Computer Networks 1
(Mạng Máy Tính 1)

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Lecture 9:
Socket Programming with Java

Using InetAddress (1)

- Get local address

```
import java.net.*;
public class HostInfo {
    public static void main(String args[]) {
    HostInfo host = new HostInfo();
    host.init();
    }
    public void init() {
        try {
            InetAddress myHost = InetAddress.getLocalHost();
            System.out.println(myHost.getHostAddress());
            System.out.println(myHost.getHostName());
        } catch (UnknownHostException ex) {
            System.err.println("Cannot find local host");
        }
    }
}
```

Using InetAddress (2)

- In địa chỉ IP của proxy.hcmut.edu.vn

```
import java.net.*;
class kku{
    public static void main (String args[]) {
        try {
            InetAddress[] addresses =
            InetAddress.getAllByName(“proxy.hcmut.edu.vn");
            for (int i = 0; i < addresses.length; i++) {
                System.out.println(addresses[i]);
            }
        }
        catch (UnknownHostException e) {
            System.out.println("Could not find
                                    proxy.hcmut.edu.vn");
        }
    }
}
```

Using Socket (1)

- Kết nối đên 1 số webserver

```
import java.net.*;
import java.io.*;
public class getSocketInfo {
    public static void main(String[] args) {
    for (int i = 0; i < args.length; i++) {
    try {
        Socket theSocket = new Socket(args[i], 80);
        System.out.println("Connected to " +
                    theSocket.getInetAddress() +
            " on port " + theSocket.getPort() +
            " from port " +
            theSocket.getLocalPort() + " of " +
            theSocket.getLocalAddress());
```

Using Socket (2)

```
    } catch (UnknownHostException e) {
        System.err.println("I can't find " + args[i]);
    } catch (SocketException e) {
        System.err.println("Could not connect to " +
                                              args[i]);
    } catch (IOException e) {
        System.err.println(e);
    }
    } // end for
  } // end main
} // end getSocketInfo
```

Using ServerSocket (1)

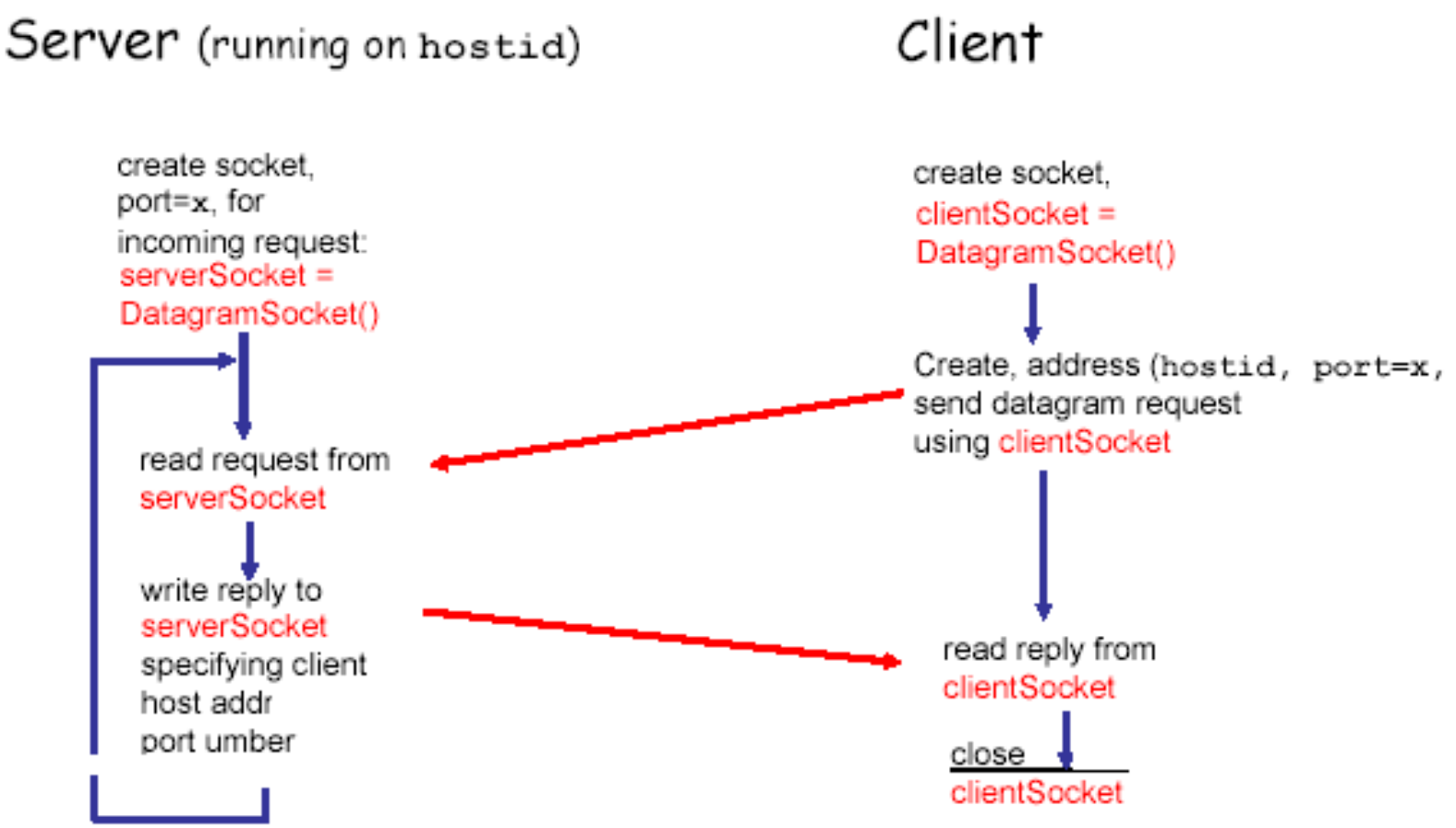
- DateTime Server

```
import java.net.*;
import java.io.*;
import java.util.Date;
public class DayTimeServer {
   public final static int daytimePort = 5000;
   public static void main(String[] args) {
      ServerSocket theServer;
      Socket theConnection;
      PrintStream p;
      try {
         theServer = new
                     ServerSocket(daytimePort);
```

