**3413ICT Network Security - Lab 3 griffith_logo**

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**ICMP Ping**

ICMP  (Internet  Control  Message  Protocol)  is  used  for  network  troubleshooting  and

control  messaging.  It  is  used  to  notify  that  a datagram  did  not  reach  it’s  destination

either  because  the  destination  host  was  not found   (UNREACHABLE   HOST)   or   because

the   IP   packets   traveled   across   too   many routers  (TTL  EXCEEDED).

This   Lab   explains   yet   another   application:   ICMP   ECHO   REQUEST/ECHO   REPLY   (aka

Ping).   An   ECHO   REQUEST   message   is   sent   to   an   IP   address   to   find   out   if   the

communication  between  peers  is  working.  The  destination  computer  is  supposed   to

answer with  a  ECHO  REPLY  message.

**Description**

A  network   is  created   with  a  5-routers-ring-backbone  and  2   workstations  (A  and  B)

directly  opposite.*A*  will  send  an  ECHO  REQUEST  to*B*,  and*B*  will  answer  with  an  ECHO

REPLY.   We’ll   check   out   that   the   REQUEST   packet   went   through   the   three   routers

between  peers,  and  the  REPLY  packet  came  back  using  the  same  path  (the  routing

protocol  for  this  Lab  is  RIP).  In  a  second  scenario,  one  of  this  links  will  fail,  and  we  will

study  how  does this change the ping  trace.

**Creating the Scenario**

1. Open  a  new  Project  in  OPNET  IT  Guru  Academic  Edition  (**File** 🡪 **New  Project**)

using  the following  parameters (use default  values for the  remainder):

 **Project Name: <your\_name>\_Ping**

 **Scenario Name: NoFailure**

 **Network  Scale: Campus**

Press**Next**  several  times  to  end  the  Startup  Wizard.  The  Project  Editor  will  be

launched  with  a  blank  Grid.

2. To  create  the 5-router  ring:**Topology 🡪** **Rapid  Configuration**,

 On  the Popup  window,**Configuration:  Ring**, and  press **OK**.

 Click  on**Select  Models**  and  choose  internet\_toolbox  in  the  combo  box,  to

select   the   library   where   we   want   to   pick   up   the   routers   and   links   from.

Press**OK**.

 In the **Node** **Model** combo box, pick up the router

**CS\_4000\_3s\_e6\_fr2\_sl2\_tr2**.

 Select  the link to connect  the  routers,**Link Model:  PPP\_DS1**

 **Number: 5**  routers.

 The center for the  ring  is (X,Y)=(5,5).

 The  radius length is   2.5.

 Press**OK** to create the  network.

3. Insert two workstations **Sm\_Int\_wkstn** and connect each other with **10BaseT** wires:

Open  the**Object Palette.**

 Drag  the  two**Sm\_Int\_wkstn**  workstations,  and  drop  them  into  the  Grid.

This  can  be  found  in  the**Sm\_Int\_Model\_List**  palette  in  the  Object  Palette.

Change the attributes:

o Right-click  on  the  station  and  press**Edit  Attributes**.

o Select**Application  Supported  Profiles 🡪 rows:  0**.  By  doing  this,

the  workstations  won’t  have  any  profile  defined  (We  don’t  need  any,

because the  only traffic demand  we  want  is Ping).

o Repeat  this process  for  the  two  workstations.

 Connect   the   two   workstations   to   the   two   routers   directly   opposite   using

**10BaseT**  wires  from  the same palette.

 Now  the  network  is  complete  and  is  time  to  set  the  ICMP  traffic.  The  first

step  is  to  place  an**IP  Attribute  Config**  control.  This  can  be  found  in  the

**internet\_toolbox** palette.

 Edit  the  control  properties  of the **IP  Attribute  Config**   (**right  click 🡪**

**Edit  Attributes**).  The  parameters to be set can be found in **IP** **Ping** **Parameters 🡪**

**row** **0** (**Pattern: Default**):

o **Interval (sec): 90**

o **Count: 1000**

o **Record Route: Enabled**

 Press**OK** to accept  the  changes.

4. Using the **ip\_ping\_traffic** object from the **Object** **Palett**

(**internet\_toolbox**), draw an  ICMP  ping  demand  from  one host  to the  other:

 Select  the**ip\_ping\_traffic**  object  in  the palette.

 Click  on  one workstation  (start)  and  then  to  the  other  one (end).

 When   finished, press the right button and select **Abort**  **Demand**

**Definition** to  stop  drawing  wires.

 Right-click  on  the  flow line and  click**Edit  Attributes**,  and  then  set:

o **Ping Pattern: Default**

o **Start  Time: constant(1000)**

Chose RIP  as  routing  protocol  for the  scenario:

 On  the Project   Editor, **Protocols 🡪** **IP** **Routing 🡪** **Configure** **Routing**

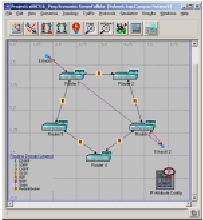
**Protocols...**  Check  out  that  only RIP  is selected  and  press**OK**.

 **Protocols 🡪** **RIP 🡪** **Configure  Start  Time.**  Select**Mean  Outcome:  20**  and

press **OK**. The RIP protocol will begin creating routing tables at this

moment.

