

## Blocking TCP sockets in Java

### Socket server source code

```
import java.io.IOException;
import java.io.ObjectInputStream;
import java.io.ObjectOutputStream;
import java.net.ServerSocket;
import java.net.Socket;

public class Server {
    ServerSocket providerSocket;
    Socket connection = null;
    ObjectOutputStream out;
    ObjectInputStream in;
    String message;

    Server() {
    }

    void run() {
        try {
            // 1. create a socket server listening to port 8080
            providerSocket = new ServerSocket(8080);
            // 2. waiting for the connection (here we are waiting until
next connection)
            connection = providerSocket.accept();
            // 3. create Input and Output streams
            out = new ObjectOutputStream(connection.getOutputStream());
            in = new ObjectInputStream(connection.getInputStream());
            // 4. socket communication
            do {
                try {
                    message = (String) in.readObject();
                    System.out.println("client>" + message);
                    if (message.equals("bye")) {
                        sendMessage("bye");
                    }
                } catch (ClassNotFoundException classnot) {
                    System.err.println("Data received in unknown
format");
                }
            } while (!message.equals("bye"));
        } catch (IOException ioException) {
            ioException.printStackTrace();
        } finally {
            // 4: close connection
            try {
                in.close();
                out.close();
            }
        }
    }
}
```

```
        providerSocket.close();
    } catch (IOException ioException) {
        ioException.printStackTrace();
    }
}

void sendMessage(String msg) {
    try {
        out.writeObject(msg);
        out.flush();
        System.out.println("server>" + msg);
    } catch (IOException ioException) {
        ioException.printStackTrace();
    }
}

public static void main(String args[]) {
    Server server = new Server();
    while (true) {
        server.run();
    }
}
}
```

## Socket client source

```
import java.io.IOException;
import java.io.ObjectInputStream;
import java.io.ObjectOutputStream;
import java.net.Socket;
import java.net.UnknownHostException;

public class Client {
    Socket requestSocket;
    ObjectOutputStream out;
    ObjectInputStream in;
    String message;

    Client() {
    }

    void run() {
        try {
            // 1. try to connect to the socket: localhost:8080
            requestSocket = new Socket("localhost", 8080);
            // 2. Input and Output streams
            out = new
ObjectOutputStream(requestSocket.getOutputStream());
```

```
        in = new ObjectInputStream(requestSocket.getInputStream());
        // 3: communications
        do {
            try {
                sendMessage("Hello server");
                sendMessage("bye");
                message = (String) in.readObject();
            } catch (Exception e) {
                System.err.println("data received in unknown
format");
            }
            } while (!message.equals("bye"));
        } catch (UnknownHostException unknownHost) {
            System.err.println("You are trying to connect to an unknown
host!");
        } catch (IOException ioException) {
            ioException.printStackTrace();
        } finally {
            // 4: close connection
            try {
                in.close();
                out.close();
                requestSocket.close();
            } catch (IOException ioException) {
                ioException.printStackTrace();
            }
        }
    }

    void sendMessage(String msg) {
        try {
            out.writeObject(msg);
            out.flush();
            System.out.println("client>" + msg);
        } catch (IOException ioException) {
            ioException.printStackTrace();
        }
    }

    public static void main(String args[]) {
        Client client = new Client();
        client.run();
    }
}
```

## Blocking UDP sockets in Java

The following Agent sends a message and waits for a response on port 8080, also with UDP. Older versions of the Eclipse IDE, the text you type on the console can be sent by pressing ctrl+z

```
package org.ait;

import java.io.BufferedReader;
import java.io.InputStreamReader;
import java.net.DatagramPacket;
import java.net.DatagramSocket;
import java.net.InetAddress;

public 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("localhost");

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

        String sentence = inFromUser.readLine();
        sendData = sentence.getBytes();

        DatagramPacket sendPacket = new DatagramPacket(sendData,
sendData.length, IPAddress, 8080);
        clientSocket.send(sendPacket);

        DatagramPacket receivePacket = new DatagramPacket(receiveData,
receiveData.length);
        clientSocket.receive(receivePacket);
        String modifiedSentence = new String(receivePacket.getData());

        System.out.println("converted:" + modifiedSentence);
        clientSocket.close();
    }
}
```

