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#PART A: MLab5.tcl:Implement and study the performance of GSM on NS2/NS3(Using MAC Layer)or equivalent environment

#set Parameters
set stop 100  ;# Stop time.

# Topology
set type gsm ;#type of link:

# AQM parameters
set minth 30
set maxth 0
set adaptive 1                  ;# 1 for Adaptive RED, 0 for plain RED

# Traffic generation.
set flows 0     ;# number of long-lived TCP flows
set window 30                   ;# window for long-lived traffic

# Plotting statistics.
set opt(wrap) 100 ; # wrap plots?
set opt(srcTrace) is ;# where to plot traffic
set opt(dstTrace) bs2 ;# where to plot traffic


#default downlink bandwidth in bps
set bwDL(gsm)  9600

#default downlink propagation delay in seconds
set propDL(gsm)  .500

set ns [new Simulator]

set tf [open Mlab5.tr w]
$ns trace-all $tf

set nodes(is) [$ns node]
set nodes(ms) [$ns node]
set nodes(bs1) [$ns node]
set nodes(bs2) [$ns node]
set nodes(lp) [$ns node]


proc cell_topo {} {
  global ns nodes
    $ns duplex-link $nodes(lp) $nodes(bs1) 3Mbps 10ms DropTail
    $ns duplex-link $nodes(bs1) $nodes(ms) 1 1 RED
    $ns duplex-link $nodes(ms) $nodes(bs2) 1 1 RED
    $ns duplex-link $nodes(bs2) $nodes(is) 3Mbps 50ms DropTail
    puts "GSM Cell Topology"
    }

 proc set_link_params {t} {

 global ns nodes bwDL propDL
 $ns bandwidth $nodes(bs1) $nodes(ms) $bwDL($t) duplex
 $ns bandwidth $nodes(bs2) $nodes(ms) $bwDL($t) duplex

 $ns delay $nodes(bs1) $nodes(ms) $propDL($t) duplex
 $ns delay $nodes(bs2) $nodes(ms) $propDL($t) duplex

 $ns queue-limit $nodes(bs1) $nodes(ms) 10
 $ns queue-limit $nodes(bs2) $nodes(ms) 10
 }

  # RED and TCP parameter
  Queue/RED set adaptive_ $adaptive
  Queue/RED set thresh_ $minth
  Queue/RED set maxthresh_ $maxth
  Agent/TCP set window_ $window

#Create topology
  switch $type {
   gsm -
   umts  {cell_topo}
  }

set_link_params $type
$ns insert-delayer $nodes(ms) $nodes(bs1) [new Delayer]
$ns insert-delayer $nodes(ms) $nodes(bs2) [new Delayer]

  # Set up forward TCP connection
  if {$flows == 0} {
                set tcp1 [$ns create-connection TCP/Sack1 $nodes(is) TCPSink/Sack1 $nodes(lp) 0]
                set ftp1 [[set tcp1] attach-app FTP]
        $ns at 0.8 "[set ftp1] start"
                }

        proc  stop {} {
                                global nodes opt tf
                 set wrap $opt(wrap)
                                set sid [$nodes($opt(srcTrace)) id]
                                set did [$nodes($opt(dstTrace)) id]

                                set a "Mlab5.tr"

                                set GETRC "/var/cn/ns-allinone-2.35/ns-2.35/bin/getrc"
                                set RAW2XG "/var/cn/ns-allinone-2.35/ns-2.35/bin/raw2xg"

                                exec $GETRC -s $sid -d $did -f 0 Mlab5.tr | \
                                $RAW2XG -s 0.01 -m $wrap -r > plot.xgr

                                exec $GETRC -s $did -d $sid -f 0 Mlab5.tr | \
```

```
$RAW2XG -a -s 0.01 -m $wrap >> plot.xgr

exec xgraph -x time -y packets plot.xgr &
exit 0
}
$ns at $stop "stop"
$ns run
```