COMP504

Operating Systems and Systems Support

Student Lab Manual

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| --- |
| https://upload.wikimedia.org/wikipedia/commons/thumb/a/ab/Logo-ubuntu_cof-orange-hex.svg/120px-Logo-ubuntu_cof-orange-hex.svg.pngPranav Loves Apple.png  https://upload.wikimedia.org/wikipedia/commons/thumb/3/34/VMware_Workstation_11.0_icon.png/120px-VMware_Workstation_11.0_icon.png  Android dance.svg  NewTux.svgWindows logo - 2012.png |



COMP504 S1 2020 Lab work

Completion of these labs contribute towards your final mark.

Unless otherwise arranged the lab work must be done in class so that the tutor can see it is your own work and you completed the tasks. Assignments done at home (due to illness) must be brought into class on a laptop and demonstrated to the tutor to get signed off.

Employers value time management and this is expected for all work that contributes to your grades. You get an automatic ONE WEEK extension to complete your lab and present it for marking in the next class.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Topic** | **Description** | **Marks** | **Student self-assessment** | **Tutor Signature** |
| Windows Desktop and VMWare Workstation | Install Windows into VMWare, perform common windows configuration tasks, install programs and configure and demonstrate usage of Remote desktop. | 10 | 10 | Done |
| Windows Server | Install Windows Server and configure | 10 | 10 | Done |
| Server upgrade | Upgrade windows server | 5 | 5 | Done |
| macOS | Explore the world of Mac computers | 10 | 10 | Done |
| Android | Install and use an Android emulator | 10 | 10 | Mark |
| Embedded | Explore the world of embedded systems | 10 | 10 | Mark |
| Ubuntu | Install Ubuntu into VMWare and configure | 10 | 10 | Mark |
| Linux Unhatched | Complete the NDG Linux Unhatched course in Netacad to learn the basics of Linux command line. Complete the online assessment. | 5 | 5 | Mark |
| Linux Essentials | Complete selected chapters of the Netacad self-paced interactive learning resources to prepare for the Linux Shell Scripting assignment (2 weeks). | 15 | 5 | Mark |
| CentOS Linux | Install CentOS Linux and configure. | 15 |  |  |
| **Total out of 100** | |  |  |  |

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**SCAN THIS PAGE AND SUBMIT IT TO MOODLE AS A RECORD OF YOUR PRACTICAL WORK.**

*The Moodle submission will be used to record your grade for the practical work. Only signed activities will be counted.*

**Make sure your name is on this page and you take a photo of this page on a regular basis.**

**The photo is your backup of evidence if you lose your Lab book.**

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Learning outcomes

## Aim

To enable students to select, install, and configure IT hardware and systems software and use graphical (GUI) and command line interfaces (CLI) to meet organisational requirements.

* Use graphical (GUI) and command line interfaces (CLI)
* Select, install and configure general purpose and specialist operating systems in current use, both proprietary and open source

## practical Coursework assignments (40%)

These learning outcomes are covered in weekly practical labs which will be completed in class time.

* Networking and connectivity
* Administration of software installation and configuration
* Graphical user interface and command line interface
* Resources requirements
* Special purpose operating systems
* Proprietary operating systems
* Open source operating systems
* Security and authorised access
* Auditing and logging in operating systems

## practical graded Assignments (20%)

These are two marked assignments that you will start in class time and complete in your own time.

* Automation and shell scripting

## theory Tests (40%)

The two theory tests are closed book in a supervised test environment. To pass the module you must achieve a minimum of 40% average across the two theory tests.

* Basic hardware and software architecture
* Architecture of different type of computers
* Operating systems internals

BYOD

The labs can be done on your own device in the classroom. You need to make sure that it has appropriate specifications for the task and install a recent version of VMWare Workstation Pro. You need 8GB of RAM for most activities. You should download a copy of the ISO before class – it may take a while to download to your device.

Schedule

The following schedule gives you an idea of what you are doing each week but is subject to change. Check your detailed schedule in Moodle.

This course is designed to minimise “lecture” time and maximise hands on learning experiences by using activity based learning and project based learning in lab time.

Work at your own pace:

* faster students may start on the next weeks lab after getting signed off.
* the question sections can be done for homework – but **only** if you run out of class time – not an excuse to leave early!

|  |  |  |  |
| --- | --- | --- | --- |
| **Week** | **Coursework - Lab Book (40%)**  **Activity based learning (1)** | **Automation and shell scripting assignment (20%)**  **Project based learning (2)** | **Supervised Tests (40%)** |
| 1 |  |  |  |
| 2 |  | Part 1: DOS commands and batch files |  |
| 3 | Windows desktop |  |  |
| 4 | Windows server |  |  |
| 5 | Windows server upgrade  macOS |  |  |
| 6 | Android |  |  |
| 7 | Embedded operating systems |  |  |
| 8 | Ubuntu |  | Theory Test 1 |
| 9 | Linux Unhatched |  |  |
| 10 | Linux Essentials |  |  |
| 11 | Linux Essentials |  |  |
| 12 |  | Part 2: Linux shell scripting |  |
| 13 | CentOS Linux |  |  |
| 14 | CentOS Linux |  |  |
| 15 |  |  | Theory Test 2 |
| 16 | Contingency |  |  |

1. Activity based learning is learning by doing – you work through facilitated activities at your own pace and may collaborate with other students in the class.
2. Project based learning is where you learn skills by investigating and solving a question, problem or challenge.

# Professional Practice and work readiness

A component of this course, in addition to technical skills, is to assist you to become work ready. Here are some work ready skills that you can develop during this course.

Personal

|  |  |
| --- | --- |
| Developing resilience in facing challenges | Completing the weekly lab tasks develops these skills.  Tasks require overcoming challenges, assessing your skills, dealing with uncertainty, solving problems and having good time-management to meet deadlines.  You take responsibility for being motivated to complete the tasks and ownership of how you spend time in class. |
| Appraising own skills and the job tasks realistically |
| Tolerating ambiguity, uncertainty and pressure |
| Taking initiative |
| Employing field-specific reasoning to solve problems |
| Showing decisiveness in action |
| Developing time-management skills |
| Committing to deadlines and appointment times |
| Showing motivation to completing tasks |
| Taking responsibility |
| Owning decisions and actions |

Relational and connections

|  |  |
| --- | --- |
| Contributing and participating | Working with your classmates in pairs develops these skills. You have the opportunity to demonstrate that you can contribute as part of a team to solve problems and communicate with others.  Demonstrate this by taking part in classroom group discussions, being respectful of students from other cultures and assisting other students with their work. |
| Engaging in team-based problem-solving |
| Exhibiting solution-centred reasoning and problem-solving in context. |
| Contributing to group discussion |
| Active listening and reciprocal communication |
| Responding to feedback and communicating |
| Responsive to culture |
| Aware of the benefits of technology |

Sense making

|  |  |
| --- | --- |
| Novel thinking – thinking outside the square | The lab activities provide opportunities to encounter problems and find solutions to problems using adaptive and novel thinking. |
| Adaptive/design thinking –creative solutions |
| Coping with changes and challenging circumstances |
| Finding solutions and deal with problems |

|  |  |
| --- | --- |
|  | **Develop work-readiness skills – tests and exams**   * Tolerating pressure * Committing to deadlines and appointment times * Owning decisions and actions * Coping with challenging circumstances |

### Wintec Teaching and Learning Directions

Three principles define Wintec teaching and learning and will be present in all learning experiences. These are learner-centred, authentic and inquiry-based learning.

**Learner-centred teaching to promote authentic experiences**

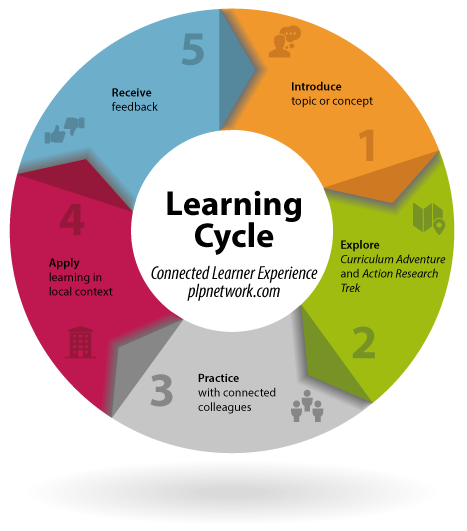
* Engages students in the hard, messy work of learning
* Includes explicit skill instruction
* Encourages students to reflect on their learning
* Motivates students by giving them control over their learning
* Encourages collaboration (Weimer, 2012)

**Authentic learning experiences which ensure work-readiness of graduates**

* An activity that involves real-world problems and that mimics the work of professionals.
* Use of open-ended inquiry, thinking skills and metacognition.
* Students engage in discourse and social learning in a community of learners.
* Students direct their own learning in project work.

**Inquiry-based learning and teaching which ensures learner engagement**

* learning stimulated by inquiry
* a learner-centred approach
* a move to self-directed learning
* an active approach to learning (Spronken-Smith, n.d., p. 1)



Theory

For the following activities, consult with your neighbour(s) and compare answers. You can download the Word document from Moodle and type your answers if you prefer.

## Activity 1 What is an operating system

**What is an operating system?**

|  |  |
| --- | --- |
| What do device drivers do? |  |
| What is a system call? |  |
| Why is multi-tasking important? |  |

**Operating system types**

|  |  |
| --- | --- |
| Give examples of operating systems used on battery powered devices |  |
| What are early examples of embedded operating systems |  |
| What are examples of modern devices with embedded operating systems |  |
| What are the features of a real-time operating system |  |
| What are examples of devices using a real-time operating system |  |
| What is a templated system |  |

**What is a multi-user operating system?**

|  |  |
| --- | --- |
| What are the key features of a multi-user operating system? |  |
| How does this differ from a single user operating system? |  |

## Activity 2. What are operating system internals?

An operating system manages the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The four essential managers are listed below. Use the spaces to take notes on what each of the four managers do.

|  |  |
| --- | --- |
| Name | Function |
| Process manager |  |
| Memory manager |  |
| Device manager (I/O manager) |  |
| File manager |  |

**Other managers**

Use internet resources to work out what these other managers do (collaborative, self-directed research).

|  |  |
| --- | --- |
| Network manager |  |
| Security |  |

## Activity 3. Special purpose operating systems

**Distributed**

Why is a distributed system needed? What are examples of who uses them?

|  |
| --- |
|  |

How does a distributed system work? What is the advantage?

|  |
| --- |
|  |

**Embedded**

What are examples of devices that contain an embedded operating system? List as many as you can.

|  |
| --- |
|  |

## Activity 4. Compare operating systems

In groups of 2-3, research the following operating systems and identify the key features listed below.

Use only the most recent/current version of each one (collaborative, self-directed research).

