

TCP and UDP Socket Programming

Tom Kelliher, CS 325

Feb. 25, 2011

1 Administrivia

Announcements

Assignment II due Monday.

Assignment

Read 3.1–3.3.

From Last Time

Wireshark labs.

Outline

1. Introduction.
2. TCP socket example.
3. UDP socket example.

Coming Up

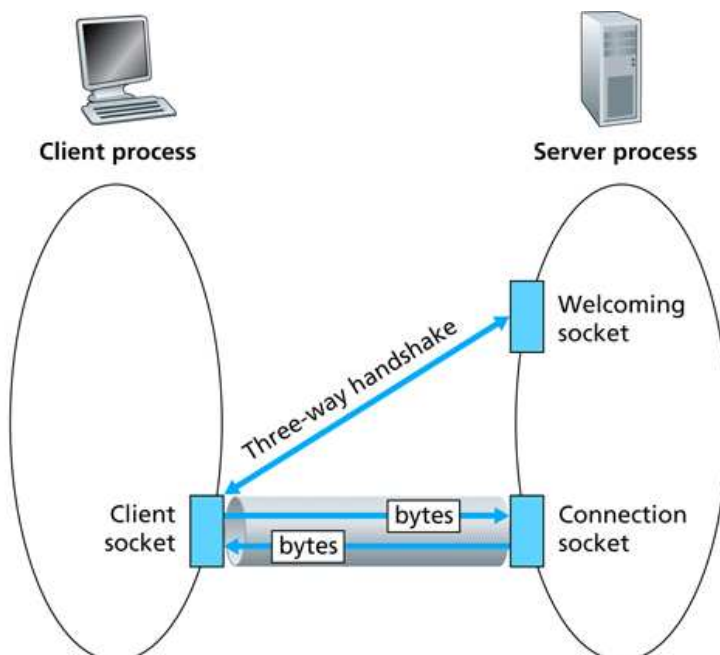
Transport layer introduction and UDP.

2 Introduction

Basics:

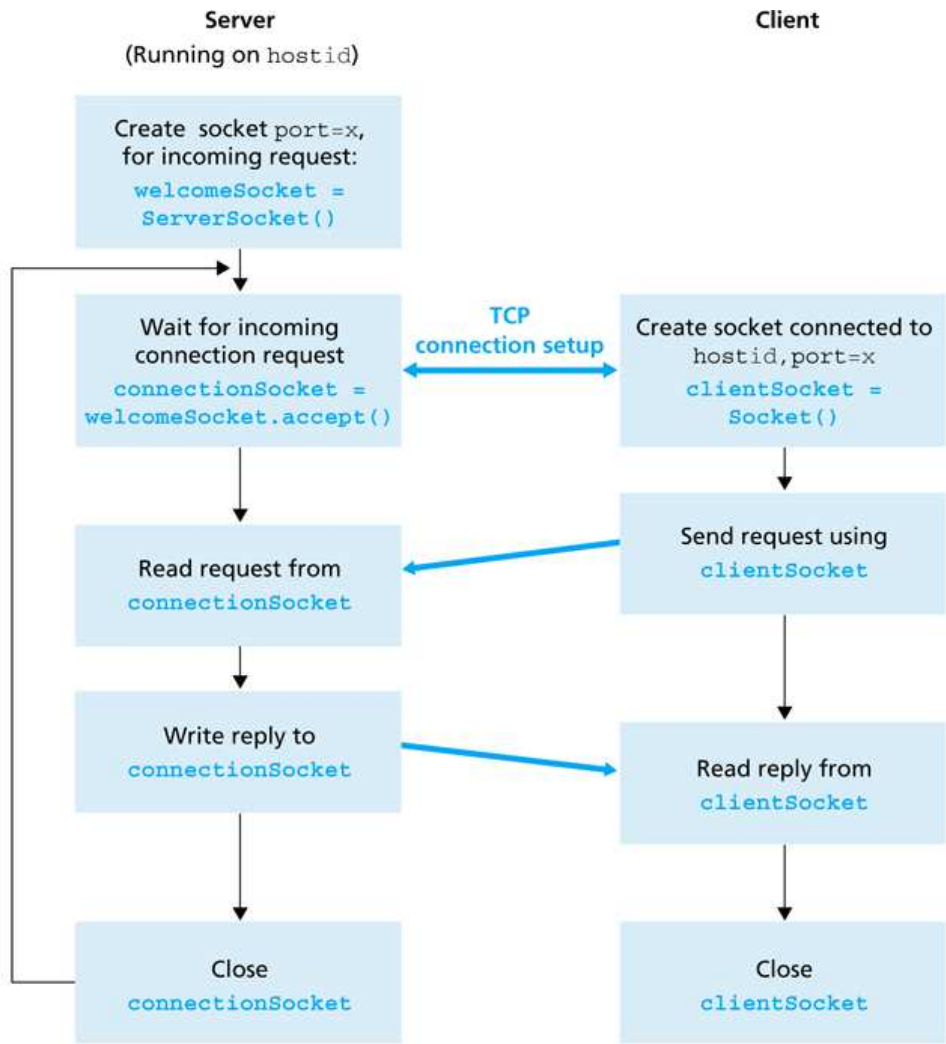
1. Hostname and port are used to specify transport endpoints.
2. Socket — the communication object.
3. TCP properties: reliable, connection-oriented, byte-stream, connection established before application-level protocols exchange information, two-way communication.
4. UDP properties: unreliable, packet-switched, packet data, no connection overhead, application-level protocols exchange information immediately, two-way communication.