The UDP server waits for the agents messages on port 8080 and converts them to uppercase letters and sends them back to the client UDP socket.

```
package org.ait;

import java.net.DatagramPacket;
import java.net.DatagramSocket;
import java.net.InetAddress;

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

        DatagramSocket serverSocket = new DatagramSocket(8080);

        byte[] bytesReceived = new byte[1024];
```

```
byte[] bytesSent = new byte[1024];

DatagramPacket receivePacket = new DatagramPacket(bytesReceived,
bytesReceived.length);
// here we are waiting for the packets
serverSocket.receive(receivePacket);

String textMessage = new String(receivePacket.getData());

System.out.println("I got: " + textMessage);

InetAddress IPAddress = receivePacket.getAddress();
int port = receivePacket.getPort();

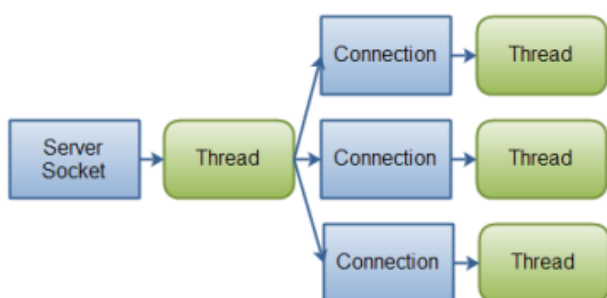
String upperCaseText = textMessage.toUpperCase();
bytesSent = upperCaseText.getBytes();

// send back
DatagramPacket sendPacket = new DatagramPacket(bytesSent,
bytesSent.length, IPAddress, port);
serverSocket.send(sendPacket);
serverSocket.close();

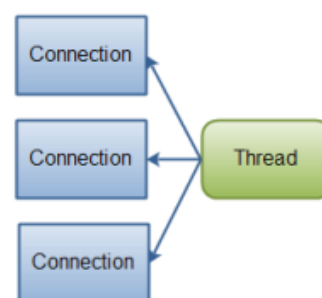
}
}
```

