Exercise 4

INET Framework Introduction

The question we want to answer in this exercise is the following: You want to upload a large file via FTP to a server. Which throughput can you achieve over a connection with 200 ms delay, a transmission rate of 1 Mbps and a bit error rate (BER) of 10^{-7}?
As TCP is very complex, it is difficult to calculate the answer analytically, and therefore we will use a simulation model to answer the question.

The INET framework can be ~~installed (version 3.6.4) via the built-in installer, or~~ downloaded manually[1] (file provided by us via TUHH-Cloud), extracted and imported as OMNeT++ project. For this and the following exercises, we assume that you have a running OMNeT++ installation and you have imported and compiled the INET framework ~~version 3.6.4~~ as provided by us (or the INET Github master branch with at least the version of 3rd May (6551c80).

Create a new project. In order to use the INET framework for your project, set a reference to the INET framework in the properties of your new project. Make sure both the INET framework and your project are set up to the same build configuration. You can check/change this by setting the active built configuration either to gcc-debug or to gcc-release.

Create a simple network as shown in Figure 1. For the client and server, use the StandardHost module. Use PPP for the link layer and configure the channel parameters as given above. For measuring throughput, a hook with a throughput meter has to be configured for the PPP interface. To configure the modules correctly, use the provided excerpt of the omnetpp.ini at the end of this exercise sheet. For the FTP file transfer use the TCPBasicClientApp and TCPSinkApp. Have a look at the corresponding .ned files for their configuration.

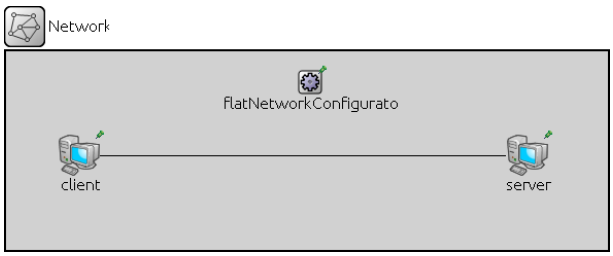

Figure 1: Network

Analyze the measured throughput for the given parameters. How does the throughput behave when you change the given network parameters (delay, bit error rate, transmission rate)?

Hint: To check the version of your INET framework, have a look at the version file in the INET root directory.

[1] https://cloud.tuhh.de/index.php/s/qlnKIvGkiE3d4Lk/download

omnetpp.ini (excerpt)

```
[General]
network = your_network
sim-time-limit = ${simtime=10}s
repeat = 1
**.networkConfiguratorModule = ""

**.ppp[*].numInputHooks = 1
**.ppp[*].inputHook[0].typename = "ThruputMeter" # Statistic recording
**.ppp[*].inputHook[0].maxInterval = 1s
**.ppp[*].inputHook[0].batchSize = 10000
**.ppp[*].inputHook[0].**.vector-recording = true

**.vector-recording = false

# Client settings
**.client.numTcpApps = 1
**.client.tcpApp[0].typename = "TCPBasicClientApp"
# [...]

# Server settings
**.server.numTcpApps = 1
**.server.tcpApp[0].typename = "TCPSinkApp"
# [...]

# TCP settings
**.tcpType = "TCP"
**.tcp.mss = 1460
**.tcp.advertisedWindow = 22*this.mss
```