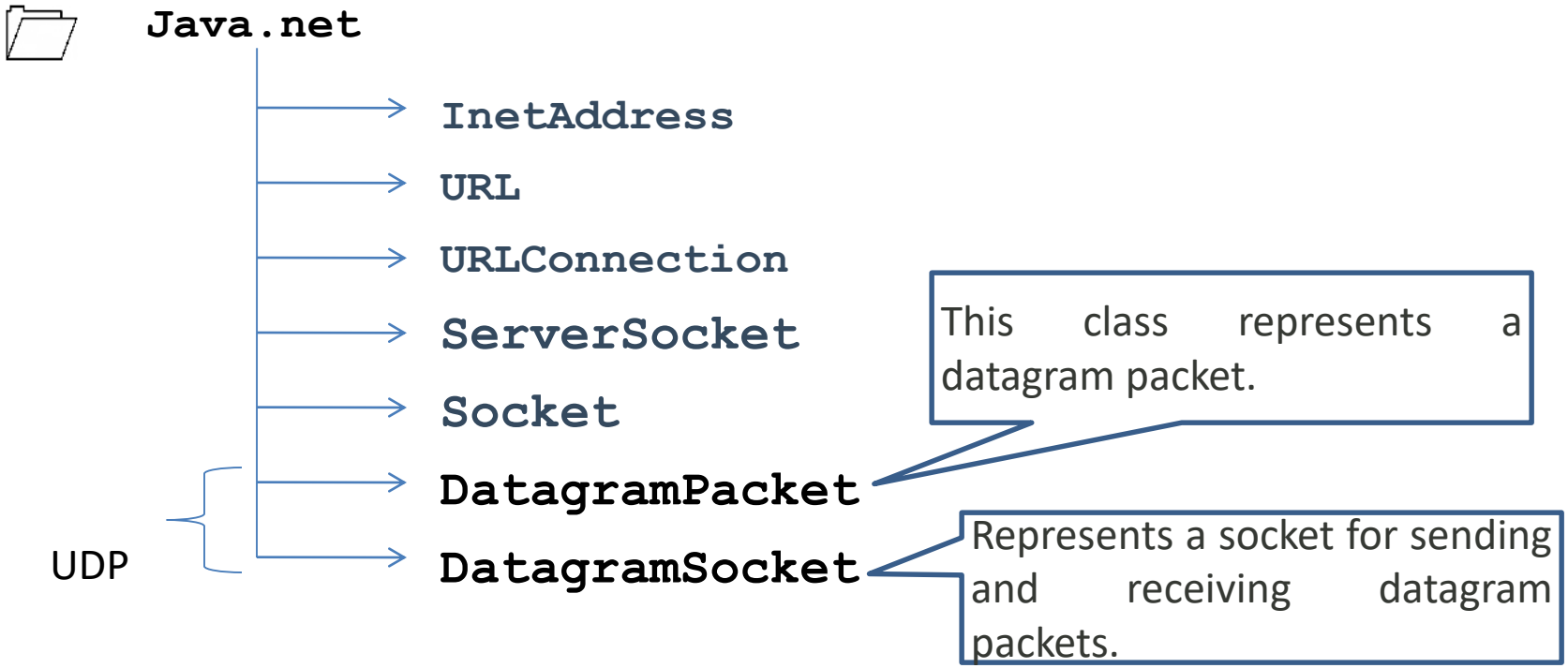
Datagrams


Java.net
InetAddress
URL
URLConnection
ServerSocket
Socket
DatagramPacket
DatagramSocket
UDP
This class represents a datagram packet.
Represents a socket for sending and receiving datagram packets.

Datagrams: DatagramSocket class

- **DatagramSocket** class represents a connection-less socket for sending and receiving datagram packets.
- A datagram is basically an information but there is no guarantee of its content, arrival or arrival time.
- *Constructor*

DatagramSocket()	it creates a datagram socket and binds it with the available Port Number on the localhost machine.
DatagramSocket(int port)	it creates a datagram socket and binds it with the given Port Number.
DatagramSocket(int port, InetAddress address)	it creates a datagram socket and binds it with the specified port number and host address.

Datagrams: DatagramPacket class

- **Java DatagramPacket** is a message that can be sent or received.
- If you send multiple packet, it may arrive in any order.
- Additionally, packet delivery is not guaranteed.

buffer for holding the incoming datagram.

number of bytes to read.

Constructor

DatagramPacket(byte[] barr, int length)	It creates a datagram packet. This constructor is used to receive the packets.
DatagramPacket(byte[] barr, int length, InetAddress address, int port)	It creates a datagram packet. This constructor is used to send the packets.