Using ServerSocket (2)

```
        while (true) {
            theConnection =
    theServer.accept();
            p = new
    PrintStream(theConnection.getOutputStr
    eam());
            p.println(new Date());
            theConnection.close();
        }
        theServer.close();
      }catch (IOException e) {
        System.err.println(e);
      }
    }
}
```

Client-Server Application with UDP



UDP Client (1)

```
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();

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

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

      String sentence = inFromUser.readLine();

      sendData = sentence.getBytes();
```

Create input stream

Create client socket

Translate hostname to IP address using DNS

UDP Client (2)

Create datagram with data-to-send, length, IP addr, port

Send datagram to server

Read datagram from server

```
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());

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

}
```

UDP Server (1)

```
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  = new byte[1024];

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

Create datagram socket at port 9876

Create space for received datagram

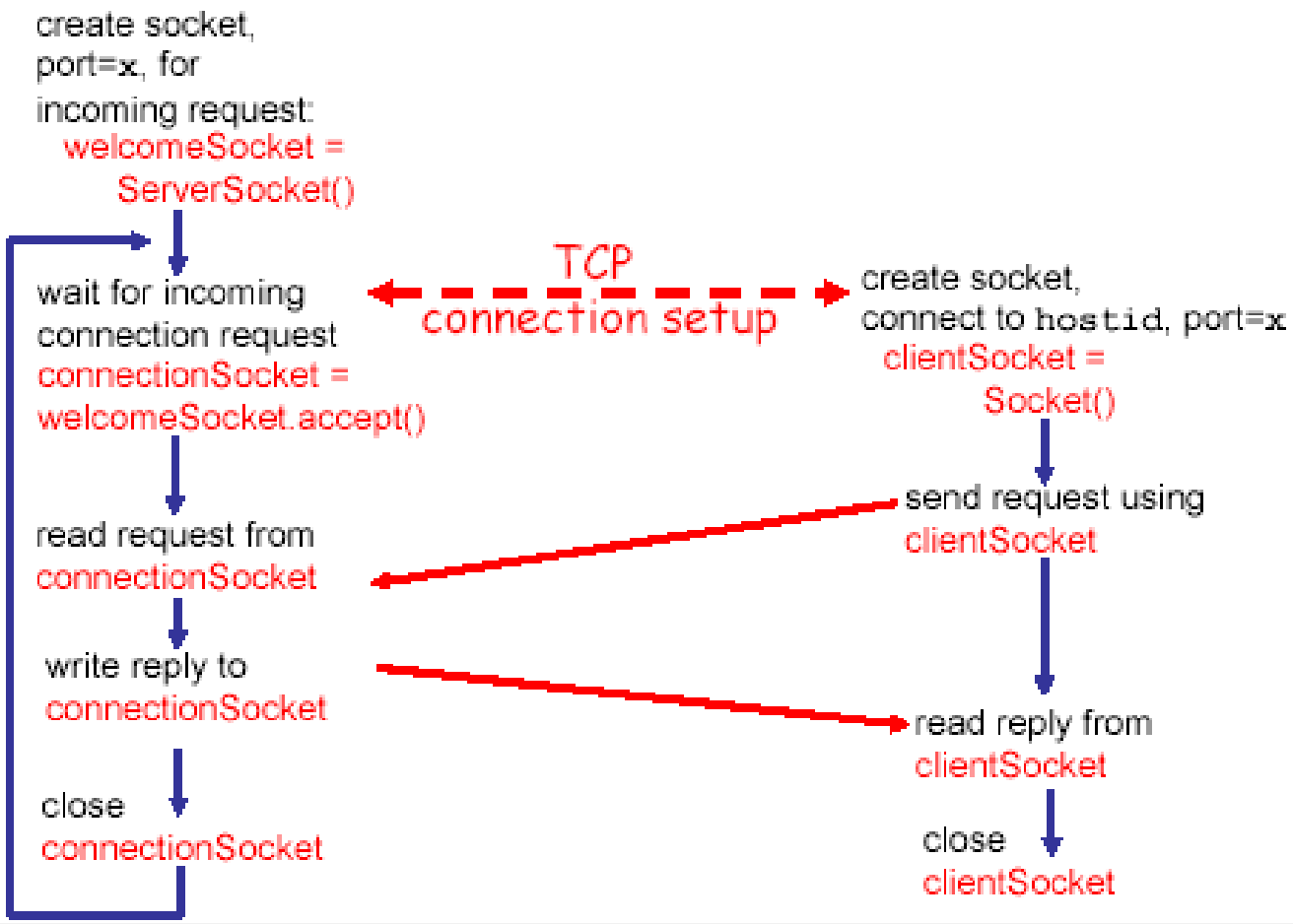
Receive datagram

UDP Server (2)

```
                String sentence = new String(receivePacket.getData());

Get IP addr
port #, of
sender          InetAddress IPAddress = receivePacket.getAddress();

                int port = receivePacket.getPort();

                        String capitalizedSentence = sentence.toUpperCase();

Create datagram
to send to client
                sendData = capitalizedSentence.getBytes();

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

Write out
datagram
to socket
                serverSocket.send(sendPacket);
              }
            }
          }
```

End of while loop,
loop back and wait for
another datagram

Client-Server Application with TCP (4)



TCP Client (1)

```
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());
```

Create input stream

Create client socket, connect to server

Create output stream attached to socket

TCP Client (2)

Create input stream attached to socket

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

sentence = inFromUser.readLine();
```

Send line to server

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

Read line from server

```
modifiedSentence = inFromServer.readLine();

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

clientSocket.close();

  }
}
```

TCP Server (1)

