OBJECT ORIENTED PROGRAMMING

ACADEMIC YEAR 2017-2018

Network Simulator

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INTRODUCTION

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This assessment can be completed within and outwith class class time. There are several separate stages of this project, please ensure that you manage your time effectively to meet the overall deadline. Your assessor will check the authenticity of any unsupervised work.

Please read all of the evidence requirements for each stage and clarify any points with your assessor.

Assessment Brief

Develop a program (in Java) that will allow the user to keep track of devices connected to a company computer network. Assume that the network uses private IPv4 addressing (with 32 bit addresses).

The network components and their functions are as follows:

SWITCH (OSI LAYER 2)

Responsible for registering the MAC addresses (12 hex digits) of devices connected to the network. Maximum amount of ports: 48.

ROUTER (OSI LAYER 3)

Maintains a routing table, which determines the networks the router is attached to. Assume that there is one "inside" address - which must be a PRIVATE subnet, and one "outside" address - which must be a public subnet.

WIRELESS ACCESS POINTS (WAPS)

The WAPs have a MAC address and an IP address (static). Allow laptops and mobile devices to be connected to them. WAPs must be connected to a switch, and they must maintain a list of MAC addresses of devices (currently) attached.

Laptops and mobile devices CANNOT connect to the network if WAPs are offline.

HOSTS

Each host must have a MAC address, an IP address and a name. Types of hosts are:

PCs, with dynamic IP addresses (assume that they are “reserved” addresses, collected on a DHCP server).

Laptops and Mobile Devices, also with dynamic “reserved” IP addresses.

Servers, which have static IP addresses AND **open port numbers** for services as follows:

(1) Domain controller – open ports: 67, 68 (DHCP), and 53 (DNS).

(2) File server - open ports: 137-139, 445 (SMB).

(3) Database server - open ports: 1521 (Oracle), 3306 (MySQL), 5432(PostgreSQL).

(4) Web server – open ports: 80 (http), 443(https).

(5) Network printers - open ports: 631, 9100

(6) Gateway – assume that there are no defined open ports. However, a gateway must have 2 IP addresses (inside/outside interface).

NETWORK CONVERGENCE

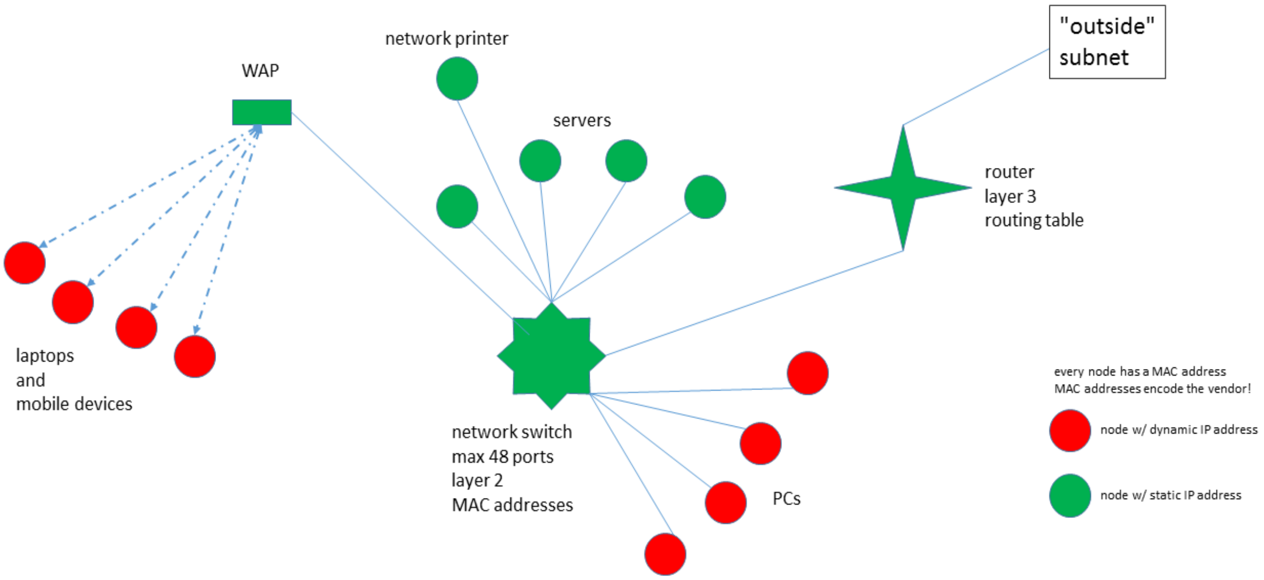
When the network converges, the switches and the routers boot up first. Then, the servers and network printers come "online". After that, PCs, laptops, and mobile devices can connect/disconnect to/from the network randomly.

Whenever one of the hosts with a static IP address connects to the network, the (central) network switch must register/update its MAC address table. Whenever a mobile (wireless) device connects to the network, its MAC address gets registered on a WAP.

When a host disconnects from the network, their MAC entries must be removed by the responsible devices (switches and WAPs).

NETWORK DIAGRAM

Network Diagram



USE CASES

Use Cases

REPRESENTATION OF NETWORK DEVICES

The Network Management Application must be able to represent the Network in its entirety, and also must allow the user to find out details about the network. In particular, the application must allow the user to find the following details about the networked devices:

(1) The amount of hosts currently online.

(2) The MAC and IP addresses of single hosts.

(3) The network number and subnet mask.

(4) The amount of free IP addresses on the local subnet.

(5) The state (online/offline) and port numbers of servers.

(6) The MAC addresses registered with a switch.

(7) The name-to-IP address mappings of hosts.

Testing and Internal Documentation

UNIT TESTING

The finished project must contain code that uses the jUnit (version 4) testing framework for testing methods that have been developed. The jUnit tests must contain calls to assertEquals() or other appropriate methods of the testing framework.

AUTOMATED ACCEPTANCE TESTING

The finished project shall include an automated (partial) acceptance test that runs every time the application is compiled/executed. This test should be a method (or collection of methods) called from main(). Ideally, the test method should be thoroughly commented.

The automatic test shall encompass at least every use case listed in the project brief. You will have to demonstrate the functionality of your finished application by successfully compiling/building the Java project and running the automated test.s

INTERNAL DOCUMENTATION

The internal documentation of the project code must be produced via Javadoc. The generated Javadoc files should be included in the project's "dist" folder.

ASSESSMENT CHECKLISTS

Assessment Checklists

Quote from the SQA specification: “Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can investigate object oriented programming techniques and apply them appropriately to a design.”

Please make sure that your solution contains examples of the following items, coded in Java, using jUnit, and Javadoc. Use the design (diagrams) that you have produced for the unit “Object Oriented Analysis and Design” as a model for your application.

OUTCOME 1

- Object oriented concepts and terms.
- Object oriented programming techniques.
- Objects and classes.
- Attributes and methods.
- Parameter passing.
- Abstraction, encapsulation and information hiding.
- Inheritance.
- Polymorphism.
- Association.
- Aggregation and collection.
- Coupling and cohesion.

OUTCOME 2

- Declaring and initialising variables.
- Using operators.
- Implementing control structures.
- Defining data structures.
- Accessing and manipulating data structures.
- Using parameter passing.
- Creating classes.
- Creating instances of classes.
- Creating relationships between classes.
- Creating constructor methods.
- Use of exceptions.
- Use of standard object libraries.
- Documenting code.

ASSESSMENT CHECKLISTS

OUTCOME 3

- Implementing a test plan using a defined strategy.
- Maintaining test documentation.
- Evaluating results of test runs.
- Amending code as necessary.