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IP Address

- An IP address is a 32-bit number that uniquely identifies a host on a TCP/IP network.
- IP addresses are normally represented in the form of "dot-decimal notation" where each byte is written in the decimal form, and they are separated by the period

Example: 192.168.123.132

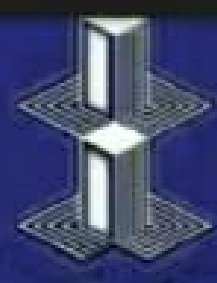
- An IP address has two parts. The first part of an IP address is used as a network address, the last part as a host address.

N/W Address	Host Address
32 bits	
Example 192.168.123.132	
192.168.123.0	Network address.
0.0.0.132	Host address.

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Networking Classes

Outline

Internet Addressing

DNS

Proxy Server

Networking classes and interfaces

InetAddress class

Factory Methods
Instance Methods

URL class

URLConnection class

Client-Server
Socket Communication

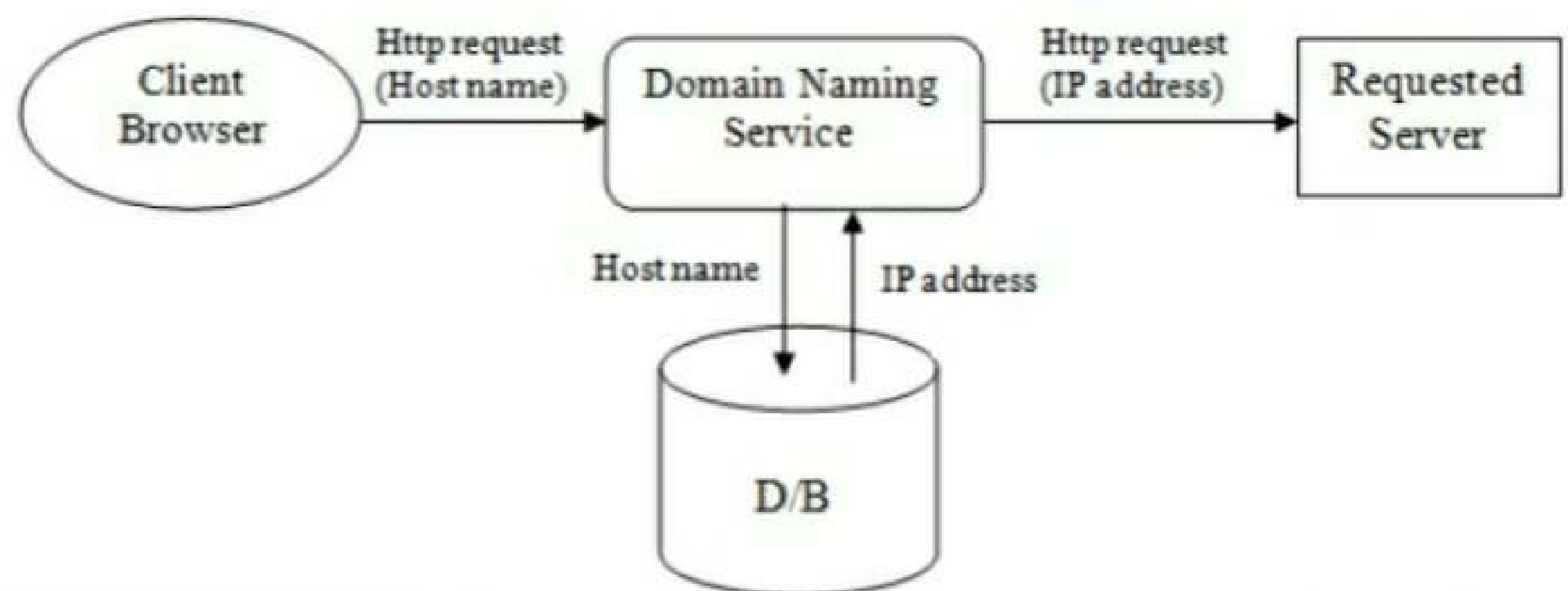
References

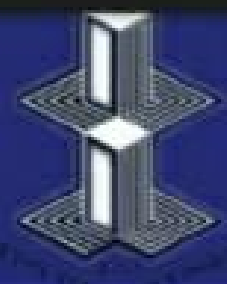
Networking classes and interfaces are contained in **java.net** package are as follows:

