National College of Ireland

Configuration Manual

MSc Cybersecurity
Blockchain Authentication in smart home IoT devices

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MSc Project Submission Sheet

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Module: RESEARCH PROJECT

Lecturer: VANESSA AYALA-RIVERA

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Project Title: BLOCKCHAIN AUTHENTICATION IN SMART HOME IOT DEVICES

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Configuration Manual

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1 Introduction

Information on the software tools used to carry out this project is provided in this handbook. Additionally, this handbook details how to load the necessary software into systems, execute a project to achieve results, and install the necessary software step-by-step.

Overview of NS-3
• Free and open-source discrete event network simulator.
• Available for Linux, OS-X, and Windows “with Cygwin tools”.
• Written in C++, with optional Python interface for visualization and scripting.
• Built-in helpers to make “scripting” in C++ easy.
• Supports different network layers:
– Applications: On/Off, Bulk transfer, HTTP, etc.
– Transport: TCP, UDP.
– Network: IPv4, IPv6, routing.
– Physical: Ethernet, PPP, 802.11, LTE, mobility models.

2 Hardware Details

Specifications

The suggested architecture will need powerful resources. The following details the hardware configuration of my hosted computer and the virtual machine used to host the ubuntu operating system. These standards go beyond what is necessary. The official websites of each piece of software include information about its specs.

Hardware

Device	MacBook Pro
Operating System	Mac OS Monterey
Processor	2.7GHz Dual core
Installed RAM	8GB
System type	64-bit

Virtual Machine – Virtual Box

Virtual Machine	Ubuntu 16.04
Operating System	Linux
Processor	2GHz
Installed RAM	4GB
System type	64-bit

3 Required Software

Recommended to install NS-3.27
• Use virtual machine (i.e. VirtualBox https://www.virtualbox.org).
• Install Linux Ubuntu 16.04.
• Install the minimum prerequisites requirements.
• ns-3 Installation includes following steps:
• Download;
• Build;
• Validation.
• Detailed instructions:
• http://www.nsnam.org/getting_started.html

• http://www.nsnam.org/wiki/index.php/Installation

• For C++ coding, Eclipse with Mercurial can be a good tool (http://www.eclipse.org).

4 Installation

How to Download and install VirtualBox or VMWare on your machine.

- Download and Install VirtualBox or VMWare from the official website https://www.virtualbox.org/wiki/Downloads https://www.vmware.com/latam/products/workstation-player/workstation-playerevaluation.html
- Choose the appropriate version for your host operating system

How to install Ubuntu 16.04 on your Virtual Machine

- Download and Install Ubuntu from the official website https://releases.ubuntu.com/16.04/
- Select the Desktop Image and Attach to your virtual machine
- Follow the tutorial link below to learn how to install ubuntu on your virtual machine https://brb.nci.nih.gov/seqtools/installUbuntu.html#:~:text=Select%20your%20new%20virtual%20machine,this%20page%20for%20more%20information. https://linuxhint.com/install_ubuntu_vmware_workstation/

How to install NS-3.27 Simulator on Ubuntu

Download ns-3 package, unzip it (*for projects, recommend ver. 3.27)
$ wget http://www.nsnam.org/release/ns-allinone-3.27.tar.bz2
$ tar -xjf ns-allinone-3.27.tar.bz2

• Check for prerequisites, and build ns-3 (http://www.nsnam.org/wiki/Installation)
$ cd ns-allinone-3.27/ns-3.27/