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Windows 10 Desktop (64 bit)** | **Windows Server 2016 Enterprise** | **MacOS (latest)** |
| Minimum amount of RAM required for operating system |  |  |  |
| Amount of (hard drive) storage for operating system |  |  |  |
| Name of manufacturer |  |  |  |
| Single user (one user at a time) or  multi user |  |  |  |
| Open source or proprietary |  |  |  |
| What type of hardware or devices do they run on |  |  |  |
| Where would get their applications from |  |  |  |
| What is the operating systems approximate market share |  |  |  |
| What is it generally used for/main or common use |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Android (Google version)** | **Ubuntu (latest desktop version)** | **CentOS (latest version)** |
| Minimum amount of RAM required for operating system |  |  |  |
| Amount of (hard drive) storage for operating system |  |  |  |
| Name of manufacturer |  |  |  |
| Single user (one user at a time) or  multi user |  |  |  |
| Open source or proprietary |  |  |  |
| What type of hardware or devices do they run on |  |  |  |
| Where would get their applications from |  |  |  |
| What is the operating systems approximate market share |  |  |  |
| What is it generally used for/main or common use |  |  |  |

Use the information you have gathered to answer the following questions.

|  |  |
| --- | --- |
| Which are multi-user operating systems? |  |
| Which requires the least amount of RAM? |  |
| Which requires the least amount of storage? |  |
| Which has the biggest market share? |  |

If your group does not finish this task in class, you should finish it for homework.

# Before you begin

The windows desktop and windows server labs teach the concepts of virtualisation. You will create a virtual copy of windows desktop, a virtual copy of windows server, and set up communications between them. You will also do activities where the host operating system communicates with the virtual machines. To conceptualise this, look at the image below.

|  |
| --- |
| Windows Desktop    Windows Server  Windows Host PC with VMWare |

## Storing your files

You have four options:

* Classroom removable hard drive
* Your own USB3 removable hard drive with at least 64GB free
* Your own 64 GB USB3 flash drive (provided it has a fast read/write speed)
* Your own laptop with at least 64 GB free

Approximate space requirements:

* Windows 20GB
* Windows Server 40GB
* Ubuntu 20 GB
* CentOS 20GB

Once completed and signed off, Windows and Windows Server files may be deleted to make space.

### classroom removable hard drive

1. Each student will be offered a removable drive. You will put your name on the label and store it in a box. These drives only work on the machines in this room and the two other labs with PCs with bays for the removable drives.
2. Open the latch and insert the drive, close the latch – you don’t have to lock it
3. Press the power button on the drive bay to power it on
4. If your PC is running. Shut it down and restart it. The PC will not “see” the removable drive until after you reboot.
5. Delete all the contents, or format the drive to remove any pre-existing files. Make sure you are not deleting anything from the PC’s hard drive!

### Your own external device

1. Plug this into a USB3 port (that is a blue one).
2. Plugging into the back of the PC might be safer – the ones on the top could damage your device by bending it if you rotate the PC into the frame of the desk.

A USB2 device is NOT fast enough. A USB3 flash drive needs a good read/write speed – cheap flash drives might not be fast enough.

### Laptop

1. You should have Windows Pro. Some labs do not work on Windows Home.
2. You need at least 60 GB of free space. Back up your work to another device after each class.
3. Enable virtualisation in the BIOS, you need 8GB RAM, fast multi-core CPU, Ethernet port.
4. Install VMWare Workstation.
5. Copy the ISO files for Windows Workstation, Windows Server and CentOS to your device BEFORE your scheduled class – they take a while to download, especially over wireless.

### Backing up your work

The files that you create will be used over several weeks.

Make sure that you make a backup of your files. It is up to you how you do this.

### Classroom information

* Software location: [\\itsw1\Public](file:///\\itsw1\Public)
* Login username: **internal\student**
* Login password: **router**
* Emergency PC login:  **.\localuser, password router**

Virtualisation

VMWare workstation software is required to create virtual (software) copies of operating systems. These operating systems run on your host computer without interfering with your host operating system – typically Windows.

We use VMWare Workstation Pro because two virtual operating systems need to run concurrently. VMWare Workstation Player (formerly VMWare Player) can only run one virtual operating system at a time.

These labs have not been tested on Mac laptops, but there is a version called VMware Fusion for the Mac if you want to purchase it and try. There is also VirtualBox for Mac which is free. The instructions in this lab manual are for VMWare workstation – if you are using different virtualisation software you will need to work out for yourself how to use it.

|  |
| --- |
| You can download and install VMWare Workstation Pro from **\\itsw1\Public\Other software** Select the latest version.  The login is **internal\student**, password **router**. |

Windows Desktop

Windows is the most common Desktop Operating System in use. Using the supplied instructions use VMWare Workstation to install a virtual copy of Windows 10, perform common windows configuration tasks, install programs and configure and demonstrate usage of Remote desktop.

|  |
| --- |
| Here is what we are going to do in this lab  1. Setup a virtual machine and install Windows    * Customise the virtual machine to run windows without impacting on the host PC’s performance.    * Install the Windows operating system    * Configure basic disk partition 2. Common Windows Tasks    * Perform common Windows everyday tasks    * Install Web browser    * Install Utility program and configure default program setting    * Show Computer specifications 3. Remote Desktop    * Setup and configure remote Access for your Virtual PC    * Connect to your virtual PC and perform assigned tasks.    * Log back into your virtual PC and verify that assignment tasks were completed successfully.    * Install Teamviewer and connect to virtual pc |

# section 1 - Windows virtual machine installation (4 marks)

Follow the instructions to setup a new install of windows. This takes about 30-40 minutes.

## Setting up a removable drive with Windows 10 in VMware

### Create a virtual machine

1. Start VMWare and select “New Virtual Machine” from the File menu
2. Leave it on “Typical”, and select “Next”.
3. Select “Browse”, and go to [\\itsw1\Public](file:///\\itsw1\Public)
4. In the Operating System ISOs folder, locate the ISO for Windows 10 x64, (1903 or latest 64 bit version) click on the file and select “Open”, then select “Next”.
5. Under “Personalise Windows” type your own name as the full name, leave the password blank. Click “Next” and then “Yes”.
6. For the virtual machine name, enter your own name.
7. Use “Browse” and select the location to store your files. This will be:
   * The internal hard drive (make sure it is turned on and you rebooted)
   * Your USB device, or your laptop hard drive
   * Make a folder to store your virtual machine in
8. Select Next. Set the disk size at 20GB and split the virtual disk into multiple files. Click next.
9. Make sure you choose “Custom” not “Upgrade”
10. In the settings for the VM:
    * Select “Customise Hardware”
    * Select “Network Adaptor”, then select “Bridged” and replicate physical network connection state
    * Select “Memory”, then make sure it is set to “2048” MB

The virtual machine will be created. If not, you missed the step to “press a key to install”. Restart the VM and watch for this step.

At the bottom of the screen it will say “Easy Install is installing Windows 10 x 64”. Installation should take about 15 minutes to complete. Start your virtual machine.

**Notes**

* *You shut your virtual machine down the same way you would normally shut Windows down*
* *If you need to return control to your main PC press* ***Ctrl-Alt***

### Answer the following questions.

1. Right click on your image name in the left menu and look at the Hardware settings.
2. Explain why we set the memory at the 2048 MB, and not more or less memory.

|  |  |
| --- | --- |
| Explanation: |  |

1. View the network adapter settings. Use Google to find out why we selected bridged and not NAT. (See VMWare help.)

|  |  |
| --- | --- |
| Explanation: |  |

1. Under Options, select Shared Folders. Read the screen and explain why this is set to disabled. Note, you will need to install VMWare Tools when prompted.

|  |  |
| --- | --- |
| Explanation: |  |

1. Where is the setting to synchronise the guest time with the host? It should be turned on.

|  |  |
| --- | --- |
|  |  |

1. What is the recommended method to shut down the Virtual Machine?

|  |  |
| --- | --- |
|  |  |

1. Locate the directory where your virtual machine files are stored. How much space is taken up by the files? How much of your 20GB is still free?

|  |  |
| --- | --- |
| Space used:  Space free: |  |

# Section 2 – Common windows tasks (3 marks)

Make sure you have internet access in your virtual machine. If not, then check your network adaptor settings are correct.

1. Download and install a different web browser (Firefox, Chrome or Safari).

|  |  |
| --- | --- |
| Completed Yes/No |  |

1. Download and install the free Adobe Reader DC and set the computer so that Adobe Reader DC is the default program for opening PDF documents.

|  |  |
| --- | --- |
| Completed Yes/No |  |

1. Locate and write down the specifications of your **virtual computer**.

|  |  |
| --- | --- |
| Processor  Installed RAM  Windows Specifications  Edition  Version  OS Build  IPv4 Address:  Subnet Mask:  Default Gateway: |  |

1. Locate and write down the specifications of your **host computer**.

|  |  |
| --- | --- |
| Processor  Installed RAM  Windows Specifications  Edition  Version  OS Build  IPv4 Address:  Subnet Mask:  Default Gateway: |  |

# Section 3 – remote access (3 marks)

## Remote Desktop

(Note – this will not work on Windows Home. You need Windows Pro)

1. Setup remote access from your host to your virtual computer. Use Google to find out how to do this.
2. Connect to your virtual computer from the Host computer using remote desktop. You need to enter the IP address of the virtual PC. Verify you can login using the student user account.
3. On the virtual computer desktop create a folder with your name – create a text document in the folder and enter the text “remote access”.
4. Disconnect from your virtual computer and then log back into your virtual PC. Check and verify that the folder and file you created in the previous step is present and on a new line enter the text “local access”.

|  |  |
| --- | --- |
| Completed Yes/No |  |

## Teamviewer

1. Locate, download and install Teamviewer onto both your host PC and your virtual Windows machine (note: use Personal/ no commercial use option
2. Connect to the virtual computer from your host computer and create a folder and file (like question 5 above).
3. Use Google to find THREE advantages of using Teamviewer over Remote desktop.

|  |  |
| --- | --- |
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1. What are THREE disadvantages of Teamviewer compared to Remote desktop?