## Non-blocking TCP sockets in Java

Traditional Multi threaded socket

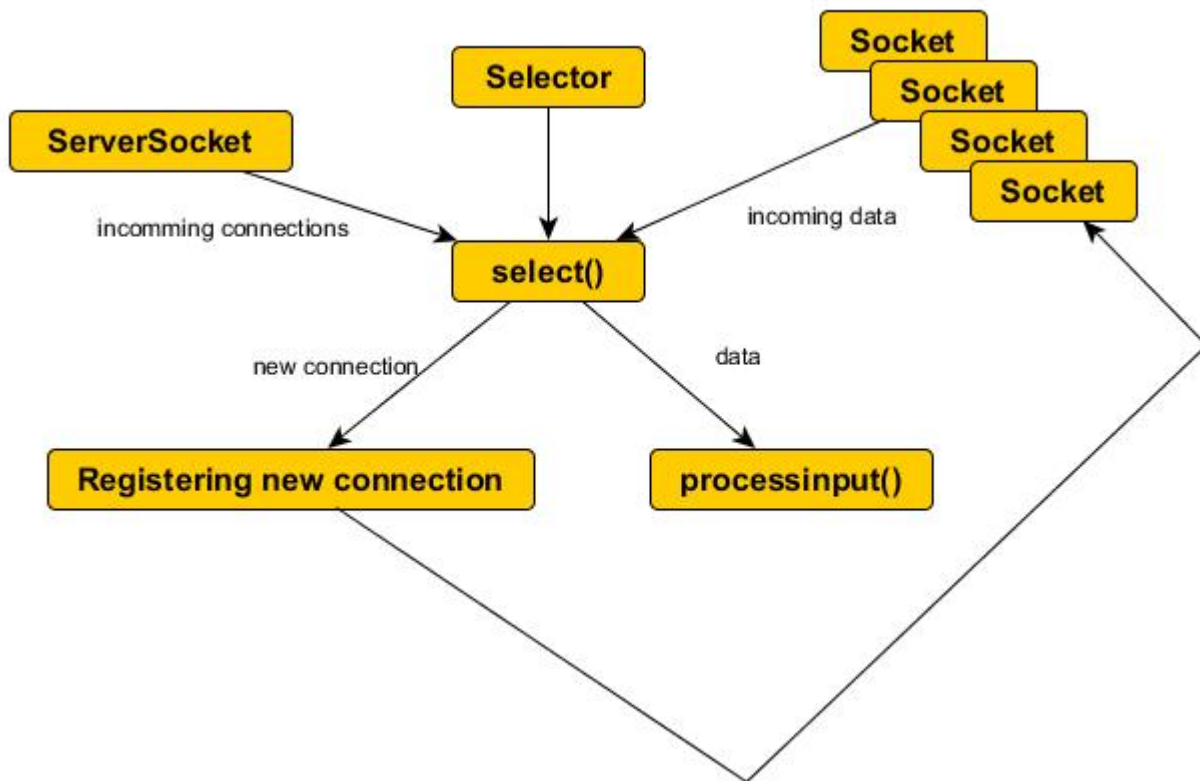


Non blocking 1 thread socket



Reading:

- <http://tutorials.jenkov.com/java-nio/nio-vs-io.html>
- <http://www.javaworld.com/article/2073344/core-java/use-select-for-high-speed-networking.html>



## Non-blocking loop

```
ServerSocketChannel serverSocketChannel = ServerSocketChannel.open();  
  
serverSocketChannel.socket().bind(new InetSocketAddress(9999));  
serverSocketChannel.configureBlocking(false); // ez a sor jelzi a  
blokkolásmentes működést  
  
while(true){  
    SocketChannel socketChannel = serverSocketChannel.accept();  
  
    if(socketChannel != null){  
        // the connection is accepted  
    }  
}
```

## Non-blocking Java client example

```
import java.io.IOException;  
import java.io.InputStream;  
import java.io.OutputStream;  
import java.net.Socket;  
import java.util.Random;
```

```
public class Client implements Runnable {
    private String host;
    private int port;

    // Bounds on how much we write per cycle
    private static final int minWriteSize = 1024;
    private static final int maxWriteSize = 65536;

    // Bounds on how long we wait between cycles
    private static final int minPause = (int) (0.05 * 1000);
    private static final int maxPause = (int) (0.5 * 1000);

    // Random number generator
    Random rand = new Random();

    public Client(String host, int port, int numThreads) {
        this.host = host;
        this.port = port;

        for (int i = 0; i < numThreads; ++i) {
            new Thread(this).start();
        }
    }

    public void run() {
        byte buffer[] = new byte[maxWriteSize];
        try {
            Socket s = new Socket(host, port);
            InputStream in = s.getInputStream();
            OutputStream out = s.getOutputStream();

            while (true) {
                int numToWrite = minWriteSize
                    + (int) (rand.nextDouble() * (maxWriteSize -
minWriteSize));
                for (int i = 0; i < numToWrite; ++i) {
                    buffer[i] = (byte) rand.nextInt(256);
                }
                out.write(buffer, 0, numToWrite);
                int sofar = 0;
                while (sofar < numToWrite) {
                    sofar += in.read(buffer, sofar, numToWrite - sofar);
                }
                System.out.println(Thread.currentThread() + " wrote " +
numToWrite);

                int pause = minPause + (int) (rand.nextDouble() * (maxPause
- minPause));
                try {
                    Thread.sleep(pause);
                } catch (InterruptedException ie) {
```

```
    }  
    }  
    } catch (IOException ie) {  
        ie.printStackTrace();  
    }  
}  
  
static public void main(String args[]) throws Exception {  
    new Client("localhost", 4444, 3);  
}  
}
```