- Authenticator
- HttpURLConnection
- Socket
- ContentHandler
- InetAddress
- SocketAddress
- DatagramPacket
- MulticastSocket
- URL
- DatagramSocket
- ServerSocket
- URLConnection
- URLEncoder

Domain Naming Service(DNS)

- Each computer on the Internet has a numerical address, called an IP address.
- For example, the numerical address of the yahoo web server is 149.142.5.42.
- Because the numbers are hard to remember, popular servers on the internet have names associated with their numbers.
- For example, the name associated with the yahoo web server is www.yahoo.com
- Domain Naming Service executes on the web server and it is used to resolve host name with IP address.
- The http request send by client-browser first comes to DNS where it resolves the host name with IP address and then forwards the request to requested server.





Outline

Internet
Addressing

DNS

Proxy Server

Networking
classes and
interfacesInetAddress
classFactory Methods
Instance
Methods

URL class

URLConnection
classClient-Server
Socket Com-
munication

References

Factory methods of InetAddress class

- Factory methods are static methods that returns an object of a class.
- Three commonly used Factory Methods of InetAddress class are as follows:

❶ **getLocalHost()**: It returns the object of InetAddress containing local host name and ip address.

Syntax: `public static InetAddress getLocalHost()`

❷ **getByName()**: It returns the object of InetAddress for the host name passed to it.

Syntax: `public static InetAddress getByName(String host)`

❸ **getAllByName()**: It returns an array of InetAddresses that represents all of the addresses that a particular name resolves to it.

Syntax: `public static InetAddress[] getAllByName(String host)`

If these factory methods unable to resolve host name, they throws an **UnknownHostException**.

InetAddress class

- InetAddress class is used to encapsulate numerical IP address and host name for that IP address.
- InetAddress class has no visible constructor.
- It provides methods to get the IP of any host name
- To create InetAddress object you have to use Factory method.



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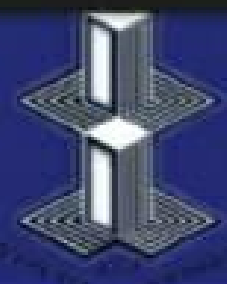
URLConnection class

Client-Server Socket Communication

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Methods of URL class

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Following are the methods of URL class:

- 1 `int getProtocol()`: it returns the protocol of the URL.
- 2 `String getHost()`: it returns the host name of the URL.
- 3 `int getPort()`: it returns the Port Number of the URL.
- 4 `String getFile()`: it returns the file name of the URL.
- 5 `URLConnection openConnection()`: it returns the instance of `URLConnection` i.e. associated with this URL.

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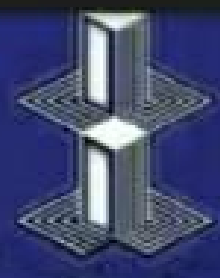
Network Classes contd...

Network Class	Default Subnet Mask	Range of first octet	Example
Class A	255.0.0.0	0-127	10.52.36.11
Class B	255.255.0.0	128-191	172.16.52.63
Class C	255.255.255.0	192-223	192.168.123.132

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URL class

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URL class

URLConnection class

Client-Server Socket Communication

References

- URL class represents an URL.
- URL stands for Uniform Resource Locator
- It points to a resource on the World Wide Web
- URL Formats: Two examples of URL are
 - 1 http://www.gmail.com
 - 2 http://www.gmail.com:80/index.html.
- A URL specification is based on four components
 - 1 Protocol
 - 2 Host name
 - 3 Port number
 - 4 File path
- **Constructors:**

```
URL(String urlSpecifier)
URL(String protocolName, String hostName, int port, String path)
URL(String protocolName, String hostName, String path)
```

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- Client-Server Sockets Communication
- References

A Presentation

On

Advanced Java Programming

By

Atul S. Chaudhari

M.E.(Computer), C-DAC Pune

Department of Computer Engineering

S. S. V. P. S's B. S. Deore Polytechnic, Dhule

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- 3 Proxy Server
- 4 Networking classes and interfaces
- 5 InetAddress class
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- 7 URLConnection class
- 8 Client-Server Socket Communication
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Network Classes

- An IP address is 32-bit long. An IP address is divided into sub-classes: Class A, Class B, Class C, Class D, Class E
- Each of the address classes has a different default subnet mask.
- You can identify the class of an IP address by looking at its first octet.