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# Appendix

|  |
| --- |
| Shutting down the PC At the end of each class follow this process to remove your drive:   1. Shut down the PC – power completely off 2. Take the drive out and put away in the box – make sure it has your name on it. 3. Turn on the computer, if it does not start up properly and let you log in, then try again. If it won’t start up then let the tutor know, the technician will need to repair it before the next class. Do not leave without testing the machine still works!  Backup and restore your image Before you start backing up your files make sure the virtual machine is shutdown. Also, the backup process can take up to 10 - 15 minutes (for a USB3 drive) so make sure you allow enough time at the end of the class to do this. Back up your image  1. Insert your USB3 drive – make sure you have plenty of space 2. Copy the folder with your image to your USB3 device  Restore/Load the image to your device  1. Copy the backup directory to your hard drive 2. Open VMware and select “Open a Virtual Machine” 3. Browse to where you have copied the folder 4. Select the .vmx file then select “Open”   The machine will appear at the top of the list of available machines. Installing VMWare on your own device If you have your own device, you can install VMWare on it. This gives you more opportunity to work on assignments at home.   1. Go to <https://www.vmware.com/products/player> 2. Download VMWare. 3. Help for VMWare Workstation can be found on the web site.   All new devices should be able to run VMWare, but some older devices might not. Some devices need to have options enabled in BIOS to allow a virtual machine to run - you will need to check in your own BIOS and research on the internet how to do this if VMWare does not immediately run on your machine.  **On your device**   1. Copy the folder and files from your USB drive to the hard drive of your device. 2. Start VMWare and select "Open Virtual Machine" 3. Browse to where you have copied the folder and click on the only file that appears – e.g. Windows 10x64 |

Windows Server 2012

Windows Server is a group of operating systems developed by Microsoft. Windows servers are more powerful versions of Windows Desktop operating systems that are designed to handle enterprise networking, database, web, cloud and authentication services. Windows server is used in most medium – large NZ businesses, schools, universities and government organisations.

|  |
| --- |
| Here is what we are going to do in this lab   1. Install Microsoft Windows Server 2012 R2 2. Configure Networking 3. Install Active Directory services and account creation 4. Set up a DCHP server role 5. Setup a Simple Webserver 6. Create a Network Share 7. Set up auditing and logging 8. Configure a Client Workstation   Testing – the client can: (10 marks)   1. Log into the domain (4) 2. Gets a DCHP address (1) 3. See the IIS web page (1) 4. See the file on the network share (1) 5. Login events are logged on the server (1) 6. Questions answered (2)   Demonstrate all these tasks to the tutor to get your lab signed off.  Note that you can answer the questions at the end while your computer is busy with the installation processes, or later when you have finished the tasks. |

Before you begin – You will need

* Computer connected to the ITS network via Ethernet to access the ISO files
* Device to store your files on – the same one you used in the previous lab.
* Windows 10 client PC from the previous lab or a premade Windows 10 VM from here
  + [\\itsw1\public\virtual machines\](file:///\\itsw1\public\virtual%20machines\)

lab instructions

## 1. Install Windows Server 2012 r2

This time we will use a different method where we create the virtual machine, and install the operating system later, as a second step.

1. Open VMware player
2. Create a new virtual machine – Typical
   1. Click **I will install the OS later** (we will be performing a network installation)
   2. Windows Server 2012
   3. Virtual Macine Name – **yourname-server**
   4. 40GB Hard Drive, split into multiple files
   5. 2GB RAM
   6. Network Connection – **Bridged**
3. Make sure your machine is powered off before continuing – do not power it on yet.
4. In the hardware settings select CD/DVD, then select use ISO image file.
5. Browse to the directory where the Windows Server 2012 image files are stored in \\**itsw1\public**
6. Select the image, then **Open**.
7. Select **OK**
8. Power the virtual machine on, and Windows Server will start installing, follow the menus.
9. Use the generic key as follows

D2N9P-3P6X9-2R39C-7RTCD-MDVJX

1. Click on: **Windows server 2012 R2** standard **(Server with a GUI)**
2. Select Custom Install (not upgrade)

Read the screen and write down what you would get if you chose the alternative option.

|  |  |
| --- | --- |
|  |  |

1. Follow the installation wizard
   * Create a 5GB partition (approximately)
   * Create a 35GB partition (approximately)
   * Install Windows Server – takes approximately 10-15 mins

While you are waiting, Google the answers to the questions at the end of this section using your host machine. When prompted, create a user.

* + Username: **Administrator**
  + Password: **Router1** (or a password you will remember) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Login. Note Ctrl-Alt-Insert = Ctrl-Alt-Del

After login you will be presented with the server manager dashboard.

## 2. Configure Networking

On the dashboard, select Local Server. Here you will do some basic configuration.

1. Computer Name: **yourname** (you need to restart the server)
2. Timezone: **Auckland/Wellington** (the screen might not display the new setting immediately)
3. Find what Internet Time server it is set to synchronise with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

By default, your server is set to DHCP. Servers should have a static IP address so that PCs can reliably find them. In the classroom, each student needs to be on a different network!

1. Open a CMD window and use ipconfig/all to find your current IP address details and write them below.

IPv4 address: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Subnet mask \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Default gateway\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

DNS Servers: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Set a static IP address and default gateway. Find your way into the IPv4 address network settings for the Local Server.
   * IP address: **192.168.*n*.1** (*n* is your PC number, or one provided by the tutor)
   * Subnet mask: **255.255.255.0**
   * Default gateway and DNS settings can be left blank

In a business the network administrator would determine what addresses to use.

If you are on a home network, make sure that **n** is **not the same** as your home network.

Once you do this step, your server will be on its own network and will no longer communicate with the classroom network.

1. Use ipconfig to confirm your changes have been applied. If not – follow the instructions in the Word document in Moodle to repair this.

## 3. Install network services

You need to install some network services on your server – to make it more useful. Network services are what make a server different from a standalone workstation.

1. There is a menu at the top – select “**Add Roles and Features**” from the “**Manage**” menu.
2. Click “**Next**” , leave it on “**Role-based or feature-based installation**”, and click “**Next**” again.
3. Leave it on “**Select a server from the server pool**”, and click “**Next**” again.
4. You will see a list of Server Roles. Select
   * **Active Directory Domain services**, then **Add Features**
   * **DNS server** then **Add Features**
   * **DHCP** then **Add Features**

If you did not set a fixed IP address in a previous step you would get error messages here.

1. Click “**Next**” until you get to the screen “Confirm installation sections”, then click “**Install**”.
2. The installation process will take a couple of minutes, when it is finished select **“close”**.

## 4. Make your server a domain controller

1. Click on the notification flag (shown on the right).
2. Click on “**Promote this server to a domain controller**”.
3. Select “**Add a new forest”**
4. Enter a Root domain name, call it: **yourname.local** e.g. stewart.local , then click “**Next**”
5. Set the password to be: Router1 and click “**Next**”
6. DNS option: leave blank and click “**Next**”
7. Leave the default NetBIOS name and click “**Next**”
8. Leave the default paths for Database, Log files and SYSVOL folders. Although it refers to “C” drive, this is the area on your storage device allocated to your virtual machine. Click “**Next**”.
9. Review your selections and click “**Next**”
10. Read the pre-requisite checks, scroll to the bottom and look for the message “All prerequisite checks passed successfully”. Click “**Install**”
11. Restart the pc if prompted (if it does not do this automatically).

When it starts up, you will see AD DS, DHCP and DNS have been added to the list in Server Manager.

## 5. Create User Accounts in Active Directory

1. On the “**Tools**” menu, select “**Active Directory Users and Computers”**
2. Expand *yourdomain*.local.

These folders hold all the computers, users and groups in your network. The plain folders are the default containers. The other ones are called OUs (organisational units) these are custom made by the user.

1. Right click on ***yourdomain*.local** , select “**New**”, **Organisational Unit**”
2. and create a new OU called ***yourname* OU**
3. Right click ***yourname* OU,** select “**New**”, “**User**”.
4. Create a new user using your own initial and surname as the Display name (to avoid confusion later). e.g sjoyce.
5. Use **Router1** as the password or your own \_\_\_\_\_\_
6. Double click on the user. Select the **Member Of** tab. Select “**Add**” and type in Administrators in the dialog box. “**Click on Check Names**”, and select “**OK**”, and then “**OK**” to close the window.

## 6. Setup the dhcp server role

A DHCP server is a server on the network that allocates IP addresses, subnet masks, gateway addresses and DNS addresses to workstations on the network that make a DHCP request. For this to work you need to set up your server to act as a DHCP server. Earlier in this lab we set up the DHCP server role.

1. Click on **Start,** search for **DHCP**, right click to pin this to taskbar then open it.
2. Expand the left menu so you see IPv4 and IPv6
3. Right click on IPv4 and select “**New Scope**”, then “**Next**”
4. Enter your name for the scope e.g. **yournameDHCP** and any description, then “**Next**”.
5. Enter the following information.  **n** is the value you entered earlier in the lab.
   * Start IP address  **192.168.n.100**
   * End IP address **192.168.n.254**
   * Length **24**
   * Subnet mask **255.255.255.0**
6. **Click “Next”**
7. There will be no exclusions so click “**Next**”
8. Leave the default settings for the lease duration and click “**Next**”
9. Configure DHCP options: **Yes I want to configure the options now** and click “**Next**”
10. Router (default gateway), enter **192.168.n.1**, select “**Add**” and **click “Next”**
11. Doman Name and DNS servers. Leave the default setting and click “**Next**”
12. WINZ Servers. Leave blank and click “**Next**”
13. Activate Scope. Yes, I want to activate the scope now - click “**Next**”.
14. Click “**Finish”**

You will see message **Authorise the DHCP Server**

1. Click on “**IPv4”** in the left menu to expand it. Click on “**Scope”** to expand it. Click on “**Address Pool”**. Here you can see what you have set up. You can also look at “**Scope Options**”.

Underneath Address Pool is Address Leases. You will look at this later when you test that DCHP is working with your virtual workstation.

1. Minimise the DHCP window.
2. Click on the notification flag (shown on the right).
3. Click on “Complete **DHCP configuration**” then click “**Next**”.
4. **“Use the** following **user’s credentials**”, click “**Commit**”, then “**Close**”

Later you will set up your virtual workstation to connect to your server to get it’s IP address from the DHCP pool you have just created.

## 7. Setup a simple webserver

Windows Server can also be used as a web server for either internal or external use. Microsoft call this service IIS (Internet Information Service) and it can be used to provide a platform for hosting static or dynamic web sites. To install IIS perform the following steps.

Earlier in the lab was a section called “**Install Network Services**”, where you selected “**Add roles and features**”.

1. Use what you learnt earlier, to add the Web Server (IIS) services.
2. Keep all the default settings.
3. Open the web browser on your server, and type the IP address of the web browser into the address bar. You should see the default **Internet Information Services** webpage.

There are two common Internet Servers. IIS and Apache. Use Google to find out about these and compare them below.

## 8. Create a network share

File services is an important server role to allow users to store and access data centrally. A network share is a location that is made available to users to access files. An example of this is one you used earlier in this class - \itsw1\Public.

1. Right click on the start button and select “**Disk Management**”
2. Right click on the 5GB partition and select “**Format**” (you created this when you partitioned the hard drive during the virtual machine setup).
3. Give it a Volume label of “**yourname”**, and a File system of **NTFS**.
4. Leave the other settings at the default, and select “**OK**”
5. Close the Disk Management window and open “**File Explorer”**.
6. Expand “This PC” and navigate to the “**yourname**” drive.
7. Create a new folder called “**yournamePublic”**
8. Use Notepad to create a text document in this folder called **yourname.txt**
9. Right click on the folder and select “**Properties**”.
10. Select the “**Sharing”** tab. then “**Advanced Sharing**”
11. Click on the “**Share this folder**” checkbox and then “**Permissions**”
12. Allow “Everyone” Full Control, Change and Read permissions. Select “**Apply**”, then “**OK**”
13. Select “**OK**”, then “**Close**”.

Later you will test access from your virtual workstation.

## Summary

Here is what you have done so far:

* Installed a 2012 virtual server
* Configured the network settings
* Installed network services
  + Active Directory
  + DHCP
  + DNS
  + IIS
* Created a user
* Created a file share

## 9. Join the virtual SErVER and CLIENT to the same lan segment

You can use the virtual machine from previous lab. If you did not complete this lab you can copy the premade Windows virtual machine from [\\itsw1\public\vitual machines\](file:///\\itsw1\public\vitual%20machines\) to your drive.

