CPSC 471: Computer Communications

A Quick Java Sockets Tutorial (using TCP sockets)

What is a socket?

- An abstraction through which an application may send and receive data
- Two types
  - Stream sockets (TCP)
  - Datagram sockets (UDP)

TCP Client

need: import java.net.*;

- Create a TCP socket and connect to server
  - Socket sock = new Socket(String remoteHostAddr, int remotePort)
    - remoteHostAddr = “192.168.1.4”
- Read from the server
  - InputStream in = sock.getInputStream()
  - Use in.read()
- Write to the server
  - OutputStream out = sock.getOutputStream()
  - Use out.write()
- Close the connection with sock.close()

TCP Server

need: import java.net.*;

- Create a TCP server socket
  - ServerSocket serv = new ServerSocket(int localPort)
- Accept new client connection
  - Socket clientSock = serv.accept()
    - Blocks until a connection is made (or until a timeout occurs)
- Communicate (read, write) using clientSock
- Close client connection (close clientSock)
- Close server
  - serv.close()

More about InputStream and OutputStream (need: import java.io.*;)

- Use byte arrays
  - byte[] buffer = new byte[100]
  - Can create a string from byte array
    - String str = new String(buffer)
- InputStream → read
  - int numBytesRead read(byte[] data)
    - -1 if end-of-stream
    - Blocks until a byte can be read (or end-of-stream)
- OutputStream → write
  - void write(byte[] data, int offset, int length)

The InetAddress class

need: import java.net.*;

- Some useful functions:

- static InetAddress getLocalHost()
  - Get IP address for the local host
- String getHostAddress()
  - Returns IP address in dotted-quad notation
  - E.g., “192.168.1.4”

For more documentation

(reminder: please document your sources)

- Socket class
  - https://docs.oracle.com/en/java/javase/20/docs/api/java.base/java/net/Socket.html
- ServerSocket class
  - https://docs.oracle.com/en/java/javase/20/docs/api/java.base/java/net/ServerSocket.html
- InputStream class
  - https://docs.oracle.com/en/java/javase/20/docs/api/java.base/java/io/InputStream.html
- OutputStream class
  - https://docs.oracle.com/en/java/javase/20/docs/api/java.base/java/io/OutputStream.html
- InetAddress class
  - https://docs.oracle.com/en/java/javase/20/docs/api/java.base/java/net/InetAddress.html

Watch for thrown exceptions

- SocketException
- IOException
- Use try…catch

Additional References

- Socket programming section from our textbook authors in Java:
  - https://gaia.cs.umass.edu/kurose_ross/programming/simple_socket/K_R_sockets_in_Java.pdf
- Sun's socket tutorial:
  - https://docs.oracle.com/javase/tutorial/networking/sockets/index.html
- Kenneth L. Calvert and Michael J. Donahoo, *TCP/IP Sockets in Java: Practical Guide for Programmers*, Morgan Kaufmann