	Byte 1	Byte 2	Byte 3	Byte 4
Class A	NET ID	Host ID		
Class B	NET ID		Host ID	
Class C	NET ID			Host ID
Class D	MULTICAST ADDRESS			
Class E	RESERVED			

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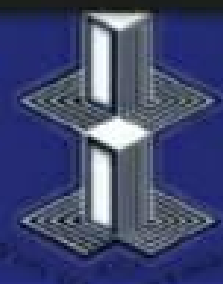
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URLConnection class

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References

- URLConnection is an abstract class that represents an active connection to a resource specified by a URL.
- This class can be used to read and write data to the specified resource referred by the URL.

- **Constructors:**

URLConnection(URL url)

- A program that uses the URLConnection class directly follows this basic sequence of steps:

- 1 Construct a URL object.
- 2 Invoke the URL object's openConnection() method to retrieve a URL-Connection object for that URL.
- 3 Configure the URLConnection.
- 4 Read the header fields.
- 5 Get an input stream and read data.
- 6 Get an output stream and write data.
- 7 Close the connection.

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Network Classes contd...

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N/W Address	Host Address
← 32 bits →	
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192.168.123.0	Network address.
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Example 192.168.123.132	
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Domain Naming Service(DNS) contd...

There are several parts to an internet name:

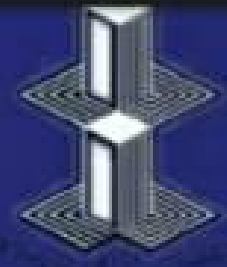
- **Top Level Domain (TLD):** This is the last part of the name.
Example: .com, .org, .edu, .gov
- **Domain Name:** This is the middle part of the name and often the most important. It is specific to the company or organization.
Example: google, yahoo.
- **Host Name:** This is the name of the server within the company, usually named after the service provided.
Example: www, news, mail.
- **Method/Scheme:** This is the method used for the communication.
Example: http:// for web connections, ftp:// for ftp connections.

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Networking Interfaces

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- ContentHandlerFactory
- SocketImplFactory
- URLStreamHandlerFactory
- FileNameMap
- SocketOptions
- DatagramSocketImplFactory



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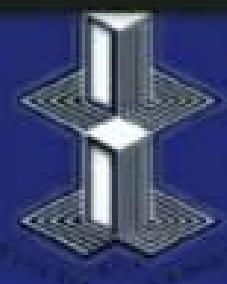
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Domain Naming Service(DNS)

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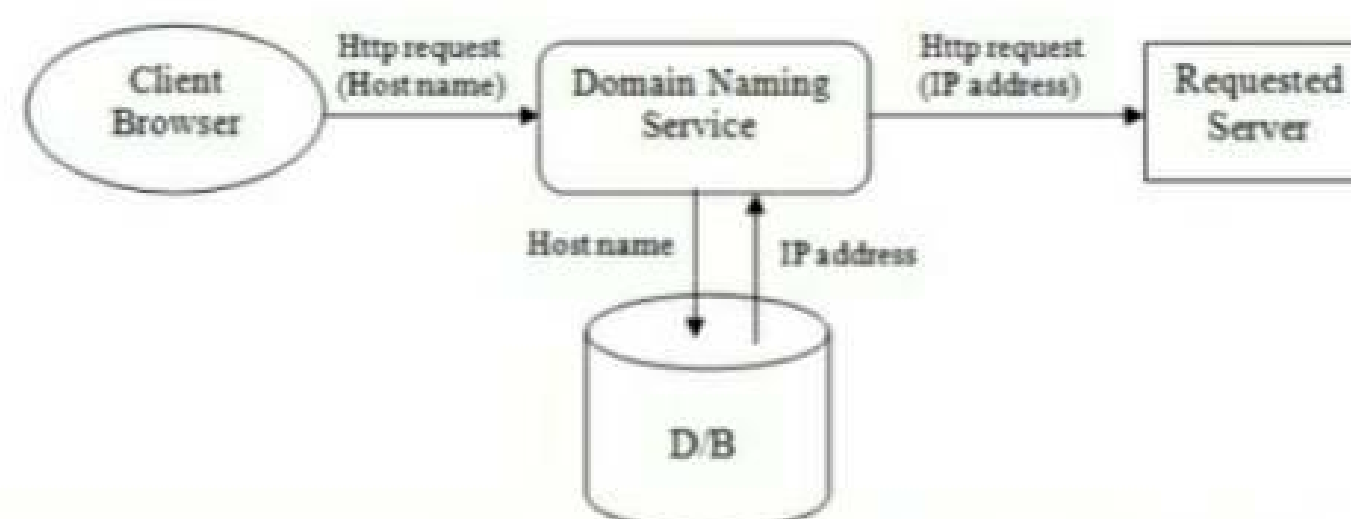
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References