You may need to connect VMWare workstation to your pre-made virtual Windows machine. Select “Open Virtual Machine”, browse to it’s location, select the .vmx file, then select “Open”.

To have a connection between the client and server we need to put our virtual machines on a private LAN segment. This will allow the client to access the DHCP server you installed on the server VM.

1. Make sure Windows client and Windows server virtual machines are shutdown.
2. On the server, right click and select “**Settings**”
3. Click on “**Network Adapter**”
4. Click “**LAN segment**” then “**LAN Segments**”
5. Select “**Add**” , leave the default name of “**LAN Segment 1**”, select “**OK**”
6. Select “**LAN Segment 1”** from the drop-down list.
7. Select “**OK**”.
8. Power the server on.
9. Repeat steps above to join the Windows client to LAN Segment 1, power it on and log in.

## 10. Join the client to the server domain

The client machine now needs to be joined to the domain you created when you built the server.

1. Open the Control Panel and select “**System and Security**”, then select “**System**”.
2. Under “Computer **name, domain, and workgroup settings”**, select “**Change settings**”
3. Select “Change”, to change the domain.
4. Type the name of your servers domain “**yourname.local”** and click **“OK”**

*(The current domain will probably be internal.rexnet.nz)*

1. At the prompt enter a username and password of a user who has privileges to join the domain (e.g. Administrator Router1)
2. Close the window and restart the workstation client when prompted.

If there are issues changing the domain try some basic troubleshooting.

* Can you ping between the client and server?
* What is the IP address for your client? Is it on the same subnet as the server? - ipconfig /all.
* Are they on the same LAN segment?
* Is DHCP working – check you received an IP address, is the client set to DHCP?
* Is the DNS server address set to 192.168.n.1 (the same as the setting on your server and workstation)?

## 11. Auditing, logging and security

Monitoring access is an important task in a corporate network.

1. Create a policy to log success and failure account logon events

You will find the settings in the **Tools menu**, under **Local Security Policy.** You should be able work out the next steps yourself.

## Test your work using the virtual client workstation

**Test your domain login and Active Directory Services**

1. At the login screen on the client select “**Other User”**
2. Enter **yourname.local\WStudent** (the user you created for the domain with your initial and surname) and your domain password **Router1**.

Reset your password on the server if you have forgotten it.

**Test your IIS web server**

1. View the default IIS webpage on your client VM

Enter the servers IP address into the web browser **192.168.n.1**

**Test your file sharing**

1. On the client virtual machine open the servers shared folder and show the text document that has your name in the title.

In File Explorer, type [\\yourname](file:///\\yourname) into the address bar (no spaces). Then open yournamePublic folder.

**Check DHCP is working**

1. Check that your client received its IP address from the DHCP server (on the server go to the DHCP server role and check for your client computer under IPv4 leases

**Check auditing and logging is working**

1. After logging in, see that this event is logged on the server.

**Demonstrate to your tutor that these tasks are complete.**

|  |  |
| --- | --- |
| Log in to domain on client (4) |  |
| IIS web page displayed (1) |  |
| Client accesses file on server (1) |  |
| DHCP is working (1) |  |
| Auditing and logging is working (1) |  |

## Questions

Use resources in Moodle, and Google, to research and find the answers to the following questions.

List all 4 versions of Windows Server 2012 R2. Describe what each one is ideal for.

|  |  |
| --- | --- |
| Edition name | Ideal for…. |
| F |  |
| E |  |
| S |  |
| D |  |

What is the purpose of an Internet Time server?

|  |  |
| --- | --- |
|  |  |

What is Active Directory Domain Services for?

|  |  |
| --- | --- |
|  |  |

What is DNS server for?

|  |  |
| --- | --- |
|  |  |

What is DHCP for?

|  |  |
| --- | --- |
|  |  |

What is an organizational unit used for?

|  |  |
| --- | --- |
|  |  |

What is the difference between the domain admin account and the builtin administrators group that you added your user to?

|  |  |
| --- | --- |
|  |  |

What is the advantage of using DCHP on a network for workstations, compared to static IP addresses?

|  |  |
| --- | --- |
|  |  |

|  |  |  |
| --- | --- | --- |
| What is one advantage and one disadvantage of IIS when compared with Apache? | | |
| Advantage: |  |  |
| Disadvantage: |  |  |

How would you view the success and failure logon event logs (where would you find them)?

|  |  |
| --- | --- |
|  |  |

Windows Server 2016

# migrate to windows server 2016 (5 marks)

If you get time in a future lab, or you have finished the server lab early, then you can upgrade your Windows Server 2012 to 2016. **You need to allow an hour for this.**

Detailed instructions are not supplied – you need to work out some of the details for yourself. Some things will break, you need to try and figure out how to fix them without tutor help.

Make a backup copy of your entire directory containing Windows Server 2012 before starting the backup. You need about 12 GB to do this.

* Open the virtual machine setting for the Server 2012 VM.
* In the hardware tab go to DVD and mount the Windows server 2016 ISO file located in the operating systems ISO’s folder.
* As we have active directory and DNS services running on the server we must run some commands to prepare it for the upgrade.
* Go to file explorer and right click - open the DVD, navigate to the support folder
* Hold the shift key and right click on the adprep folder, open command window here
* Run the command adprep /forestprep and adprep /domainprep
* Once you have successfully run the commands run the dvd setup to start the upgrade
* Choose the option to not install the updates now.
* Use this key: WC2BQ-8NRM3-FDDYY-2BFGV-KHKQY - this is a KMS client key, you can find them on google, these keys are used to activate windows on a network.
* Select the desktop experience version of windows.
* Select the option to keep personal files and apps
* Click confirm

The upgrade takes some time – you can do other work while this is happening. Demonstrate to your tutor that you have Windows 2016 installed to get signed off.

|  |  |  |
| --- | --- | --- |
| Would you recommend migrating to server 2016 from 2012?  Explain why, or why not? Use Google to check what other people think. |  |  |
| What broke? |  |  |

mac OS

So you have never used a Mac!? This lab will get you started so you won’t feel completely lost if you have to support one. (If you have your own Mac, this lab should be a breeze.)

|  |
| --- |
| Here is what we are going to do in this lab  1. Navigate the GUI and CLI interfaces 2. Use an application to complete a task 3. Manage files, folders and USB 4. Understand hardware and file system requirements 5. Locate and use applications and tools    * Finder      + AirDrop    * Dock    * Launchpad    * Dashboard    * Utilities      + Activity Monitor      + AirPort Utility      + Terminal      + System Information      + Boot Camp Assistant 6. Locate and explore configuration settings    * System Preferences      + Users and Groups      + Network      + Mission Control      + Dock      + Time Machine      + Power – Power Nap      + General - Handoff 7. Perform simple administrative tasks    * Terminate a frozen application    * Create and remove shortcuts and Dock icons |

Wintec has a suite of Macs in the hub for students to use. To complete this assignment, you will need to book in a 2-4-hour session.

While it is possible to look up most of the answers on the Internet, the experience of using a Mac is the point of this lab.

# section 1 basic navigation [4 marks]

## Installed Applications

1. Use the Finder to locate and list the installed applications.

|  |  |  |
| --- | --- | --- |
| What is the name of the application in Windows that is the equivalent of the Finder? |  |  |

## LaunchPad

1. Find and open the **Launchpad**.

|  |  |  |
| --- | --- | --- |
| Explain the purpose of the Launchpad |  |  |
| Explain what happens when you drag one icon on top of another. |  |  |

## Dashboard

1. Find and open the **Dashboard**.

|  |  |  |
| --- | --- | --- |
| Explain the purpose of the Dashboard. |  |  |

## The Dock

1. Modify the **Dock** by removing the “**Maps**” applications and adding the “**Calculato**r” Application.

|  |  |  |
| --- | --- | --- |
| What is the name of the Windows equivalent of the Dock? |  |  |

# section 2 basic configuraiton [4 marks]

## System Preferences

1. Find and Open the **System Preferences** window.
2. Open the settings for **Mission Control**, and open the help screen.
3. Open the settings for the **Dock** and adjust the settings to make the icons Large and automatically hide the Dock.
4. Open the settings for the **Time Machine** and open the **Options** window.
5. Open **Users & Groups, Login Items**. Add Safari to automatically open when you log in

|  |  |  |
| --- | --- | --- |
| What is the name of the Windows Application/Utility that is similar to System Preferences? |  |  |
| List the three types of backups the Time Machine does |  |  |

## Networking

1. Locate and open **Network** in System Preferences.
2. Open the Advanced menu of the active network.

|  |  |  |
| --- | --- | --- |
| What is the IP address and Subnet mask of your machine |  |  |
| What is the Router (Gateway) address |  |  |
| How would you change the Service order so that Ethernet is the preferred connection when others are available? |  |  |
| List ONE method to remove an icon from the dock |  |  |
| List ONE method to add an icon to the dock |  |  |

## Shortcuts (Aliases) and desktop background

1. Follow the steps below.
2. Using the **Finder**, make a shortcut (Alias) to the **PhotoBooth** application on the desktop and drag it near the folder with your name.
3. Start the **Photobooth** application. Use it to take a picture of yourself.
4. Export the picture and save it in your folder on the desktop. Name it “Photo of <yourname>.
5. Make the picture the desktop background

|  |  |  |
| --- | --- | --- |
| List the steps to SAVE a picture from Photobooth into your folder on the desktop (NOT DRAG AND DROP) |  |  |

## Utilities

1. Using the Finder, open the Utilities Folder. Locate the System Information utility. Take note of the model name and number, processor type and speed, memory and serial number.
2. In the Utilities Folder, locate and open the Activity Monitor, view the CPU tab:
3. In the Utilities Folder, locate and open a terminal window and type ls -l (to list the directory).

|  |  |  |
| --- | --- | --- |
| Describe what the AirPort Utility is for |  |  |
| Describe what the Boot Camp Assistant is for |  |  |

## Apple Menu

1. Select “**About this Mac**” from the **Apple Menu** and go to the **Storage** tab that shows the size of the disk and how much is free.

|  |  |  |
| --- | --- | --- |
| How much RAM is currently installed? |  |  |
| How much RAM does this model of Mac support? |  |  |

|  |  |  |
| --- | --- | --- |
| What is the most current released version of OS X (not beta)? |  |  |
| What are TWO file system types that you could use to format an external drive so it can be used on both Mac and Windows? |  |  |
| What is the minimum RAM requirements of the most current version? |  |  |
| How much storage does the current version of the operating system require? |  |  |

# Section 3: THEORY [2 marks]

|  |  |  |
| --- | --- | --- |
| Terminate a frozen application | | |
| What is the equivalent of Windows Ctrl-Alt-Del to open the “Force Quit Applications” window? |  |  |
| Navigation, interface and hardware | | |
| What are TWO methods to safely remove a USB? |  |  |
| What is Power Nap? |  |  |
| What is Air Drop? |  |  |
| Which application is Air Drop found in? |  |  |
| What is Handoff? |  |  |
| What is Mission Control? |  |  |

Android

Android is a very common consumer operating system for cell phones which many people will already be familiar with. However, Android has many other uses which will be less familiar.