Example of Sending DatagramPacket by DatagramSocket

```
import java.net.*; //required for Datagram Class
public class DSender{
  public static void main(String[] args)
                          throws Exception
 {
    DatagramSocket ds = new DatagramSocket();
    String str = "Message sent by Datagram socket";
    InetAddress ip = InetAddress.getByName("127.0.0.1");

    DatagramPacket dp = new DatagramPacket
            (str.getBytes(), str.length(), ip, 3000);
    ds.send(dp);
    ds.close();
  }
}
```

Example of Receiving DatagramPacket by DatagramSocket

```
import java.net.*;
public class DReceiver{
  public static void main(String[] args) throws Exception
{
    DatagramSocket ds = new DatagramSocket(3000);
    byte[] buf = new byte[1024];
    DatagramPacket dp = new DatagramPacket(buf, 1024);
    ds.receive(dp);
    String str = new String(dp.getData(), 0,dp.getLength());
    System.out.println(str);
    ds.close();
  }
}
```

Output

```
Message sent by Datagram socket
```

Example of Sending and Receiving DatagramPacket

DSender.java

```
import java.net.*;
public class DSender{
public static void main(String[] args)
throws Exception{

DatagramSocket ds=
              new DatagramSocket();
String str = "Message sent by Datagram
                        socket";
InetAddress ip =
InetAddress.getByName("127.0.0.1");

DatagramPacket dp = new DatagramPacket
(str.getBytes(),str.length(),ip,3000);

ds.send(dp);
ds.close();

   }
}
```

DReceiver.java

```
import java.net.*;
public class DReceiver{
public static void main(String[] args)
 throws Exception {

 DatagramSocket ds =
        new DatagramSocket(3000);
 byte[] buf = new byte[1024];
 DatagramPacket dp =
     new DatagramPacket(buf, 1024);

 ds.receive(dp);
 String str = new String
  (dp.getData(), 0,dp.getLength());

 System.out.println(str);
 ds.close();
  }
}
```

Output

```
Message sent by Datagram socket
```

Unit-1: Java Networking

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5. Datagrams
6. **URL**
7. URLConnection

URL: Uniform Resource Locator

- The **Java URL** class represents an URL.
- This class is pointer to "resource" on the World Wide Web.

E.g.

Port Number

http://10.255.1.1:8090/httpclient.html

http is the protocol.

Server name or IP Address

File Name or directory name

URL

Constructor

URL(String *url*)	Creates a URL object from the String representation.

Example

```
URL url=new URL("http://www.google.com");
```

Method

public URLConnection **openConnection()** throws IOException	This method of URL class returns the object of URLConnection class

Example

```
URLConnection urlcon=url.openConnection();
```

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7. **URLConnection**

URLConnection

- URLConnection is the superclass of all classes that represent a communications link between the application and a URL.
- Instances of this class can be used both to read from and to write to the resource referenced by the URL.

Constructor

URLConnection(URL *url*)	Constructs a URL connection to the specified URL

URLConnection

Method

public InputStream **getInputStream()** throws IOException	Returns an input stream that reads from this open connection.
public OutputStream **getOutputStream()** throws IOException	Returns an output stream that writes to this connection.

URLConnection : Program

```
import java.io.*; //required for input stream
import java.net.*; //required for URL & URLConnection
public class URLConnectionDemo {
    public static void main(String[] args){
    try{
        URL url=new URL("http://www.google.com");
        URLConnection urlcon=url.openConnection();
        InputStream stream=urlcon.getInputStream();
        int i;
        while((i=stream.read())!=-1){
            System.out.print((char)i);
        }
    }catch(Exception e){System.out.println(e);}
  }
}
```

Object of URLConnection Class

Important Questions:

1	What is Server Socket? Explain in detail with an example. Discuss the difference between the Socket and ServerSocket class.	
2	What is Datagram Socket? Explain in detail with example.	
3	Write a client-server program using TCP or UDP where the client sends 10 numbers and server responds with the numbers in sorted order.	
4	Write a TCP Client-Server program to get the Date & Time details from Server on the Client request.	
5	Write a client server program using TCP where client sends two numbers and server responds with sum of them.	
6	Write a client server program using TCP where client sends a string and server checks whether that string is palindrome or not and responds with appropriate message.	

Important Questions:

7	Write a sample code for client send a “Hello” message to server. [4]	
8	Write a client-server program using TCP sockets to echo the message send by the client.[7]	
9	Explain the following classes with their use. i. URLConnection class ii. DatagramSocket (iii) DatagramPacket class [3]	