## Non-blocking Java server example

```
public class Server implements Runnable {  
    // The port we will listen on  
    private int port;  
    // A pre-allocated buffer for encrypting data  
    private final ByteBuffer buffer = ByteBuffer.allocate(16384);  
    public Server(int port) {  
        this.port = port;  
        new Thread(this).start();  
    }  
    public void run() {  
        try {  
            // Instead of creating a ServerSocket,  
            // create a ServerSocketChannel  
            ServerSocketChannel ssc = ServerSocketChannel.open();  
            // Set it to non-blocking, so we can use select  
            ssc.configureBlocking(false);  
            // Get the Socket connected to this channel, and bind it  
            // to the listening port  
            ServerSocket ss = ssc.socket();  
            InetSocketAddress isa = new InetSocketAddress(port);  
            ss.bind(isa);  
            // Create a new Selector for selecting  
            Selector selector = Selector.open();  
            // Register the ServerSocketChannel, so we can  
            // listen for incoming connections  
            ssc.register(selector, SelectionKey.OP_ACCEPT);  
            System.out.println("Listening on port " + port);  
            while (true) {  
                // See if we've had any activity -- either  
                // an incoming connection, or incoming data on an  
                // existing connection  
                int num = selector.select();  
                // If we don't have any activity, loop around and wait  
                // again  
            }  
        }  
    }  
}
```

```

        if (num == 0) {
            continue;
        }
        // Get the keys corresponding to the activity
        // that has been detected, and process them
        // one by one
        Set keys = selector.selectedKeys();
        Iterator it = keys.iterator();
        while (it.hasNext()) {
            // Get a key representing one of bits of I/O
            // activity
            SelectionKey key = (SelectionKey) it.next();
            // What kind of activity is it?
            if ((key.readyOps() & SelectionKey.OP_ACCEPT) ==
SelectionKey.OP_ACCEPT) {
                System.out.println("acc");
                // It's an incoming connection.
                // Register this socket with the Selector
                // so we can listen for input on it
                Socket s = ss.accept();
                System.out.println("Got connection from " + s);
                // Make sure to make it non-blocking, so we can
                // use a selector on it.
                SocketChannel sc = s.getChannel();
                sc.configureBlocking(false);
                // Register it with the selector, for reading
                sc.register(selector, SelectionKey.OP_READ);
            } else if ((key.readyOps() & SelectionKey.OP_READ) ==
SelectionKey.OP_READ) {
                SocketChannel sc = null;
                try {
                    // It's incoming data on a connection, so
                    // process it
                    sc = (SocketChannel) key.channel();
                    boolean ok = processInput(sc);
                    // If the connection is dead, then remove it
                    // from the selector and close it
                    if (!ok) {
                        key.cancel();
                        Socket s = null;
                        try {
                            s = sc.socket();
                            s.close();
                        } catch (IOException ie) {
                            System.err.println("Error closing socket
"
                                + s + ": " + ie);
                        }
                    }
                } catch (IOException ie) {
                    // On exception, remove this channel from the

```

```
        // selector
        key.cancel();
        try {
            sc.close();
        } catch (IOException ie2) {
            System.out.println(ie2);
        }
        System.out.println("Closed " + sc);
    }
}
// We remove the selected keys, because we've dealt
// with them.
keys.clear();
}
} catch (IOException ie) {
    System.err.println(ie);
}
}
// Do some cheesy encryption on the incoming data,
// and send it back out
private boolean processInput(SocketChannel sc) throws IOException {
    buffer.clear();
    sc.read(buffer);
    buffer.flip();
    // If no data, close the connection
    if (buffer.limit() == 0) {
        return false;
    }
    // Simple rot-13 encryption
    for (int i = 0; i < buffer.limit(); ++i) {
        byte b = buffer.get(i);
        if ((b >= 'a' && b <= 'm') || (b >= 'A' && b <= 'M')) {
            b += 13;
        } else if ((b >= 'n' && b <= 'z') || (b >= 'N' && b <= 'Z')) {
            b -= 13;
        }
        buffer.put(i, b);
    }
    sc.write(buffer);
    System.out.println("Processed " + buffer.limit() + " from " + sc);
    return true;
}
static public void main(String args[]) throws Exception {
    new Server(4444);
}
}
```

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Last update: **2023/03/06 07:38**