This lab will explore how the Android operating system is used on many other consumer electronic devices and broaden your knowledge of Android.

|  |
| --- |
| Here is what we are going to do in this lab  1. Install an Android emulator on a Windows machine    * Research and select a free Android emulator    * Download and install your selected emulator    * Explore the settings    * Install Apps into the emulator from Google Play    * Explain Android security features 2. Explore how Android is used on consumer devices:    * Android Phone    * Android Wear    * Android Tablets    * Android TV    * Android Auto 3. Challenge questions    * Show an understanding of the upgrade process relating to proprietary and diverse hardware    * Show an understanding of how the operating system can be secured for use in the business environment. |

# Section 1 – Install an android emulator on a windows machine (3 marks)

## Research and select a free emulator

There are many Android emulators that you can download and run on a Windows or Mac device that supports virtualisation. You can run communications programs and sync with your mobile phone. Some let you control the virtual android interface from your phone. Search through popular emulators and choose one to download for this assignment.

|  |  |  |
| --- | --- | --- |
| Emulator name | BlueStacks |  |
| Why did you choose this emulator? | Familiar Name |  |
| How much disk space is required? | 4GB |  |
| What is the RAM requirements? | 4GB |  |
| What is a limitation of this emulator (what is something it can’t do)? |  |  |

## Download and install the android emulator

It may take some time for it to fully install and update itself with apps. You may need to rotate the screen after installation. Install your emulator to your host windows (not the virtual machine).

|  |  |
| --- | --- |
| Task | **Tick if task completed** |
| Use a browser to access the internet. | Yes |
| Go to the google play store and log in. | Yes |
| Set the background wallpaper to one of your choice | Premium Feature |
| Display the settings and select storage to display space available. | Yes |
| Locate and display the IP address, subnet mask, gateway and DNS server addresses (if permitted). | No networking settings |
| Locate and install your favourite free game. | Yes |
| Locate and install a file manager. | Yes |

Show your tutor that you have completed these tasks, then clean up by deleting your emulator from the machine (if it is a classroom machine).

## Explain Android security features

Explain THREE features of Android that help keep it secure. Use the internet to find relevant answers. Write about 15-20 words for each one.

|  |  |  |
| --- | --- | --- |
|  | security features |  |
| 1 | Find my device  A feature used to locate a lost or stolen device using the devices GPS function to pinpoint its location. This will stop thieves from stealing important information from the owner |  |
| 2 | Multi-factor authentication  Aside from accessing your device and apps with just a passcode, multi-factor authentication forces users to provide another set of identification like SMS code, fingerprint, or facial recognition scan. |  |
| 3 | Lock screen preferences  Includes features like smart lock that locks the phone when it detects itself leaving your hand. The lock screen can be locked using fingerprints a unique passcode lock. |  |

# Section 2 – research Android uses (4 marks)

Briefly describe **TWO** interesting relevant facts about each of the following uses of Android. Write the web page the information came from.

**Example**

|  |  |  |
| --- | --- | --- |
|  | *Android game console* |  |
| *1* | *Ouya was released in 2013 and discontinued in 2015 due to a lack of sales and considered a commercial failure.* [*https://en.wikipedia.org/wiki/Ouya*](https://en.wikipedia.org/wiki/Ouya) *(relevant place in the market)* |  |
| *2* | *Ouya had a quad-core 1.7 GHz ARM CPU, 1GB DDR3 SDRAM, 2 USB ports, 8GB storage, supported Ethernet and WiFi and was designed to connect to a TV with an HDMI cable.* [*https://en.wikipedia.org/wiki/Ouya*](https://en.wikipedia.org/wiki/Ouya) *(specifications = 1 fact)* |  |

|  |  |  |
| --- | --- | --- |
|  | Android Phones |  |
| 1 | **OnePlus**, is a Chinese [smartphone](https://en.wikipedia.org/wiki/Smartphone) manufacturer owned by [BBK Electronics](https://en.wikipedia.org/wiki/BBK_Electronics), which is based in [Shenzhen](https://en.wikipedia.org/wiki/Shenzhen), [Guangdong](https://en.wikipedia.org/wiki/Guangdong). It was founded by [Pete Lau](https://en.wikipedia.org/wiki/Pete_Lau) (CEO) and [Carl Pei](https://en.wikipedia.org/wiki/Carl_Pei) in December 2013. The company officially serves 34 countries and regions around the world as of July 2018. <https://en.wikipedia.org/wiki/OnePlus> |  |
| 2 | The company's first product was the highly anticipated [OnePlus One](https://en.wikipedia.org/wiki/OnePlus_One). It was unveiled on 22 April 2014, and was claimed as the "2014 Flagship Killer." The One had comparable, and in some ways better, specifications to other flagship phones of the year, while being sold at a significantly lower price at $299 for the 16 GB version or $349 for the 64 GB version.  <https://en.wikipedia.org/wiki/OnePlus> |  |

|  |  |  |
| --- | --- | --- |
|  | Android Wear |  |
| 1 | The **Huawei Watch** is an [Android Wear](https://en.wikipedia.org/wiki/Android_Wear)-based [smartwatch](https://en.wikipedia.org/wiki/Smartwatch) developed by [Huawei](https://en.wikipedia.org/wiki/Huawei). It was announced at 2015 [Mobile World Congress](https://en.wikipedia.org/wiki/Mobile_World_Congress) on March 1, 2015,[[4]](https://en.wikipedia.org/wiki/Huawei_Watch#cite_note-4) and was released at [Internationale Funkausstellung Berlin](https://en.wikipedia.org/wiki/Internationale_Funkausstellung_Berlin) on September 2, 2015.[[5]](https://en.wikipedia.org/wiki/Huawei_Watch#cite_note-twice-5) It is the first smartwatch produced by Huawei. <https://en.wikipedia.org/wiki/Huawei_Watch> |  |
| 2 | The watch uses a 1.2 GHz Qualcomm Snapdragon 400 processor. All versions of the Huawei Watch have 512MB of RAM and 4GB of internal storage, along with a gyroscope, accelerometer, vibration motor, and heart rate sensor. It supports WiFi and Bluetooth 4.1 LE, and no support for GPS locating. <https://en.wikipedia.org/wiki/Huawei_Watch> |  |

|  |  |  |
| --- | --- | --- |
|  | Android Tablets |  |
| 1 | The **Samsung Galaxy Tab** is a line of [Android-based](https://en.wikipedia.org/wiki/Android_(operating_system)) [tablet computers](https://en.wikipedia.org/wiki/Mini_tablets) produced by [Samsung Electronics](https://en.wikipedia.org/wiki/Samsung_Electronics). The first model in the series, the 7-inch Samsung Galaxy Tab, was presented to the public on 2 September 2010 at the [IFA](https://en.wikipedia.org/wiki/Internationale_Funkausstellung_Berlin) in [Berlin](https://en.wikipedia.org/wiki/Berlin).[[1]](https://en.wikipedia.org/wiki/Samsung_Galaxy_Tab_series#cite_note-Tim_Gideon-1) Since then several models have been released, including models with 7.7, 8.9 and 10.1-inch displays. The [Wi-Fi](https://en.wikipedia.org/wiki/Wi-Fi) versions of the tablet all include a [GPS](https://en.wikipedia.org/wiki/GPS) system while the 3G/4G tablets include cellular capability as well. <https://en.wikipedia.org/wiki/Samsung_Galaxy_Tab_series> |  |
| 2 | The original Galaxy Tab (which was renamed as the Galaxy Tab 7.0 with the release of the 7.7, 8.9, and 10.1) was introduced on 2 September 2010 at the [IFA](https://en.wikipedia.org/wiki/Internationale_Funkausstellung_Berlin) in [Berlin](https://en.wikipedia.org/wiki/Berlin).[[1]](https://en.wikipedia.org/wiki/Samsung_Galaxy_Tab_series#cite_note-Tim_Gideon-1) The Galaxy Tab was the first Android-powered tablet to be released.[[2]](https://en.wikipedia.org/wiki/Samsung_Galaxy_Tab_series#cite_note-2) It has a single-core 1 GHz [Exynos](https://en.wikipedia.org/wiki/Exynos) processor, and a 7-inch TFT LCD display with a resolution of 1024 x 600 pixels. <https://en.wikipedia.org/wiki/Samsung_Galaxy_Tab_series> |  |

|  |  |  |
| --- | --- | --- |
|  | Android TV |  |
| 1 | **XBR8** is a series of Sony **BRAVIA** LCD High Definition [Televisions](https://en.wikipedia.org/wiki/Televisions). They were released into the US marketplace starting in September 2008. <https://en.wikipedia.org/wiki/Bravia_(brand)> |  |
| 2 | The 46- and 55-inch models of the XBR8 series features an RGB [LED](https://en.wikipedia.org/wiki/LED) backlight system which Sony calls **Triluminos**. The new backlight system is claimed to provide a truer and higher color spectrum and allows this series of televisions to rival plasma displays in terms of dark blacks. This model also marked the debut of Sony's new video processor, the BRAVIA Engine 2 Pro. The display panel uses ten-bit processing and offers the 120 Hz MotionFlow technology.  <https://en.wikipedia.org/wiki/Bravia_(brand)> |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Android Auto | |  |
| 1 | Android Auto is part of the [Open Automotive Alliance](https://en.wikipedia.org/wiki/Open_Automotive_Alliance) that was announced on June 25, 2014, and is a joint effort between 28 automobile manufacturers, with [Nvidia](https://en.wikipedia.org/wiki/Nvidia) as tech supplier. It is available in 36 countries. <https://en.wikipedia.org/wiki/Android_Auto> |  |  |
| 2 | An Android Auto [SDK](https://en.wikipedia.org/wiki/Software_development_kit) has been released, allowing third parties to modify their apps to work with Android Auto;[[2]](https://en.wikipedia.org/wiki/Android_Auto#cite_note-cnet-2) initially, only [APIs](https://en.wikipedia.org/wiki/Application_programming_interface) for music and messaging apps would be available,[[10]](https://en.wikipedia.org/wiki/Android_Auto#cite_note-wired-10)[[11]](https://en.wikipedia.org/wiki/Android_Auto#cite_note-11) but it is expected that through Android Auto, the mobile device will have access to several of the automobile's sensors and inputs, such as GPS and high-quality GPS antennae, steering-wheel mounted buttons, the sound system, directional speakers, directional microphones, wheel speed, compass, mobile antennas, etc. Also, there is partial access to car data, a feature still under development. <https://en.wikipedia.org/wiki/Android_Auto> |  |  |

# Section 3 – android updates/android for work (3 marks)

This section requires you to locate and understand information relevant to the Android operating system.

Google have released an update of the Android operating system at least once a year since the initial release in 2008. However, the version installed onto existing devices is not typically updated in line with Googles schedule. Devices are updated much later, sometimes not at all. Other operating systems such as Windows, MacOS and Ubuntu are available for installation on any device as soon as they are released.