A socket connection is a 4-tuple — (HostA, PortA, HostB, PortB) — uniquely defining the connection.

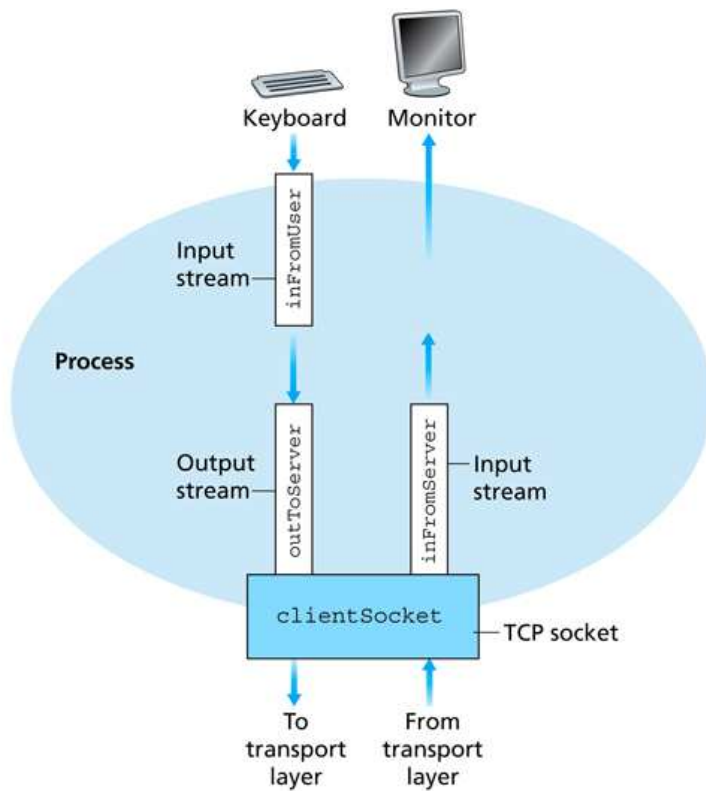


3 TCP Socket Example

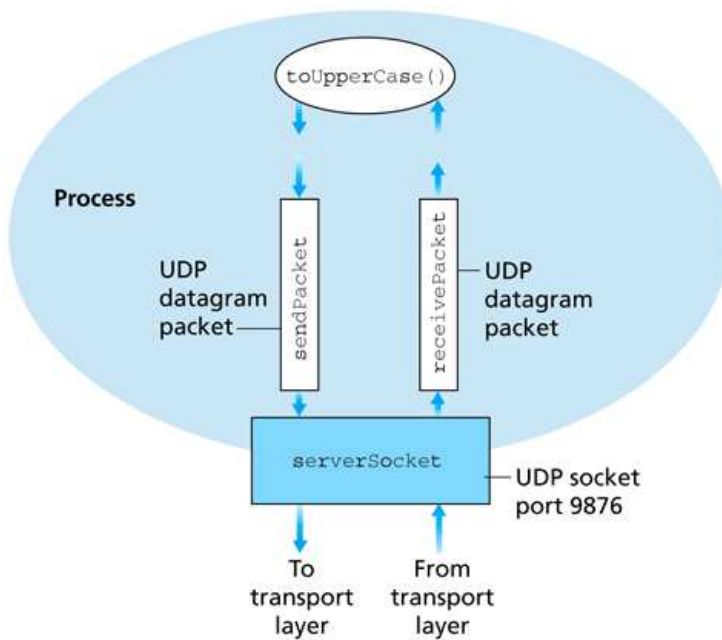
TCP client/server communication flow:



TCPClient.java communication model:



TCPServer.java communication model (UDP figure):



TCP server code:

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

class TCPServer
{
    public static void main(String argv[]) throws Exception
    {
        String clientSentence;
        String capitalizedSentence;
        ServerSocket welcomeSocket = new ServerSocket(6789);

        while(true)
        {
            Socket connectionSocket = welcomeSocket.accept();

            BufferedReader inFromClient =
                new BufferedReader(
                    new InputStreamReader(
                        connectionSocket.getInputStream()));

            DataOutputStream outToClient =
                new DataOutputStream(
                    connectionSocket.getOutputStream());

            clientSentence = inFromClient.readLine();

            capitalizedSentence = clientSentence.toUpperCase() + '\n';

            outToClient.writeBytes(capitalizedSentence);
        }
    }
}
```

TCP client code:

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

class TCPClient
{
    public static void main(String argv[]) throws Exception
    {
        String sentence;
        String modifiedSentence;

        BufferedReader inFromUser =
            new BufferedReader(
                new InputStreamReader(System.in));

        Socket clientSocket = new Socket("hostname", 6789);

        DataOutputStream outToServer =
            new DataOutputStream(
                clientSocket.getOutputStream());

        BufferedReader inFromServer =
            new BufferedReader(
                new InputStreamReader(
                    clientSocket.getInputStream()));

        sentence = inFromUser.readLine();

        outToServer.writeBytes(sentence + '\n');

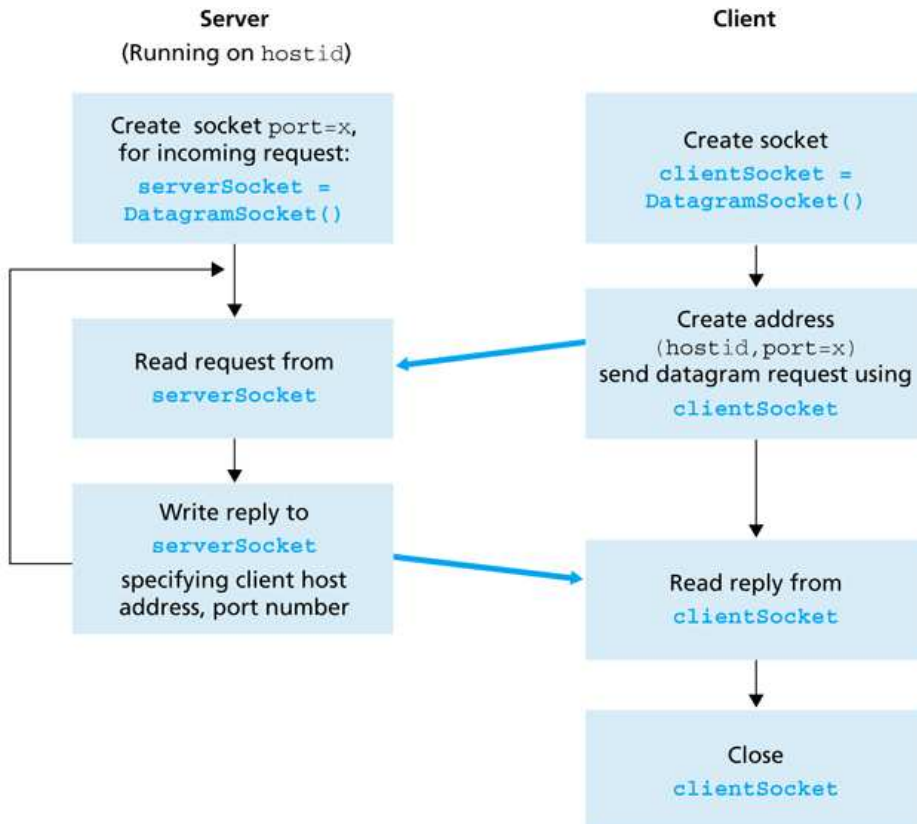
        modifiedSentence = inFromServer.readLine();

        System.out.println("FROM SERVER: " + modifiedSentence);

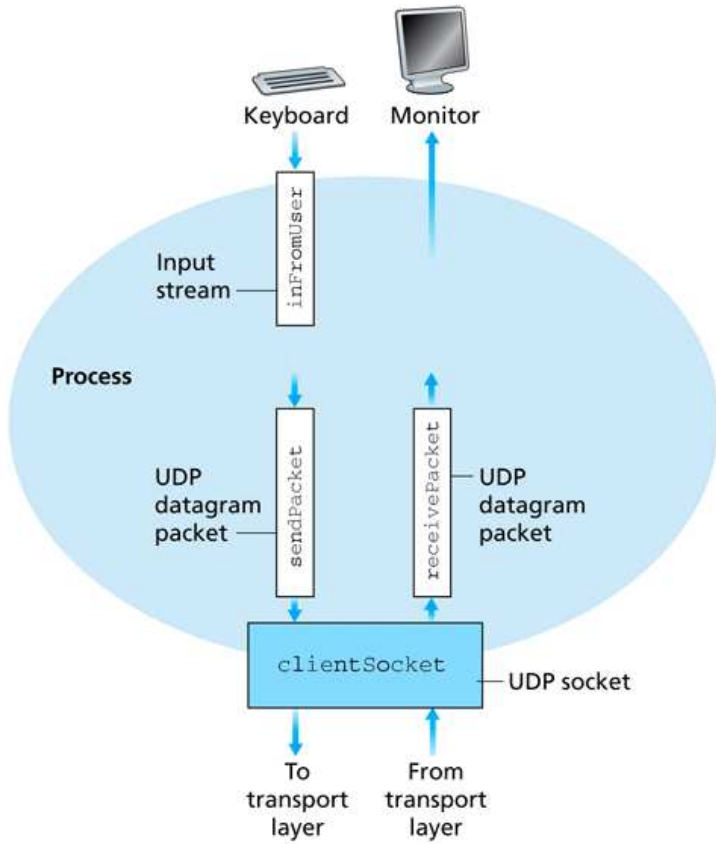
        clientSocket.close();
    }
}
```