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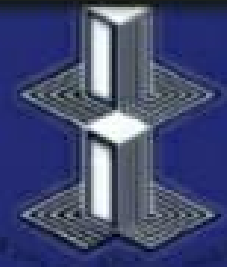


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InetAddress class

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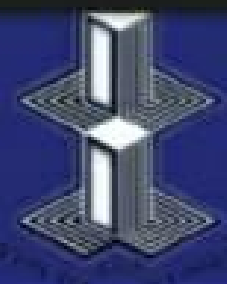
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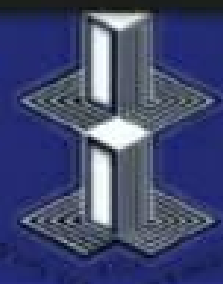
URL class

URLConnection
classClient-Server
Socket Com-
munication

References

Methods of URLConnection class

- ❶ `String getContentType()`: Returns the content type of the resource that the URL references, or null if not known.
- ❷ `int getContentLength()`: Returns the content length of the resource that this connection's URL references, -1 if the content length is not known, or if the content length is greater than Integer.MAX_VALUE.
- ❸ `String getContentEncoding()`: Returns the content encoding of the resource that the URL references, or null if not known.
- ❹ `long getExpiration()`: Returns the expiration date of the resource that this URL references, or 0 if not known.
- ❺ `long getLastModified()`: Returns the date the resource referenced by this URLConnection was last modified, or 0 if not known.
- ❻ `InputStream getInputStream()`: Returns an input stream that reads from this open connection.
- ❼ `OutputStream getOutputStream()`: Returns an output stream that writes to this connection.



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Subnet Mask

- The subnet mask is used by the TCP/IP protocol to determine whether a host is on the local subnet or on a remote network.
- Subnet mask is a 32-bit number which is used to differentiate between n/w address and host address
- Subnet mask is obtained by setting all bits of n/w address to 1 and setting all bits of host address to 0.

11000000.10101000.01111011.10000100 – IP address (192.168.123.132)
11111111.11111111.11111111.00000000 – Subnet mask (255.255.255.0)

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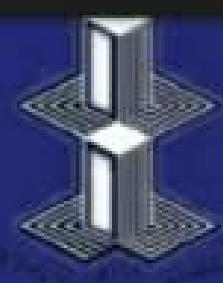
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Networking Interfaces

- ContentHandlerFactory
- SocketImplFactory
- URLStreamHandlerFactory
- FileNameMap
- SocketOptions
- DatagramSocketImplFactory

Proxy Server

- Proxy server is the software installed on some network server.
- A proxy server is a kind of buffer between your computer and the Internet resources you are accessing.
- It takes requests from the client and passes it to another server for processing.
- **Functions of Proxy Server**
 - Improved Security
 - Privacy Benefits
 - Proxy Server Chaching



Proxy Server

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11000000.10101000.01111011.10000100 – IP address (192.168.123.132)
11111111.11111111.11111111.00000000 – Subnet mask (255.255.255.0)

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Steps for establishing Connection between Client Socket and Server Socket using TCP

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- References

■ Steps for Server program:

- 1 Create server socket and begin listing i.e. wait for client request.
- 2 Call accept() method to get new connection from client sockets.
- 3 Create input and output streams for the returned socket for the data transfer.
- 4 Conduct the conversation based on agreed protocol.
- 5 Close the client streams and socket when the conversation is over.
- 6 Go back to step 2 to accept more or go to step 7
- 7 Close the server socket.