**Explain why existing Android devices are not updated with the new operating system version as frequently as new versions are released, and sometimes not at all.**

|  |  |
| --- | --- |
| The large range of android devices means that when a new version is released it requires editing to allow the OS to work on the intended device. This can take some time but if the device doesn’t included specific features or hardware it may become impossible or impractical to modify the OS to support this device. |  |

People often use an Android phone for work as well as personal use. “Android for work” provides enhancements for the enterprise that allows Android devices to have a work profile as well as a personal profile.

|  |
| --- |
| Manage your Android devices from one dashboard |

**Explain the features of a work managed device.**

|  |  |
| --- | --- |
| The entire device is managed so there is no need for an icon or profile separating apps or data since everything on the device is meant for work.  The device is controlled by the admin he can:   * Limit apps installed by whitelisting needed ones * Factory reset the devices if it doesn’t include a work profile * Admin defined network access (internet) * Optional defining login details for device |  |

Embedded operating system [EOS]

We are surrounded! Embedded operating systems are now commonplace and their use is increasing in consumer and industrial equipment. Budding programmers might consider programming EOS as a career.

* Household appliances – washing machines, microwaves, dishwashers
* Entertainment – MySky, Freeview, gaming consoles, MP3 players, DVD players, drones
* Transport – automotive vehicles, GPS, traffic lights
* Commercial industry – aerospace, defence, medical equipment

In this lab, you will use internet research to explore what embedded operating systems are, and how they are used.

|  |
| --- |
| Here is what we are going to do in this lab  1. Explore the features of an EOS    * Find out how an EOS is different from consumer operating systems 2. Explore the components of an EOS    * Inputs – sensors and human    * Outputs – actuators and status displays    * Real time processing 3. Explore how embedded systems are used on consumer appliances:    * Pick any device in your home and consider what the EOS does 4. Explore how embedded systems are used in the automotive industry    * Find out how many parts of a vehicle are controlled by computers 5. Explore how embedded systems are used in industry:    * Find and describe any two pieces of industrial equipment used in industry 6. EOS development platforms    * Programming embedded operating systems and the Internet of Things is a fast-growing industry. We briefly look at a proprietary and open source development platform. |

# Section 1 – features and components of an EOS [3 marks]

## Features of an EOS

What makes an EOS different?

Briefly describe FOUR main distinguishing features of an EOS that make it different from operating systems such as Windows, Android, iOS, MacOS and Linux.

|  |  |  |
| --- | --- | --- |
|  | features |  |
| 1 | Real Time Operation  The OS processes information in real time to process inputs to outputs faster |  |
| 2 | Memory management scheme |  |
| 3 | Scheduling scheme |  |
| 4 | Stand Alone  They are systems that can work by themselves and don’t require a host system |  |

## Explore the components of an embedded operating system

How does an EOS control machines and interact with humans? What is real time processing?

|  |  |  |
| --- | --- | --- |
| LIST THREE different types of input sensors that an EOS might use.  *(for example a thermostat)* | 1. motion  2.Light  3.Pressure |  |
| Describe how an EOS gets input from a human. | reactive operation which reacts to certain inputs like switches or sensors. |  |
| Briefly describe 2 types of actuators that an EOS may control.  *An actuator is a part of a machine responsible for moving or controlling part of a machine.* | 1.Motor  2.Pump |  |
| Describe a status display from an EOS that is human readable. | Linux has a Command Line Interface (CLI) so with use of specific commands we can interact with the system |  |
| In your own words, briefly explain what “Real Time Processing” means in practice. | Processes are completed faster resulting in an output nearly instantly after input |  |
| Give two examples of devices that requires Real Time Processing. | 1. Crash avoidance on a cars system (Tesla)  2. Robotic machinery to avoid damage and causing harm |  |
| Briefly explain what a Hard real-time system classification means. | The action has to be completed within a given time or the system will go wrong (traffic lights) since one mistake slowly compiles up to cause a big mistake (a delay of .01s adding up over time to 1s) |  |
| Briefly explain what a Firm/Soft real time operating system classification means. | The OS still needs to follow real time operating but leniency is allowed since the system never consecutively adds delays (a delay of 0.1s will always be 0.1s and not higher) |  |
| Give an example of a device with an EOS that uses Ethernet? | Raspberry pi |  |
| Give an example of a device with an EOS that uses WiFi | Android mobile phones |  |
| Give an example of a device with an EOS that uses cellular communication | Android mobile phones |  |

# section 2: how embedded systems are used [3 marks]

Select one consumer appliance that is typically found in a home and answer the questions below.

|  |  |  |
| --- | --- | --- |
| Type of device  *(e.g. washing machine)* | Game Consoles |  |
| Describe the inputs/user interface | Includes a controller for user input and a CD or Cartridge for data input |  |
| Describe the outputs | Uses inputs from the controller with the data to display a digital output on the LED display |  |
| Explain an aspect of this device that requires Hard real time responses and the consequences of missing a hard deadline  OR  Explain why soft real time is acceptable in terms of the consequences of missing a deadline. | Soft real time is used because the system doesn’t require perfect timing to function properly it only effects performance of the system under load |  |

## Explore how EOS are used in the automotive industry

Vehicles manufactured prior to 1980 were simply mechanical and prior to 1990 had very simple computer controllers.

Modern cars are computers on wheels. They are full of components that are controlled by an Electronic Control Unit (ECU) containing an embedded operating system. The ECU is connected to sensors, and the information collected is processed then used to control actuators.

|  |  |  |
| --- | --- | --- |
| List THREE components of a vehicles engine that are controlled by an EOS. | 1. sparkplugs  2.fuel injection    3.O2 sensors (fuel efficiency) |  |
| Explain ONE method that an ECU in a vehicle can output information to a human | Electronic dash replacing the analog one for wheel speed and fuel level |  |

## Explore how EOS are used in industry:

Select one different piece of industrial equipment that has an embedded operating system and answer the questions below.

|  |  |  |
| --- | --- | --- |
|  | industrial equipment |  |
| Name: | CNC Machine |  |
| What it does | Mill specific materials to obtain inputted design |  |
| Inputs | File including design of the outcome  X, Y, Z co-ordinates for milling |  |
| Outputs | Material milled to specs |  |
| Hard or soft RT requirements | Soft Realtime |  |

# section 3: EOS Development platforms [4 marks]

There are many Real-Time Operating System development platforms for programmers to build their own embedded operating systems. Select one open source and one proprietary system that is in current common use (not discontinued) and answer the questions below.

|  |  |  |
| --- | --- | --- |
|  | OPEN SOURCE development platform |  |
| 1 | Name: Mbed |  |
| 2 | Kernel type: uVisor |  |
| 3 | Language written in: C and C++ |  |
| 4 | Approximate size of Kernel: 256KB Flash 32KB SRAM |  |

|  |  |  |
| --- | --- | --- |
|  | PROPRIETARY development platform |  |
| 1 | Name: VxWorks |  |
| 2 | Kernel type: Monolithic kernal |  |
| 3 | Language/Compilers: C11/C++17, Python, Boost C++ Libraries |  |
| 4 | Example of product/use: **VxWorks** is **used** to control network and communication devices, test and measurement equipment, computer peripherals, automotive systems, avionics (aeronautics and astronautics) equipment and diverse consumer products. |  |

Ubuntu

Ubuntu is a popular distribution of the open source Linux operating system. This comes in both desktop versions with a GUI and server versions which is command line based.

This lab will explore the Ubuntu GUI and some of the everyday functions.

|  |
| --- |
| Here is what we are going to do in this lab  1. Install Ubuntu using VMWare    * Create the Ubuntu instance in VMWare workstation pro    * Configure document sharing    * Locate VMware files    * Configure guest time 2. Explore the Unity GUI:    * Launcher & Dash    * Workspaces    * Applications 3. Install applications    * Install applications 4. Configure Printing    * Successful printer configuration    * Show an understanding of IP addressing and hostnames |

# Section 1 Ubuntu Virtual Machine using VMWare Player [2 marks]

## Installation

1. VMWare Player is a useful utility for installing multiple operating systems. You will use this to install Ubuntu within a Windows environment. VMWare was used earlier in the course – refer to that section for detailed instructions.
2. Start VMWare
3. Click “Create a New Virtual Machine” from the write panel:
4. Choose “Installer disc image file (ISO)” option to use an ISO file.
5. There is an ISO file in the following path for Ubuntu: [\\itsw1\Operating\_Systems\Ubuntu](file:///\\itsw1\Operating_Systems\Ubuntu)\

* Ubuntu-18.xxxx-desktop-amd.iso (64bit for newer PC’s)

1. After choosing the ISO file, choose a name for your Linux instance e.g. yourname\_ubuntu

* Set the username and password as:
  1. Username: **student**
  2. Password: **router**

1. Choose a name for your VM that include your name in the virtual machine name and store it as “separate files” in a directory with your name. Choose 20 GB disk size**.**

## Configuration

Set the memory to the maximum recommended size – write the recommended size below.

|  |  |
| --- | --- |
| 6,336 MB |  |

Explain the effect assigning more memory has on the host **and** guest operating system

|  |  |
| --- | --- |
| Memory swapping occurs and is when memory that isn’t currently active is saved to a drive for restoring later. This severely impacts performance and may cause software crashes. |  |

After customizing the hardware and increasing the memory size, click on “close”, then the process of creating your virtual machine will start and you will be able to log in.

Find the setting to enter full screen mode after powering on.

|  |  |
| --- | --- |
| Achieved – Yes/No YES |  |

Write down the location of where the files for your virtual machine are stored.

|  |  |
| --- | --- |
| \Documents\Virtual Machines\Ubuntu 64-bit (2) |  |

Explain how you would take a backup of the virtual machine. (see earlier lab instructions)

|  |  |
| --- | --- |
| Copying the files in the stored directory and saving it to another location |  |

Synchronise the guest time with the host time – list the steps to do this and explain why you would want to do this in a business environment.

|  |  |
| --- | --- |
|  |  |

# Section 2 – Ubuntu Unity [3 marks]

Unity is the latest desktop GUI for Ubuntu. You will gain an understanding of some of the features of this utility.

What is the Launcher and how do you customise it?

|  |  |
| --- | --- |
| The launcher is the vertical bar on the left of the desktop it can be customized in the system settings > Appearance |  |

What are Workspaces used for and how would these be an advantage?

|  |  |
| --- | --- |
| They are used to reduce desktop clutter and improve desktop navigation. You can group together running applications into different windows in specific tasks allowing you to navigate to the workspace and have all the needed applications open. |  |

What application do you use to install additional software, where is this located?

|  |  |
| --- | --- |
| The ubuntu software application located on the left launcher by default |  |

How do you access the terminal and save this as a shortcut?

|  |  |
| --- | --- |
| On the bottom of the launcher is a show apps button. after that you can search for the terminal then right clicking the app and select add to favorites will add the terminal to the launcher |  |

# section 3 - Install software [3 marks]

* Go to <https://apps.ubuntu.com/cat/> and browse the apps directory
* Find a game that is compatible with your version of Ubuntu, download and install it. Write the name of your game below.

|  |  |
| --- | --- |
| Shattered Pixel Dungeon |  |

* Under the office section, locate, download and install LibreOffice productivity suite. Start the word processor and compare it to Microsoft Word. Comment on whether you would find it easy to use this new word processor.

|  |  |
| --- | --- |
| Similar to google docs |  |

# Section 4 – Configuring the Printer [2 marks]

To configure the printer, do the following steps. Note: The address of the printer in your room might be between 10.150.1.50 and 10.150.1.54. You can check the printers’ configuration menu or your tutor might give you the address.