$ ./waf configure –-enable-tests –-enable-examples
$ ./waf build

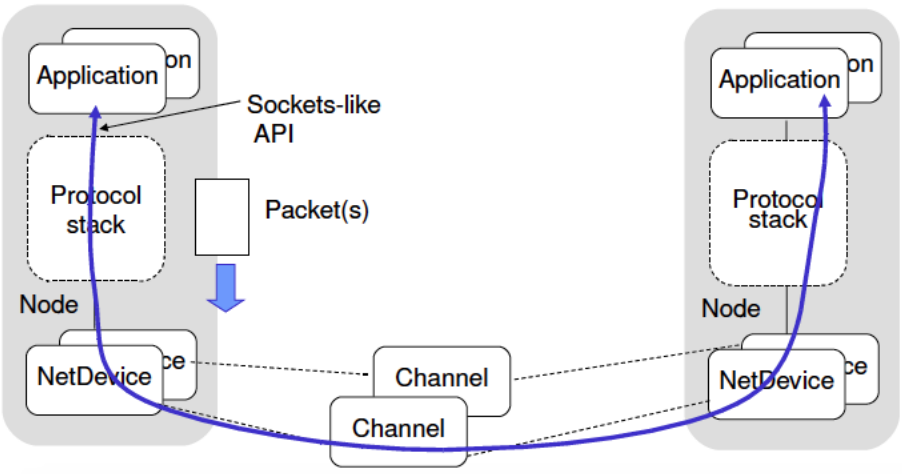
• Validate the build
$ ./waf check

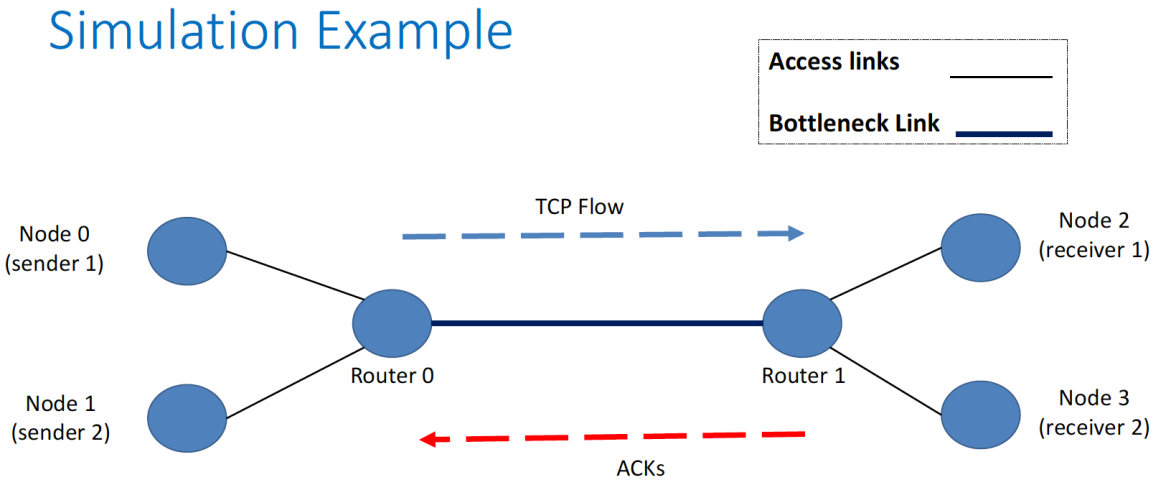
• Test the simulator
$ ./waf --run hello-simulator

Execute the following command on your Linux terminal after installation

- sudo apt update
- sudo apt upgrade
- sudo apt install build-essential autoconf automake libxmu-dev python-pygraphviz cvs mercurial bzr git cmake p7zip-full python-matplotlib python-tk python-dev pythonkiwi python-gnome2 python-gnome2-desktop qt4-dev-tools qt4-qmake qt4-qmake qt4-default gnuplot-x11 wireshark
- tar jxvf ns-allinone-3.27.tar.bz2 (To extract the Ns3 download)
- cd ns-allinone-3.27
- ./build.py --enable-examples --enable-tests
- ./waf --run scratch/first
- ./waf --pyrun scratch/first.py

NS-3 has the same conceptual structure of real network





Installation Guide to NS3
https://didattica.uniroma2.it/files/scarica/insegnamento/172781-Internet-Via-Satellite/51597-NS3-Installation

The video below will help aid the installation of NS-3.27 on your virtual machine

https://www.youtube.com/watch?v=4FCaQ_rh9bw&t=26s

5 Code Execution

Built the simulation script using Eclipse;
Run thr script using WAF ($ ./waf –run ScriptName);
Analyse the output traces.

There are three code files submitted as code artefacts for this project
After the NS3 installation, all three files should be copied into the NS3 Scratch folder

There are two code files to run in the NS3 Simulator
ablock.cc file (This is the code containing the authentication mechanism) ddosattackBA.cc (This is the code containing the DDoS Simulation)

gnuplot command is used to plot the graph for the simulation performance.

5.1 Authentication Mechanism

Below are the steps to run the code from the terminal
Enter into the ns-3.27/scratch folder

- ./waf –run ablock –vis

Step 1: Initiated authentication of IoT devices
Step 2: Blockchain IoT device data request Enquiry
Step 3: Blockchain IoT device Block reading request
Step 4: IoT device Block Authentication
Step 5: Updated Blockchain with response Step
6: Exit

The system requests for:

- IoT Device Id
- IoT Device Name
- IoT Device Data Authentication Details
- IoT Device Authenticated Data

Once this is provided the simulation begins and after the simulation you can plot the efficiency graphs using

- gnuplot BA1.plt
- gnuplot BA2.plt
- gnuplot BA3.plt
- gnuplot BA4.plt
- gnuplot BA5.plt

The graph will be saved as png files in the scratch folder

5.2 DDoS Attack

Enter into the ns-3.27/scratch folder

- ./waf –run ddosattackBA.cc --vis

Once this is provided the simulation begins and after the simulation you can plot the efficiency graphs using

- gnuplot graph1.plt
- gnuplot graph2.plt
- gnuplot graph3.plt
- gnuplot graph4.plt
- gnuplot graph5.plt
- gnuplot graph6.plt
- gnuplot graph7.plt
- gnuplot graph8.plt

The graph will be saved as png files in the scratch folder