■ Steps for Client program:

- 1 Create Clients socket for connection.
- 2 Acquire read and write streams to the socket for data transfer.
- 3 Use the streams according to the server's protocol.
- 4 Close the streams when the conversation is over.
- 5 Close the client socket.

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ServerSocket class

- The ServerSocket class is used to create servers that listen for either local or remote client programs to connect to them on published port.
- **Constructors:**
 - ServerSocket(int port)
 - ServerSocket(int port, int maxQueue)
 - ServerSocket(int port, int maxQueue, InetAddress localAddress)
- **Methods:**
 - Socket accept(): returns the socket and establish a connection between server and client.

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Methods of Socket class

Following are the methods of Socket class:

- 1 `InetAddress getInetAddress()`: Returns `InetAddress` associated with socket object.
- 2 `int getPort()`: Returns the remote port to which this socket object is connected.
- 3 `int getLocalPort()`: Returns the local port to which this socket object is connected.
- 4 `InputStream getInputStream()`: Returns the `InputStream` associated with invoking socket.
- 5 `OutputStream getOutputStream()`: Returns the `OutputStream` associated with invoking socket.

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Sign In

Reserved Sockets

Outline

Internet Addressing

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Proxy Server

Networking classes and interfaces

InetAddress class

Factory Methods

Instance Methods

URL class

URLConnection class

Client-Server Socket Communication

References

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■ Port is represented by a positive (16-bit) integer value

■ Some ports have been reserved to support common/well known services:

● FTP21

● Telnet23

● SMTP25

● HTTP80

■ User level process/services generally use port number value ≥ 1024

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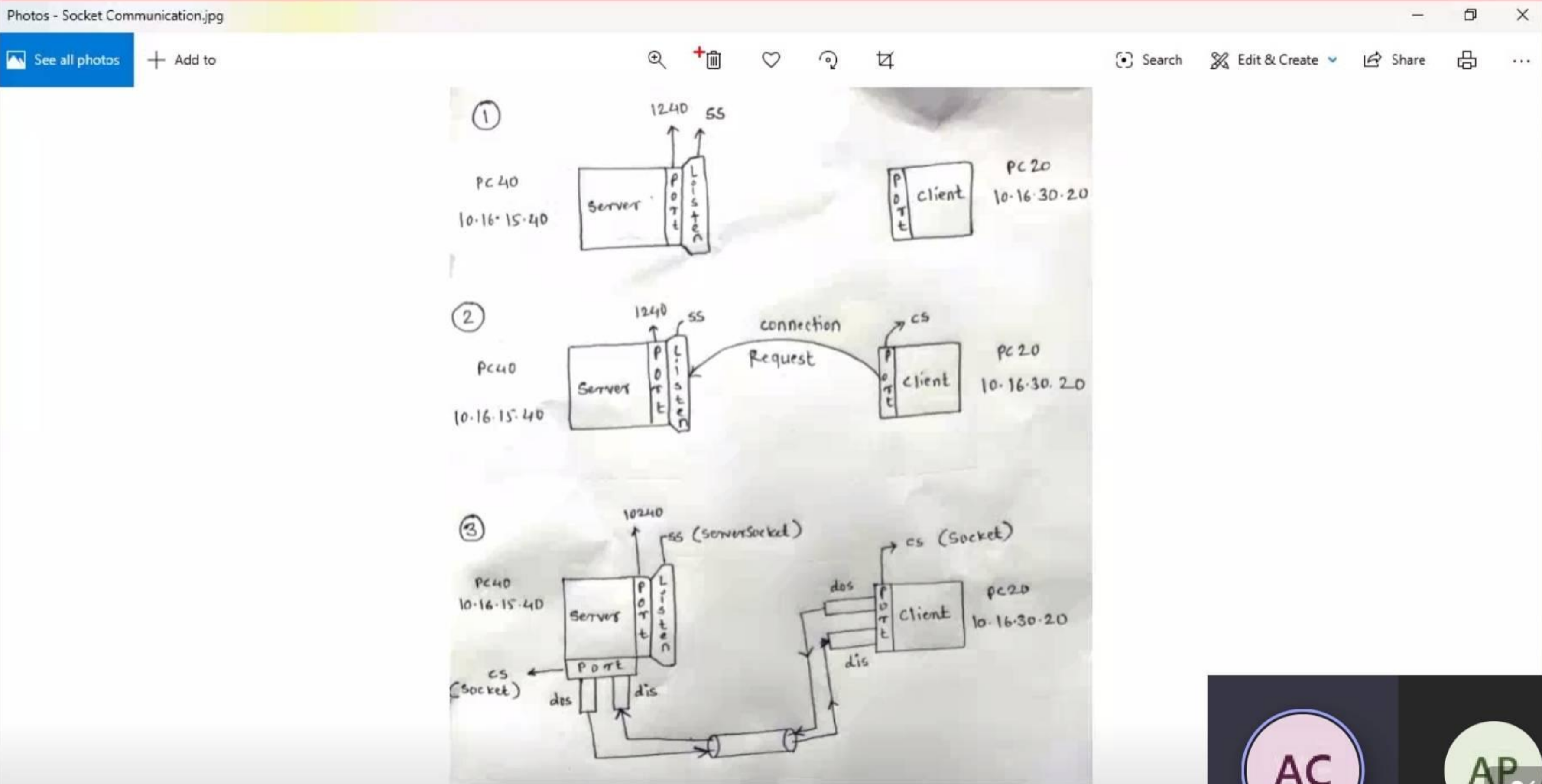
Socket class