1. Select the menu item **System🡪Administration🡪Printing.**
2. Click the **Add** button.
3. Under **Network Printer**, enter the address **10.150.1.*nn*** and click the **Forward** button.
4. At the **Installable Options** screen, click **Forward**.
5. Enter **E2.05 or E2.04** for the location (the name of your classroom); click **Apply**.
6. Select **Cancel** – don’t print a test page.
7. Open the printer icon, open the printer properties the print status should say “Idle”.

Explain why you used 10.150.1.*nn* and E2.04 or E2.05. What does this mean, what is the relationship between the address and name?

|  |  |
| --- | --- |
|  |  |

Linux Unhatched

Building on your introduction to the Linux operating system (Using Ubuntu which has a GUI) the Linux Unhatched tutorial will provide you with an overview of the everyday Command Line Interface (CLI) commands. This is the first step towards learning how to create Linux scripts and leads into the next activity where you learn Linux in more detail.

|  |
| --- |
| Here is what we are going to do in this lab  1. Complete the tutorial and exercises    * Linux command syntax    * Directory commands    * Permissions    * Moving and copying    * The use of grep    * Network configuration    * Processes    * Package Management    * Passwords    * Text editing with vi 2. Complete module assessment |

# Instructions

The NDG Linux Unhatched course is aligned to the Linux exam objectives in the CompTIA A+ certification - CompTIA A+: 220-902 Domain 2.1.

* This is part of the CISCO Networking Academy material which you should already have a logon for.
* Browse to: <https://www.netacad.com/>
* Select Login from the top right hand menu
* Go to **Courses** and select **NDG Linux Unhatched -1116**
* Under **Modules** go to **Course Content**
* Work through the course content and use the simulator on the screen to follow along with the activities
* Complete the Assessment. You can complete it more than once to get a better mark.

What was your chapter test mark? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Linux Essentials

To prepare for your graded Linux Shell Scripting assignment you will enrol in the free online Netacad course “NDG Linux Essentials” and complete specific modules. They are essential self-directed learning prior to attempting the shell scripting assignment and the CentoOS Linux assignment. Two weeks have been allocated for this, and you will also need to use your study time (approximately 18 hours total learning time).

There are 5 sections. Give yourself two marks for each section that you complete.

* This is part of the CISCO Networking Academy which you should already have a logon for.
* Browse to: <https://www.netacad.com/>
* Select Login from the top right hand menu
* Go to **Courses** and select NDG Linux Essentials, then self-enrol

This course aligns to the Linux Professional Institute (LPI) Linux Essentials Professional Development Certificate. You are free to complete the other modules in your own time.

You will work through the following modules and labs. Test your knowledge by attempting the short chapter exams. Times are approximate.

* + **Module 5 – Command Line Skills** (2 hours)
    - Variables
    - Globbing (wild cards)
    - Quoting
    - Basic Shell (BASH)
    - Command Line Syntax
    - Lab 4: Command Line Basics
      * Explore Bash features
      * Use shell variables
      * Understand how to use globbing
      * Use quoting
  + **Module 8 – Working with Files and Directories** (1 hour)
    - Using directories and listing files (absolute and relative paths, hidden files)
    - Creating, moving and deleting files
  + **Module 9 – Archiving and Compression** (1 hours
    - Files and directories
    - Archives (Tar)
    - Compression
    - ZIP files (like PC’s)
    - Lab 7: Create a tar archive
      * 7.2.1 to 7.2.5
  + **Module 10 – Working with text** (1 hour)
    - I/0 redirection
    - Basic regular expressions
    - Command Line Pipes
  + **Module 11 – Basic Scripting** (3 hours)
    - Basic Shell Scripting (including variables, conditions, loops)
    - Text editors (vi, vim, nano)
    - Lab 9: Basic Scripting practice
      * Use the vi editor to create and edit text files.
      * Create simple shell scripts.
      * Create shell scripts with conditional execution.
      * Use loops in the script for repetition.

|  |  |
| --- | --- |
| Write your marks in the table below and add them up. | |
|  | **Chapter test mark** |
| Module 5 |  |
| Module 8 |  |
| Module 9 |  |
| Module 10 |  |
| Module 11 |  |
| Total Marks |  |

Scaled to 15% \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ /3.33

You can now start on your Linux scripting assignment.

## key terms Reference

Key terms for each chapter are listed below.

|  |  |
| --- | --- |
| **Chapter** | **Key terms** |
| 4 | **PATH environmental variable**  The term path refers to a list that defines which directories the shell will look in for commands. If you type in a command and receive a “command not found” error, it is because the BASH shell was unable to locate a command by that name in any of the directories included in the path.  **bash**  The most commonly used shell for Linux distributions is called the BASH shell.  **echo**  Command that displays text, used to demonstrate globbing in chapter 4  **export**  After exporting variable1, it is now an environment variable. The export command can also be used to make an environment variable upon its creation.  **history**  To view the history list of a terminal, use the "history" command  **type**  The type command can be used to determine information about various commands |
| 6 | **ls -a**  To display all files, including hidden files, use the -a option to the ls command.  **ls -d**  When the command ls -d is used, it refers to the current directory, and not the contents within it.  **ls -l**  You can view the ownership of a file with the -l option to the ls command.  **mkdir**  The mkdir command is used to create a directory.  **mv**  To move a file, use the mv command. The syntax for the mv command is much like the cp command. When a file is moved, the file is removed from the original location and placed in a new location.  **recursive listing**  There will be times when you want to display all of the files in a directory as well as all of the files in all subdirectories under a directory. This is called a recursive listing. To perform a recursive listing, use the -R option to the ls command.  **rm**  To delete a file, use the rm command. The files will be permanently deleted  **rmdir**  You can also delete a directory with the rmdir command, but only if the directory is empty.  **touch**  The touch command is used to create an empty file. The touch command doesn't place any data within the new file. |
| 7 | **common tar options**  Creating an archive requires two named options. The first, c, specifies the mode. The second, f, tells tar to expect a file name as the next argument. Additionally, the t option lists files in the archive. Finally you can extract the archive with the –x flag.  **gzip**  Linux provides several tools to compress files, the most common is gzip. The gzip method uses the .gz file extension.  **tar**  The traditional UNIX utility to archive files is called tar, which is a short form of TApe aRchive. Tar takes in several files and creates a single output file that can be split up again into the original files on the other end of the transmission. |
| 8 | **cat**  A file can be viewed with the cat command.  **cut**  The cut command can extract columns of text from a file or standard input. A primary use of the cut command is for working with delimited database files.  **grep**  The grep command can be used to filter lines in a file or the output of another command based on matching a pattern.  **head**  If you want to view a select number of lines from the top of the file, you use the head command.  **less**  The less command: This command provides a very advanced paging capability. It is normally the default pager used by commands like the man command.  **sort**  The sort command can be used to rearrange the lines of files or input in either dictionary or numeric order based upon the contents of one or more fields.  **tail**  If you want to view a select number of lines at the bottom of a file, you use the tail command.  **wc**  The wc command allows for up to three statistics to be printed for each file provided, as well as the total of these statistics if more than one filename is provided. By default, the wc command provides the number of lines, words and bytes (1 byte = 1 character in a text file). |
| 9 | **#! (shebang)**  The shebang is used for traditional shell scripts and other text-based languages like Perl, Ruby, and Python. Any text file marked as executable will be run under the interpreter specified in the first line as long as the script is run directly.  **/bin/bash**  Absolute path used in scripts to indicate the bash shell.  **Exit status**  An exit code of 0 means “everything is OK”. Exit codes greater than 0 mean some kind of error happened, which is specific to the program.  **argument**  You can pass arguments to your script. A dollar sign followed by a number N corresponds to the Nth argument passed to the script.  **echo**  Command that displays text, used to demonstrate globbing in chapter 4  **for loop**  For loops are used when you have a finite collection over which you want to iterate, such as a list of files, or a list of server names.  **variable**  A very simple use of variables is to assign some text to a variable. To assign to a variable, just use the name of the variable. To access the contents of the variable, prefix it with a dollar sign. |

CentOS Linux

CentOS is a Linux server operating system (like Windows Server). It is popular for Web Hosting.

CentOS is a community-supported Linux distribution based on Red Hat Enterprise Linux (RHEL). CentOS Linux is no-cost and free to redistribute.

|  |
| --- |
| Here is what we are going to do in this lab  1. Install CentOS to a virtual machine (2 marks) 2. Initial configuration of a CentOS server (2 marks) 3. Create users, groups, home folders, and permissions (2 marks) 4. LAMP – Linux, Apache, MySQL, PHP webserver installation (2 marks) 5. Answer some questions relating to CentOS (7 marks) |

## lab instructions

You will install CentOS (which contains the GNOME GUI) and then perform basic configuration and some simple exercises using the terminal (command line only).

This assignment will have components that will draw on the knowledge gained in the last few Linux assignments. The instructions are basic so that you must use critical thinking to complete the activities.

Modules 13, 14 and 15 in the Netacad Linux Essentials course will help you with more detailed information relating to the tasks in this assignment.

**Using the up-arrow keys on the keyboard to scroll through previous commands saves you a lot of typing in this assignment!**

# section 1: Install CentOS 7 (2 markS)

Open vmware > Create a new virtual machine and install CentOS 7 from an ISO file

There is an ISO in the “operating Systesm ISO’s” folder on the rexnet computers, alternatively you can download from the internet. **Use the DVD ISO as it has the GNOME desktop package included.**

1. Use default settings for the VM except for ticking the following under software selection
   1. Gnome desktop
   2. Gnome applications
2. Install the OS (30 minutes or more depending on drive speed)
3. Set Root password to **router**.
4. Create a user for yourself (student and router is fine!)
   1. Username \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. Password \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Set the network adaptor to bridged in the settings
6. Maximise the CentOS screen and click the “Pin” to hide the VMware command bar.

## Explore the GNOME desktop

**Note: If you did not select the version with a Gnome desktop, and install the Gnome desktop – you will have to reinstall CentOS!**

1. On the Gnome “Getting Started” screen, explore the getting started and common tasks on the help screen to get familiar with the interface. You will see similarities with the MacOS GUI.
2. The icons in the top right-hand side of the screen are where you can see your network settings, and get into a control panel called “All Settings”.
3. You can turn the screen lock off in privacy settings.
4. Open the “Home” folder and explore the menus.
5. Click on “Applications” in the top left corner of the menu bar. Explore the applications.
6. Use the web browser to make sure you have internet access.

# section 2 Initial configuration [2 markS]

## Set the hostname

Right click on the desktop and click open “Terminal”. This gets you into the CLI.

