

Assignment 2

Individual Assignment

Due date: Jan 17, 2016

Objective of the assignment is make yourself know how to configure attributes of NS3 objects (e.g., error model) by using first.cc as the reference program.

Modify myfirst.cc by including an error model. Error models are used to indicate that a packet should be considered to be errored, according to the underlying (possibly stochastic or empirical) error model. NS-3 offers the following error models (refer References section for more details).

- RateErrorModel
- ListErrorModel
- ReceiveListErrorModel
- BurstErrorModel

In this assignment, you play with the following two error models

1. Rate Error Model has these parameters
 - a. ErrorRate (0,1)
 - b. ErrorUnit [Packet, Bit, Byte]
2. Burst Error Model (similar to Rate Error Model except that it tries to ensure that packets are lost in burst) has these parameters
 - a. ErrorRate (0,1)
 - b. BurstSize (min,max by following some random distribution)

Run the following commands to know available attributes of these error models and their default values.

```
./waf --run "scratch/myfirst --PrintAttributes=ns3::RateErrorModel"
```

```
./waf --run "scratch/myfirst --PrintAttributes=ns3::BurstErrorModel"
```

Though there supposed to be error rate for a given link (e.g., point-to-point channel), NS-3 requires you to set error rate for each receiver (e.g., NetDevices like PointToPointNetDevice).

The following command shows default error model for PointToPointNetDevice which is "0" meaning error-free channel.

```
./waf --run "scratch/myfirst --PrintAttributes=ns3::PointToPointNetDevice"
```

In this assignment, you need to select error model as RateErrorModel/BurstErrorModel and tune their parameters to measure Packet Delivery Ratio (PDR) in myfirst.cc by transmitting at least 100 packets in each run of the simulation. As we are interested in average behavior of the network, repeat each experiment by varying RngRun value 10 times as one of command line arguments. Refer [simple-error-model.cc](#) and [fifth.cc](#) (refer References section to know their path in your NS-3 installation) to know how to set error model for a NetDevice. For ensuring same error rate for both devices connecting to a point-to-point channel, set same ErrorRate value for both of them in your program.

PDR is the ratio of successfully delivered packets at the receiver to the total transmitted packets by the sender. In this assignment, you need to measure PDR of network by summing up total no. of packets received at EchoServer and EchoClient (say R_Total) and summing up total no. of packets transmitted by EchoClient and EchoServer (say T_Total). Then $PDR = R_Total / T_Total$

Finally, plot variation in average PDR (on Y-axis) by varying ErrorRate on the scale of 0 to 1 (on X-axis) for each of error models by using tools like GNUplot.

PART A: PDR vs Error Rate for Rate Error Model by setting ErrorUnit [Bit]

Fill in below table with PDR by transmitting at least 100 packets in each run of myfirst.cc

RngRun/Error Rate	ER1=	ER2=	ER3=	ER4=	ER5=
RngRun1=					
RngRun2=					
...					
RngRun10=					
AVG. PDR					

- How to select RngRun values for above table?
RngRun1 = "Last TWO DIGITS of your ROLL NUMBER"
RngRun10 = RngRun1+9
- How to select ErrorRate (ER) values for above table?
Select ER in the range of 0 to 1 in such as way that we could clearly observe effect of ER on PDR. For example, when ErrorUnit is Bit, it would suffice to set ERs as very low levels like 10^{-3} . But, when ErrorUnit is Packet, you may need to set ERs as high values to observe variation in PDRs.
- How to get AVG. PDR?

- Take average of PDRs in each column to get avg. PDR and fill in the last row.
- Plot avg. PDR Vs ER by using values from above table

PART B: PDR vs Error Rate for Rate Error Model by setting ErrorUnit [Byte]

Repeat PART A experiment by replacing ErrorUnit with “Byte”. Keep RngRun values same as that experiment, but you may need to choose bit higher values for ERs for observing variation in PDR.

PART C: PDR vs Error Rate for Rate Error Model by setting ErrorUnit [Packet]

Repeat PART A experiment by replacing ErrorUnit with “Packet”. Keep RngRun values same as that experiment, but you may need to choose bit higher values for ERs for observing variation in PDR.

PART D: PDR vs Error Rate for [Burst Error Model](#)

Repeat [PART C](#) experiment by replacing error model as Burst Error Model with BurstSize (Min=1, Max=5). Keep RngRun values and ERs same as that experiment for getting PDRs.

PART E: Summary

By observing trends in your plots (PARTs A-D), draw some conclusions. You should able to tell how different values of error models affected/not affected avg PDR.

Optionally, you could answer the following query:

Query: myfirst.cc has DataRate of 5 Mbps and UDPEchoClient packet interval of 1 sec. What happens to PDR if we set DataRate to 10 Kbps and packet interval to 100 msec? Answer this by enabling and disabling error model in your experiment. Could you suggest some solution to reduce PDR? Hint: Refer other attributes of PointToPointNetDevice

Annexure: keep your modified [myfirst.cc](#) here

Modify first.cc in such a way that it takes RngRun, number of packets, error model and its parameters as command line arguments and you should be able to complete this assignment by specifying appropriate values as the command line arguments w/o requiring to modify myfirst.cc for each of the PARTs.

[Deliverables on GC; Deadline Jan 17, 2016](#)

- **Readable PDF Report**

Late Policy:

7 slip days overall

10% cut in marks for each day beyond slip dates.

References

- <https://www.nsnam.org/docs/release/3.24/models/singlehtml/index.html>
 - <https://www.nsnam.org/docs/release/3.24/models/singlehtml/index.html#error-model>
- <https://www.nsnam.org/docs/release/3.24/manual/singlehtml/index.html>
- <https://www.nsnam.org/docs/release/3.24/tutorial/singlehtml/index.html>
- https://www.nsnam.org/docs/release/3.16/doxygen/group__randomvariable.html
- ~/ns-allinone-3.24.1/ns-3.24.1/examples/tutorial/fifth.cc
- ~/ns-allinone-3.24.1/ns-3.24.1/examples/tutorial/sixth.cc
- ~/ns-allinone-3.24.1/ns-3.24.1/examples/error-model/simple-error-model.cc