- The Socket class is designed to connect to the server socket and initiate protocol exchange.
- The creation of Socket object implicitly establishes a connection between the clients and server.
- Both client and server use this class to read and write the message.
- **Constructors:**
`Socket(String hostName, int port)`
`Socket(InetAddress addr, int port)`

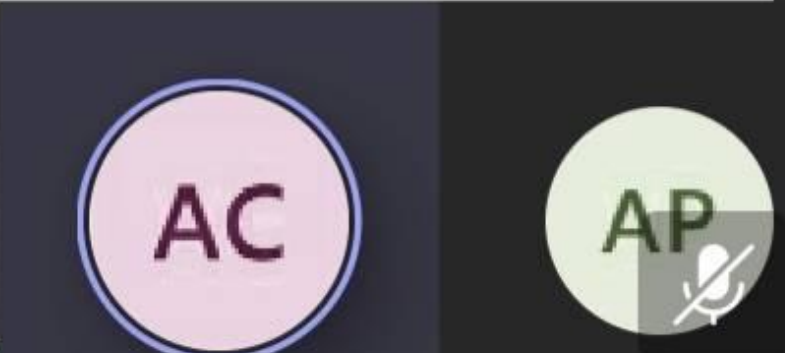
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Sockets

- A socket is one end-point of a two-way communication link between two programs running on the network.
- A socket is bound to a port number so that the TCP layer can identify the application that data is destined to be sent.
- Socket classes are used to represent the connection between a client program and a server program.
- The java.net package provides two classes:
 - ① **Socket class**: implements the client side of the connection
 - ② **ServerSocket class**: implements the server side of the connection
- Socket can perform seven basic operations:
 - ✓ Connect to a remote machine
 - ✓ Send data
 - ✓ Receive data
 - Close a connection
 - Bind to a port
 - Listen for incoming data
 - Accept connections from remote machines on the bound port

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Methods of URL class

Following are the methods of URL class:

- 1 **String** `getProtocol()`: it returns the protocol of the URL.
- 2 **String** `getHost()`: it returns the host name of the URL.
- 3 **int** `getPort()`: it returns the Port Number of the URL.
- 4 **String** `getFile()`: it returns the file name of the URL.
- 5 **URLConnection** `openConnection()`: it returns the instance of URLConnection i.e. associated with this URL.

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Outline

Internet
Addressing

DNS

Proxy Server

Networking
classes and
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Methods

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URLConnection
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Socket Com-
munication

References

Presenting...

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TCP vs UDP protocol

No.	TCP	UDP
1	This Connection oriented protocol	This is connection-less protocol
2	The TCP connection is byte stream	The UDP connection is a message stream
3	It does not support multicasting and broadcasting	It supports broadcasting
4	It provides error control and flow control	The error control and flow control is not provided
5	TCP supports full duplex transmission	UDP does not support full duplex transmission
6	It is reliable service of data transmission	This is an unreliable service of data transmission
7	The TCP packet is called as segment	The UDP packet is called as user datagram.

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