4 UDP Socket Example

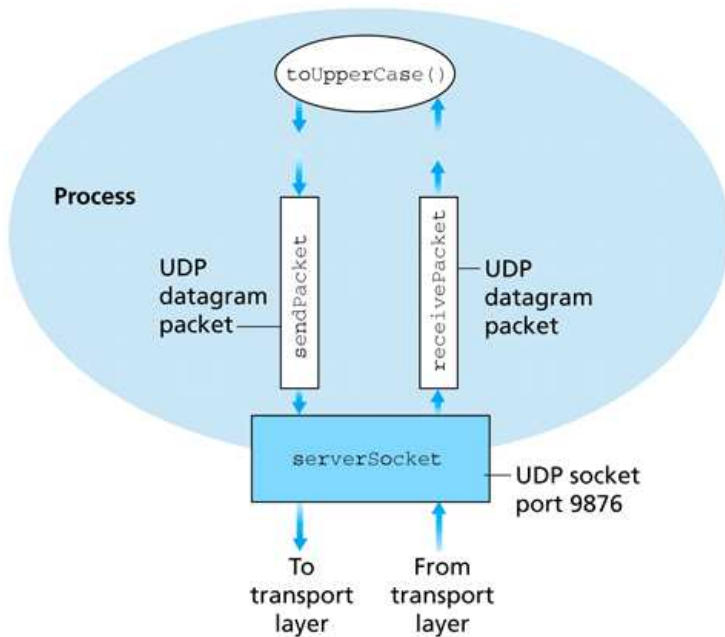
UDP client/server communication flow:



UDPClient.java communication model:



UDPServer.java communication model:



UDP server code:

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

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

        DatagramSocket serverSocket =
            new DatagramSocket(9876);

        byte[] receiveData = new byte[1024];
        byte[] sendData;

        while(true)
        {
            DatagramPacket receivePacket =
                new DatagramPacket(receiveData, receiveData.length);

            serverSocket.receive(receivePacket);

            String sentence = new String(receivePacket.getData(),
                0, receivePacket.getLength());

            InetAddress IPAddress = receivePacket.getAddress();

            int port = receivePacket.getPort();

            String capitalizedSentence = sentence.toUpperCase();

            sendData = capitalizedSentence.getBytes();

            DatagramPacket sendPacket =
                new DatagramPacket(sendData, sendData.length,
                    IPAddress, port);

            serverSocket.send(sendPacket);
        }
    }
}
```

UDP client code:

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

class UDPClient
{
    public static void main(String args[]) throws Exception
    {
        BufferedReader inFromUser =
            new BufferedReader(
                new InputStreamReader(System.in));

        DatagramSocket clientSocket = new DatagramSocket();

        // Replace hostname with the FQDN of the server.

        InetAddress IPAddress = InetAddress.getByName("hostname");

        byte[] sendData;

        byte[] receiveData = new byte[1024];

        String sentence = inFromUser.readLine();

        sendData = sentence.getBytes();

        DatagramPacket sendPacket =
            new DatagramPacket(sendData, sendData.length,
                               IPAddress, 9876);

        clientSocket.send(sendPacket);

        DatagramPacket receivePacket =
            new DatagramPacket(receiveData, receiveData.length);

        clientSocket.receive(receivePacket);

        String modifiedSentence = new String(receivePacket.getData(),
                                             0, receivePacket.getLength());

        System.out.println("FROM SERVER: " + modifiedSentence);

        clientSocket.close();
    }
}
```

}
}