TCP - Socket communication

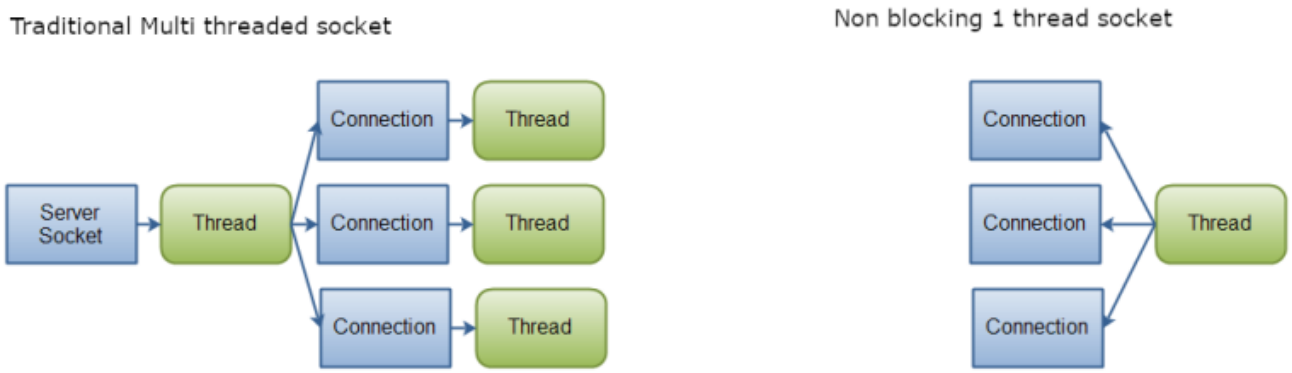
The client sends requests to the server over a TCP socket connection, and the server responds to these requests. Here are the basic steps involved in integrating software systems or components using TCP socket communication:

1. **Select a protocol**: TCP/IP is a common protocol for socket communication, but other protocols like UDP can also be used depending on the requirements.
2. **Determine the message format**: Decide on the format of the messages that will be exchanged between the client and server. This could be a simple text-based format or a more complex binary format.
3. **Define the communication interface**: Define the functions or APIs that will be used for communication between the client and server.
4. **Create the server**: Write the code for the server that listens for incoming client connections and handles incoming requests.
5. **Create the client**: Write the code for the client that connects to the server and sends requests.
6. **Handle errors**: Implement error handling mechanisms to ensure that communication errors are handled gracefully and do not cause the system to crash or become unstable.
7. **Test and iterate**: Test the system thoroughly and make any necessary changes or improvements to ensure that it is functioning correctly.

Features:

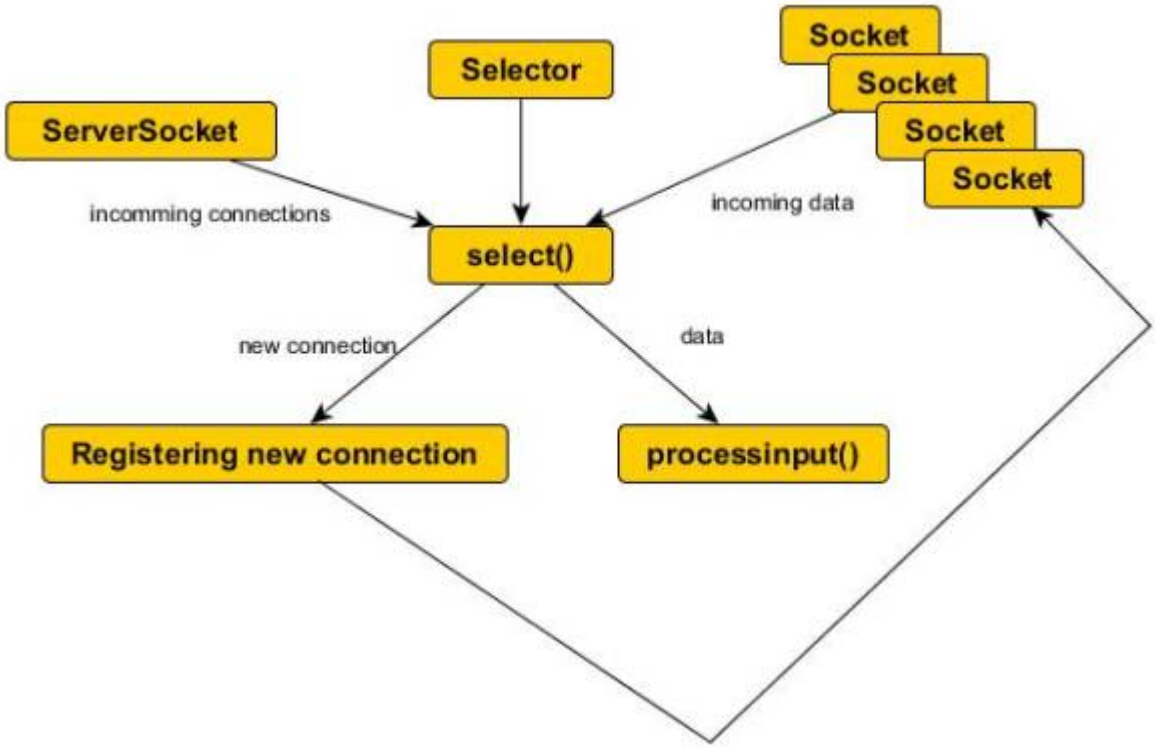
- Socket ::= IP address + (TCP/UPD) port number. A Socket is a combination of ip address and port number.
- TCP Sockets provides 'real-time' data transfer
    - binary data transfer but can be normal text or JSON, XML as well
    - no direct method sharing (can be implemented by hand)
    - TCP and UDP connections are possible. UDP is min 3 times quicker but one-way communication
- Persistent or On-Demand communication channel
    - because of connection time-loss usually persistent channels are better, but periodically 'ping' messages should be sent. (in order to avoid connection closing). In case of any problems reconnection is possible
    - in case of UDP channels an extra TCP channel is available for synchronizing - in online games
- Results in the fastest possible transmission:
    - Where the number of transactions per second up to ~ 50 transactions, there should have been applied. (20ms / sec transfer)

Blocking and non-blocking TCP sockets in Java



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
    }
   }
```

Java examples

Java example for Blocking and Non-Blocking Socket

HTTP server

Exercises

Exercise 1.

Create a simplified FTP (file transport) client and **blocking** server where the client can send or download text files from the server:

General use-cases

1.) Client connects to the server and sends a 'file listing' message
2.) Server sends back the list of the downloadable files
3.) Client lists the files and asks the user what action they want to take? Upload or download? ('u' or 'd')
4.) In both cases users must give the full file name with extension
5.) The client sends the selected file to the server (upload) or downloads the selected file from the server to a specific directory.

Server viewpoint

1.) After connecting, it reads the files from the /store subdirectory and sends the file names to the client after receiving the listing message.
2.) We are waiting for the client's 'u' or 'd' operation
3.) We get a filename from the client and if the action is 'd' (download), we read the file content and return its contents
4.) If the operation is 'u' (upload), we open a new file with the specified name and wait for the data to be written to the file.

Client viewpoint

1.) The client connects and waits for the list of files coming back and writes it to the console
2.) We ask for the “u” or “d” key
3.) Then we'll ask for the file-name as well.
4.) The client reads the files from the /files folder, or creates the downloaded file here

5.) If you press “d”, it creates /files/ and writes data from the server
6.) If you press “u”, /files/ is sent to the server

Exercise 2. Modify the **blocking** UDP code so that you can transfer a burned-in name and existing text or image file larger than 2 kbytes and verify that it was successfully sent.

Exercise 3. Try out the non-blocking starter Java code and examine/debug the code.

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https://edu.iit.uni-miskolc.hu/tanszek:oktatas:iss_t:integration_based_on_tcp_ip_sockets?rev=1683571561

Last update: **2023/05/08 18:46**