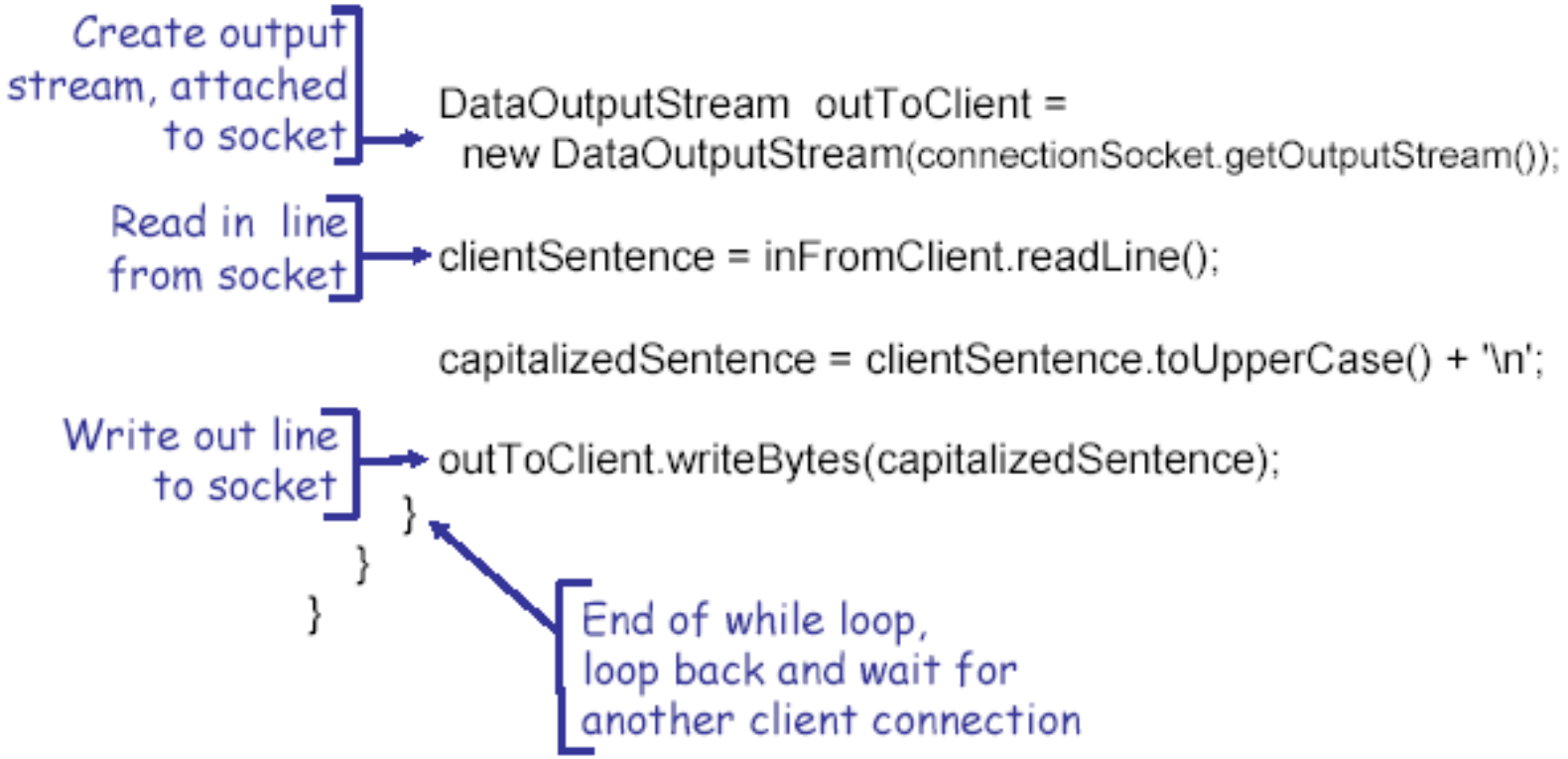
```
import java.io.*;
import java.net.*;

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()));
```

Create welcoming socket at port 6789

Wait, on welcoming socket for contact by client

Create input stream, attached to socket

TCP Server (2)


Create output stream, attached to socket
DataOutputStream outToClient =
new DataOutputStream(connectionSocket.getOutputStream());
Read in line from socket
clientSentence = inFromClient.readLine();
capitalizedSentence = clientSentence.toUpperCase() + '\n';
Write out line to socket
outToClient.writeBytes(capitalizedSentence);
}
}
}
End of while loop, loop back and wait for another client connection

Java Multi-Threading

```
1.  class PrimeRun implements Runnable {
2.     long minPrime;
3.     PrimeRun ( long minPrime )  {
4.        this.minPrime = minPrime;
5.     }
6.     public void run() {
7.        // compute primes larger than minPrime
8.        . . .
9.     }
10. }
11. PrimeRun p = new PrimeRun(143);
12. new Thread(p).start();
```

Stop a Thread (1)

- Using Thread.interrupt(), after changing loop condition
- **This method does not work with ServerSocket.accept()!**

```
public void stop() {
    running = false;
    this.interrupt();
    }
public void run() {
    running = true;
    while (running){
        Socket s = ssocket.accept();
        ...
    }
}
```

Stop a Thread (2)

- Close ServerSocket

```
public void stop() {
    running = false;
    ssocket.close();
    }
public void run() {
    running = true;
    while (running){
        Socket s = ssocket.accept();
        ...
    }
}
```

Server Side Thread

Main window thread

- Main Server Form
- Create a thread to listen and accept incoming connection

Child thread

- Listen and accept incoming connection
- Create a thread to handle connection

Grand-child thread

- Handle a connection
- Create a thread to handle socket InputStream

Grand-grand-child

- Handle socket InputStream

Client Side Thread

Main window thread

- Main Client Form
- Create a window for new connection

Chat window thread

- Chat window
- Connect to a server socket
- Create a thread to handle socket InputStream

Grand-child thread

- Handle socket InputStream