1. Find the hostname of your server: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**hostname**

1. Change the hostname of your server to CentOS-*yourname*

**hostnamectl set-hostname *<hostname>***

1. Use the hostname command again to see if the hostname has changed.

## Set a static IP address

Servers need a static IP address so they can reliably be accessed remotely. To change the IP address from DHCP to a static IP address you need to install net tools on the server. CentOS uses the same package manager as RedHat which is the “yum” package manager. The sudo command gives administrator rights. Make sure your CentOS network settings are not set to NAT.

1. Install the “net-tools” package. **sudo yum install net-tools**
2. Check what your current IP address is and make sure it is on the same network as your host.

**ifconfig**

Interface name: ens33 IPv4 address: 192.168.127.132

(the interface name is to the left with a colon:, not the lo: one)

1. Confirm you can access the internet by pinging google.com. Ctrl-C will cancel the command which continues until you ask it to stop.
2. Install the NetworkManager package. **sudo yum install NetworkManager**
3. Open the Network Manager Text User interface **nmtui**
4. Use the keyboard to navigate - select your ethernet interface
5. Set the ipv4 configuration to manual and enter the information below (get the x value from your tutor – each student MUST use a different address)

IPv4 Address = **10.150.5.x/20** (ask your tutor for **x**)

Gateway = **10.150.1.1**

DNS Servers = **10.150.1.100, 10.150.1.101**

1. Restart the network service **service network restart**
2. Use **ifconfig** to confirm your new settings.

|  |
| --- |
| **Error messages**  On some machines these settings will not allow you to save. If this is the case, leave your IP address set to automatic and use ifconfig to find what your address is. |

|  |
| --- |
| **Wintec wireless network**  Unfortunately, you are unable to manually set the IP address on the Wintec wireless network, since we do not know what addresses are available.  You will need to leave your IP address set to automatic and use ifconfig to find your address. |

|  |
| --- |
| **At home**  You will need to change the IP addresses to match your network. If this is too hard set it to automatic and use ifconfig to find what your address is.  Example of addresses at home which will depend on your ISP – check your host settings with ipconfig/all to find out the gateway and DNS server.  Address **192.168.1**.250/**24** (if 250 is not being used on your network)  Gateway **192.168.1.1** (usually)  DNS server (depends on your ISP)  You can find out what addresses are free by pinging it (try addresses starting at 250 and work backwards one at a time). If you don’t get a reply, the address is free (for now). |

# section 3 users and permissions (2 marks)

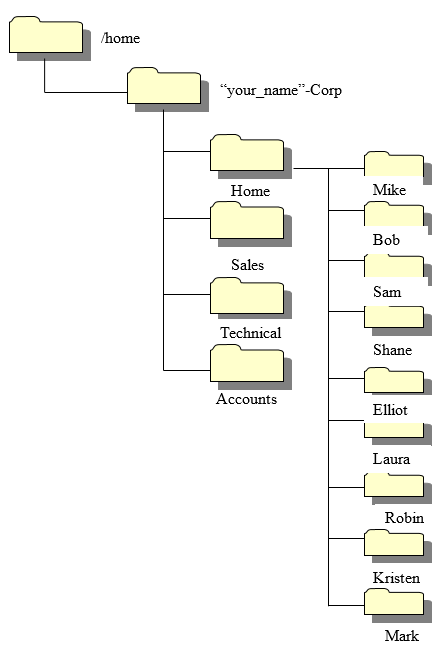
## Connect to the server from Windows

Now that you have created the CentOS server, you will use a terminal emulator to connect to it from the Windows host PC, just like you would in a business network.

1. Download PuTTY to your Windows host from the internet. Run PuTTY.
2. Type the IP address of your server and login

## create the directory structure

Create a new Company directory structure like the diagram shown below. Remember Linux is case sensitive. You learnt how to create directories in a previous lab.



Make sure you start in the /home directory by using the **pwd** and **cd** commands

Create your company folder first, then the subdirectories. ‘sudo’ is required as we are creating the directory structure in a folder that is not under our users’ home directory (and we need to use the rights of the root/super user)

**sudo mkdir *yourname*-corp**

To view the results:

1. Install the tree package **sudo yum install tree**
2. Navigate to the /home directory and run the command: **tree *yourname*-Corp**

## Create groups

Create 3 groups called Sales, Accounting and Technical. Use the group ids 501, 502 and 503.

e.g. **sudo groupadd –g 501 Sales** *(this is an example – not the right answer)*

This creates a group called sales and assigns a group identifier (gid) of 501 to this group. The gid must be greater than 500. Each group needs a different gid.

If you make a mistake you can delete the group: **sudo groupdel** *groupName*

To check that these groups have been created use the command: **cat /etc/group** to display the contents of the group file onto the screen. You will notice that your newly created groups appear at the bottom of this list.

## assign groups to directories

By assigning the groups to directories, we will be able to put our users into the groups, and control access to directories via those groups.

1. Navigate to the yourname-corp directory
2. Assign the Sales, Accounts and Technical directories to the groups you created earlier.
3. Use the command: **sudo chgrp <groupname> <foldername>**

e.g. **sudo chgrp Accounting Accounts**

Do the same with the Technical and Sales Folders (not the home folder)

## Setting GROUP access rights

Set access rights for folders you have created. The image below helps explain the rights.

|  |
| --- |
|  |

Using the information above, work out what number represents the rights required. Write the answer in the Rights column. Note that a user must have execute (X) rights to change into a directory.

|  |  |  |
| --- | --- | --- |
|  |  | **Rights** |
| Sales folder | Owner has full access |  |
|  | Sales group has full access |  |
|  | Public have read only access. |  |
| Technical folder | Owner has full access |  |
|  | Technical group has full access |  |
|  | Public have read only access |  |
| Accounts folder | Owner has full access |  |
|  | Accounting group has full access |  |
|  | Public have no access |  |

The syntax is:

**sudo** **chmod <###> <path/folder>**

The first # is for Owner rights, the second # is for Group rights and the final # is for the rights of every other user (Public) for this folder. The number for each hash will be between 0 and 7.

For example: **sudo chmod 751 Sales**

The **ls –l** command displays a list of folders and rights, owner, group and other details. Use it to confirm your changes.

|  |  |
| --- | --- |
| List the rights that you set below |  |
| Sales | rwxrwxr-- |
| Technical | rwxrwxr-- |
| Accounts | rwxrwx--- |

## Create users

Create a new user account and associate with a group using the following command:

**sudo useradd –g 501 Mike**

The Mike user account will be created and assigned to the sales group (which has a gid of 501)

Do this for all the users paying careful attention to the group that they are assigned to.

Check that they are assigned to the right group by using the following command:

**groups *username***

Create the following users and assign them to the appropriate groups.

Sales

* Mike
* Bob
* Sam

Accounts

* Robin
* Kristen
* Mark

Technical

* Shane
* Elliot
* Laura

## Set users passwords

Use the following command to set the password for each user to **router**

**sudo passwd *username***

Use the following command to list the users and encrypted passwords

**sudo cat /etc/shadow**

## Give users ownership of their own directories

Use the chown command to change the owner of a folder:

**sudo chown <username> </path/to/folder/foldername>**

For example, to change the owner of mike’s home folder use:

**sudo chown Mike /home/your company/Home/Mike**

You can also change to the Home directory and type a shortened command

**cd /home/your company/Home**

**sudo chown Mike Mike**

Use **ls –l** to see the owner of the home folders

1. Change the owner of each of the users’ home folders so that they own their own folder (current owner is root)
2. Change the rights of each users’ home directory so that each user can only see the contents of their own home directory (use chmod and check the rights with ls -l).

# Testing

1. Use a new putty session to connect to the CentOS Linux server. Login as Mike with router as the password.

|  |  |
| --- | --- |
| Can Mike access and make a new directory his home directory? | **Y**/N |
| Can you make a directory in the sales folder? | **Y**/N |
| Can you make a directory in the technical folder? | Y/**N** |
| Can you access the Accounts folder? | Y/**N** |
| Can Mike access Anyone’s home directory apart from his own? | Y**/N** |

If any of your tests have problems you will need to switch back to your main users’ session and make sure the rights are correct.

Troubleshooting

* groups List what groups a user belongs to
* ls -l Directory permissions (does the user have x access to cd into the directory?)
* id *username* Another way of listing what groups someone is in

1. Now test the system with Shane (Technical Group) and Robyn (Accounting Group) and fill in the following tables (with ticks or crosses) the first line has been done for you.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Groups** | **Users Home Folder** | **Bob’s Home Folder** | **Sales**  **folder** | **Technical folder** | **Accounts folder** |
| Mike | **✓** | **X** | **✓** | **✓** | **X** |
| Shane | **✓** | **X** | **✓** | **✓** | **✓** |
| Robin | **✓** | **X** | **✓** | **✓** | **X** |

# section 4: lamp (linux, apache, mysql and php) web server (4 marks)

LAMP is an [open source](http://searchenterpriselinux.techtarget.com/definition/open-source) Web development platform that uses [Linux](http://searchenterpriselinux.techtarget.com/definition/Linux) as the operating system, [Apache](http://searchcio-midmarket.techtarget.com/definition/Apache) as the Web server, [MySQL](http://searchenterpriselinux.techtarget.com/definition/MySQL) as Database and PHP as the scripting language.

1. Install the LAMP stack on your CentOS server **yum install httpd**
2. Start the service running **service httpd start**
3. Check the status is running **service httpd status**
4. Configure the firewall

**firewall-cmd - -permanent - - add-service=http**

**systemctl restart firewalld**

1. Using a browser on the windows host, browse to the IP address of the server – if everything was completed correctly you will see a ***Testing 123..*** page.

# section 5: questions (5 marks)

Some answers require just a couple of words. Explain, Describe, List, questions require full sentences.

|  |  |  |
| --- | --- | --- |
| Describe one CentOS Advantage over Ubuntu | Better for a business because more secure and stable because less frequent updates |  |
| Describe one Ubunutu Advantage over CentOS | Ubuntu has more support for software and easier to manage |  |
| What mode are you in if you have the “$” symbol at the terminal? | User mode. When you open the terminal as a normal user |  |
| What mode are you in if you have the “#” symbol at the terminal? | Administrator mode. After running su in the terminal and inputting password |  |
| Describe what the net-tools package provides? | Access to information about network connections and management tools |  |
| List 2 differences between the Linux file structure and the Windows file structure | Windows users FAT and NTFS . linux is bootable from a network drive |  |
| Explain why you should disable root SSH login? | It makes it much harder for someone to gain privledged access |  |
| Describe the directory permissions for the command CHMOD 777 | This gives full access to all user types Owner, Group and Public |  |
| Describe the directory permissions for the command CHMOD 755 | Owner has full access and both group and public have read and execute permissions |  |
| Describe the directory permissions for the command CHMOD 700 | Owner has full access while group and public users have no access |  |
| Explain what the LAMP software bundle is | Sufficient to host a variety of web site frameworks. It’s a web service stack |  |
| Describe what would you find in the /etc/ folder? | System configuration files |  |
| What is the CentOS package manager called? | Yellow dog updater (YUM) |  |
| What is the main desktop user interface used by CentOS? | Gnome |  |

END OF LAB MANUAL