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| ExperimentNo.9 |
| Perform to simulate NATonthe routerusingCiscopacket tracer/GNS3 |
| DateofPerformance: |
| DateofSubmission: |

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**Aim:**PerformtosimulateNATontherouterusingCiscopackettracer/GNS3.

**Objective:**DevelopingtheunderstandingofNATontheswitch/router.

**Theory:**

Network Address Translation (NAT) is a vital network function that allows private IP

addresses to be translated into public IP addresses.Thisprocessenablesdeviceswithina

private network to communicate with external networks, such as the internet, while conservingglobalIPaddressspaceandprovidingalayerofsecurity.ToolslikeCiscoPacket Tracer and GNS3 are excellent for simulating NAT configurations, providing a practical environmenttounderstandandapplyNATinnetworkscenarios.

**UnderstandingNAT**

NATmodifiestheIPaddressinformationintheheadersofIPpacketswhiletheyareintransit acrossatrafficroutingdevice.TheprimaryfunctionsofNATinclude:

1. **IPAddressConservation**:Byallowingmultipledevicesonalocalnetworktobe

mappedtoasinglepublicIPaddress,NATconservesthelimitednumberofavailable

IPaddresses.

2. **Security**:NAThelpsprotecttheinternalnetworkbyhidinginternalIPaddressesfrom externalnetworks.

3. **Flexibility**:NATallowsforinternalnetworkrestructuringwithoutneedingchangesto theexternalIPaddressscheme.

There are several types of NAT, including Static NAT, Dynamic NAT, and Port Address

Translation(PAT),alsoknownasOverloading.

**ToolsforSimulation**

**CiscoPacketTracer**:CiscoPacketTracerisanetworksimulationtooldevelopedbyCisco.It

iswidelyusedforlearningnetworkingconceptsandpracticingconfigurationsinacontrolled, virtualenvironment.

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**GNS3 (Graphical Network Simulator-3)**: GNS3 is an open-source network software

emulatorthatprovidesamorerealisticandadvancedsimulationenvironment.Itallowsfor

the use of real Cisco IOS images, making it suitable for professional network engineers

preparingforcertificationsormanagingcomplexnetworkdesigns.

**SettingUpNATUsingCiscoPacketTracer**

**1.CreateaNewProject**:

● OpenCiscoPacketTracerandstartanewproject.

● Addthenecessarydevicestotheworkspace,includingrouters,switches,andend

devices(e.g.,PCs).

**2.DesigntheNetworkTopology**:

● Connectthedevicesusingappropriatenetworkcables.

● ConfigureIPaddressingschemesfortheinternalnetworkandtheexternalnetwork

(e.g.,theinternet).

**3.ConfigureRouterInterfaces**:

● Accesstherouter'sconfigurationinterface.

● AssignIPaddressestotherouterinterfaces.Typically,oneinterfacewillbeconnected

totheinternalnetwork(inside)andanothertotheexternalnetwork(outside).

**4.ConfigureNATontheRouter**:

● Definetheinsideandoutsideinterfacesontherouter.

● ConfiguretheNATrules.Forexample,forPAT,youwouldspecifytherangeof

internalIPaddressesthatwillbetranslatedandthesinglepublicIPaddresstheywill

betranslatedto.

● Setupanynecessaryaccesscontrollists(ACLs)topermittrafficthatwillbe

translated.

**5.VerifyConfiguration**:

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● UsetoolswithinPacketTracertotestconnectivity.Ensurethatdevicesintheinternal

networkcancommunicatewithexternalnetworks.

● VerifytheNATtranslationsusingappropriatecommandstoensuretheinternal

addressesarebeingtranslatedcorrectly.

**SettingUpNATUsingGNS3**

**1.CreateaNewProject**:

● OpenGNS3andstartanewproject.

● Addrouters,switches,andothernecessarydevicestotheworkspace.

**2.DesigntheNetworkTopology**:

● Connectthedevicesusingvirtualnetworkcables.

● PlantheIPaddressingschemesforboththeinternalnetworkandtheexternal

network.

**3.ImportCiscoIOSImages**:

● UserealCiscoIOSimagestoensurearealisticsimulationenvironment.

● Assigntheseimagestothevirtualroutersinyourtopology.

**4.ConfigureRouterInterfaces**:

● StarteachrouterandaccessitsCLI.

● AssignIPaddressestotherouterinterfaces,designatingoneastheinsideinterface

andanotherastheoutsideinterface.

**5.ConfigureNATontheRouter**:

● Definetheinsideandoutsideinterfaces.

● SetupNATrules,suchasdynamicNAT,staticNAT,orPAT.

● ConfigureACLsifnecessarytocontrolwhichtrafficissubjecttoNAT.

**6.VerifyConfiguration**:

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● Usediagnostictoolsandcommandstotestconnectivityandensurepropertranslation.

● VerifythatinternaldevicescanaccessexternalnetworksandthatNATtranslationsare

occurringasexpected.

**PracticalApplicationsandBenefits**

**1.AddressConservation**:

● NATallowsmultipledevicesonaprivatenetworktoshareasinglepublicIPaddress,

reducingtheneedforalargenumberofpublicIPaddresses.

**2.Security**:

● ByhidinginternalIPaddresses,NATaddsalayerofsecurity,makingitmoredifficult

forexternalattackerstotargetinternalnetworkdevices.

**3.NetworkFlexibility**:

● NATallowsinternalnetworkconfigurationstochangewithoutaffectingtheexternal

IPaddressingscheme.Thisflexibilityiscrucialfornetworkscalabilityand management.

**4.Connectivity**:

● NATenablesdeviceswithinaprivatenetworktocommunicatewithexternal

networks,facilitatinginternetaccessandexternalcommunications.

**Conclusion**

Simulating NAT using Cisco Packet Tracer and GNS3 provides invaluable practical

experiencefornetworkengineersandstudents.Thesetoolsofferarealisticenvironmentto study and apply NAT configurations, ensuring that users can design, configure, and troubleshoot NAT implementations effectively. Mastering NAT in these simulated environmentsenhancesone'sabilitytomanageandsecurereal-worldnetworks,providinga strongfoundationforefficientandscalablenetworkdesign.

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