Change the node names  as seen  in  the picture below:



**Setting up the simulation**

1. Click  on**configure/run  simulation ** at  the  Project  Editor,  and  set  this

values:

 **Duration: 1 hour(s)**.

 In  the**Global  Attributes** tab,

o **RIP  Sim  Efficiency:  Disabled**.  RIP  messages  will  be  sent  all  the

time during  the simulation.

o **RIP  Stop  Time:  10000**.  Routing  Tables  will  be  updated  during  all

the simulation  (the simulation is finished  before RIP  stops).

o **IP  Routing  Table  Export/Import:  Export**.  We  will  export  routing

tables to a  file at  the end.

2. Click on**Run**.

**Results analysis**

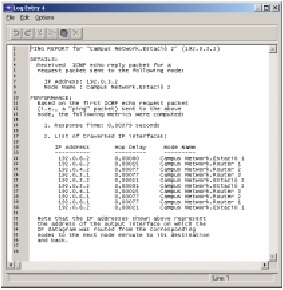
Once  the  simulation is over,

1. Exit  the simulation  window by  clicking  on**Close**.

2. At   the**Project   Editor**,   click**Results 🡪** **Open   Simulation   Log**. Review   the

ECHO  and   ECHO  REPLY  paths,  and  the  routers  the  packets  have  gone  through.

All  this information  is at the**PING REPORT,** as  seen  at  the  picture below:



**Questions**

Duplicate  the  scenario**NoFailure**  and  call  it**WithFailure**.  Choose  a  link  the  PING

was   using   in   the   last   simulation   (e.g.**Router   1-   Router   2**),   and   make   it   fail,   by

selecting  it  and  clicking  on  the**mark  selected  node  or  link  as  failed** button.

Analyze  the  new  ping  trace.

**NoFailure**:

PING REPORT for "Campus Network.node\_6" (192.0.8.2)

DETAILS:

Received ICMP echo reply packet for a

request packet sent to the following node:

IP Address: 192.0.8.2

Node Name : Campus Network.node\_6

PERFORMANCE:

Based on the first ICMP echo request packet

(i.e., a "ping" packet) sent to the above

node, the following metrics were computed:

1. Response Time: 0.00389 seconds

2. List of traversed IP interfaces:

IP Address Hop Delay Node Name

---------- --------- ---------

192.0.3.2 0.00000 Campus Network.node\_5

192.0.4.1 0.00017 Campus Network.node\_1

192.0.6.1 0.00077 Campus Network.node\_2

192.0.8.1 0.00077 Campus Network.node\_3

192.0.8.2 0.00023 Campus Network.node\_6

192.0.8.2 0.00001 Campus Network.node\_6

192.0.6.2 0.00017 Campus Network.node\_3

192.0.4.2 0.00077 Campus Network.node\_2

192.0.3.1 0.00077 Campus Network.node\_1

192.0.3.2 0.00023 Campus Network.node\_5

Note that the IP addresses shown above represent

the address of the output interface on which the

IP datagram was routed from the corresponding

nodes to the next node enroute to its destination

and back.

**WithFailure**:

**PacketDrop**

SYMPTOM(S):

Discarding UDP datagram received (destined

for port number: 520)

It is typical for end nodes (e.g., wkstn

and servers) to discard datagrams containing

RIP messages (i.e., port 520) and LDP (Label

Distribution Protocol, port 646) messages.

In that case, this message can be ignored.

EFFECT(S):

1. The datagram is discarded by the UDP.

2. Application data may not be received.

3. No Effects if the datagram was received

for port 520 and node is not using RIP.

4. No Effects if the datagram was received

for port 646 and node is not MPLS enabled.

SUGGESTIONS:

Make sure that the applications are

sending packets to a port that UDP

is listening on.

This message will not be repeated.

**Model\_Configuration\_Error**

ERROR:

An ARP module in the network encountered an IP

packet whose next hop address could not be mapped

to a MAC layer address.

Information about all such addresses has been

logged in the following file:

AnthonyGuevara\_Ping-WithFailure-ip\_addr\_err\_log.gdf

POSSIBLE CAUSE(s):

1. No interface with these IP addresses exists in

this network.

2. The interfaces with these addresses do not run a

compatible MAC protocol.

SUGGESTION(s):

1. Make sure that these IP addresses exist.

2. Make sure they belong to the correct MAC protocol.

RESULT(s):

1. These packets will be dropped.

**Timeout**

ERROR(S):

The echo request for destination (Campus Network.node\_6)

sent at (1000.00) seconds failed to

receive a response before the timeout

interval of (20.00000) seconds.

POSSIBLE CAUSE(S):

1. The packet was dropped either on its way

to the destination or on its way back to

this source node.

2 The timeout value of (20.00000) seconds is

too short for the round trip from the

destination.

SUGGESTIONS:

1. Check the timeout values in the ping pattern

and make sure the value is large enough.

2. Make sure there is a valid route to the

destination and also to the source from the

destination.

This can be done by using Routing Table Export

to dump the IP Route Table to the simulation log

**Performance**

Try setting the 'event\_speed\_parameter' preference to (137505).

The advanced event management system in the Simulation

Kernel can be tuned to maintain peak performance when

simulating very large systems. Your trade-off is that

higher values of event\_speed\_parameter require

additional memory.

Optimal values depend on the type and size of models,

so the value above is an estimate based on how this

simulation performed. You may wish to experiment

with different values and compare the simulation's

performance. In general, increasing this parameter

will not yield significant performance gains for small,

lightly-loaded systems.