Land Information New Zealand (LINZ) SALT Database

Migration from original hardware to virtualised hardware: Process Documentation

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1. Background

Land Information New Zealand (LINZ) recently transferred a large set of paper records to Archives New Zealand. Those records used to be indexed and made discoverable by a database system called SALT (Simple Access to Land Titles). Most of the data from this database was migrated out and used in other systems however the database was still a useful tool for making the paper records discoverable. The database consists of an MS SQL server backend running on Windows 2000 Server with a custom html front-end.

Archives New Zealand was given the option of taking the original database hardware to try to recover the database from by migrating the whole desktop to virtual hardware. The database hardware that was transferred to us was a Windows 2000 server tower with a 10 GB and 40 GB hard drive in it. The 40 GB drive only held the MSSQL data, the 10 GB drive held all other data and software.

This document outlines the process used to move the server desktop from the original hardware to virtualised then emulated hardware for long term preservation and access.

2. Imaging the hard disks

The first step in migrating the SALT database server to virtual hardware was to make image files from the hard drives in the machine.

There were two options that were considered:

1. Non-invasive disk imaging. This involves booting an operating system on the original hardware that runs only in ram, leaving the hard disks free to be copied to another machine over a network cable connection.

2. Removing the hard drives and connecting them directly to another machine using direct IDE or indirect USB connections.

The first option was not possible in this case as the original hardware had been damaged while being transported between Auckland, Hamilton and Wellington. The motherboard was damaged to such an extent that the computer would not boot at all.

The second option was therefore select and the disks were removed from the machine and attached to the virtual hardware "host" machine using an IDE-USB convertor connector.

The host machine was a Linux server running Ubuntu 10.04 LTS that had the "dd" and "ddrescue" programs installed on it.

The dd (disk dump) program was then invoked to create an image of each hard drive in turn using the following command:

"dd if=locationOfConnectedDrive[e.g. /dev/sdb] of=locationToPutImageAndFileName.img"

This was successful with the large 40 GB drive but failed on the 10 GB drive. The 10 GB drive appeared to have damaged sectors on it. In order to make an image of this drive the “ddrescue” program had to be used by invoking the following command:

“ddrescue locationOfConnectedDrive[e.g. /dev/sdb] locationToPutImageAndFileName.img”

This program was successful at making an image file from the hard disk.

3. Convert to VMware compatible disk images (vmdk)

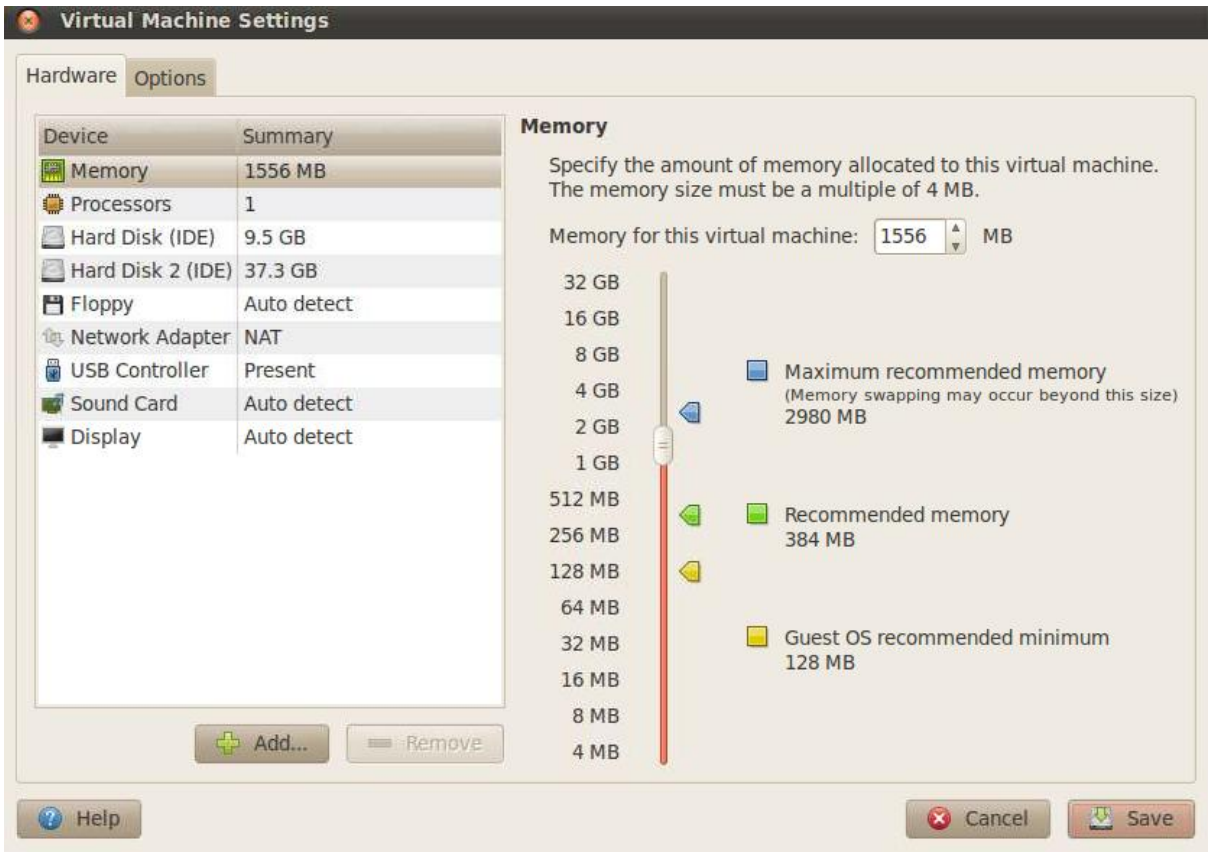
In order to make the images compatible with VMware the content had to be migrated to image files of a different format. This was achieved by using the qemu-img program by invoking the following command:

“qemu-img convert -O vmdk originalImagePathAndName.img convertedImagePathAndName.vmdk”

For large images this can take hours and can be left to process. For the 40 GB drive it took approximately 1 hour.

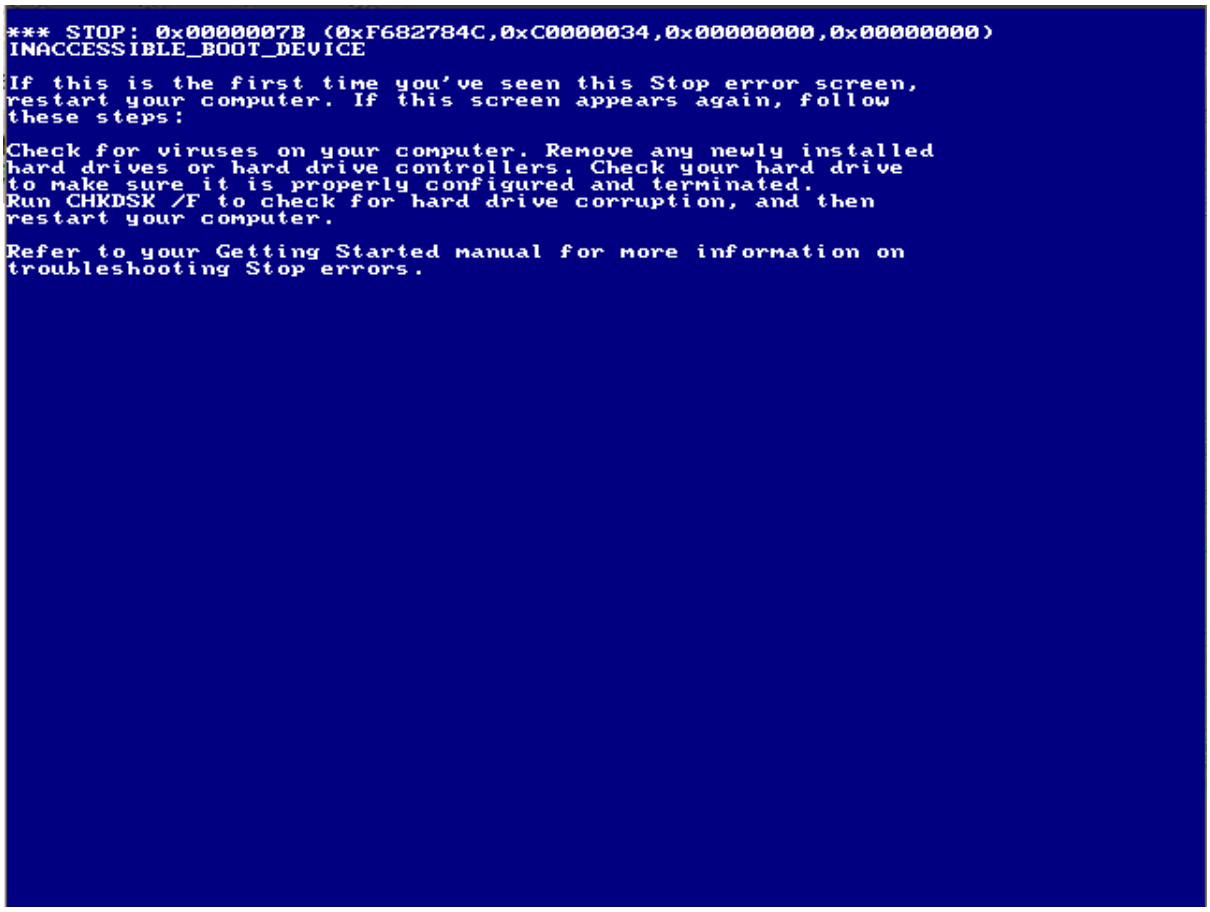
4. Setup VMware machine

The VMware machine had to be configured for a Windows 2000 Server Desktop. This was done automatically in VMware once the disk image had been attached. VMware automatically identified it as holding a Windows 2000 installation. The only alteration made to the configuration was to increase the ram to 1.5 GB from the default of 256 MB.



5. Test booting of virtual machine

Once the VMware machine has been configured it can be tested by selecting “play virtual Machine”. This will boot the virtual hardware. Upon booting the SALT machine a “blue-screen” error was eventually encountered specifying an “inaccessible boot device”:



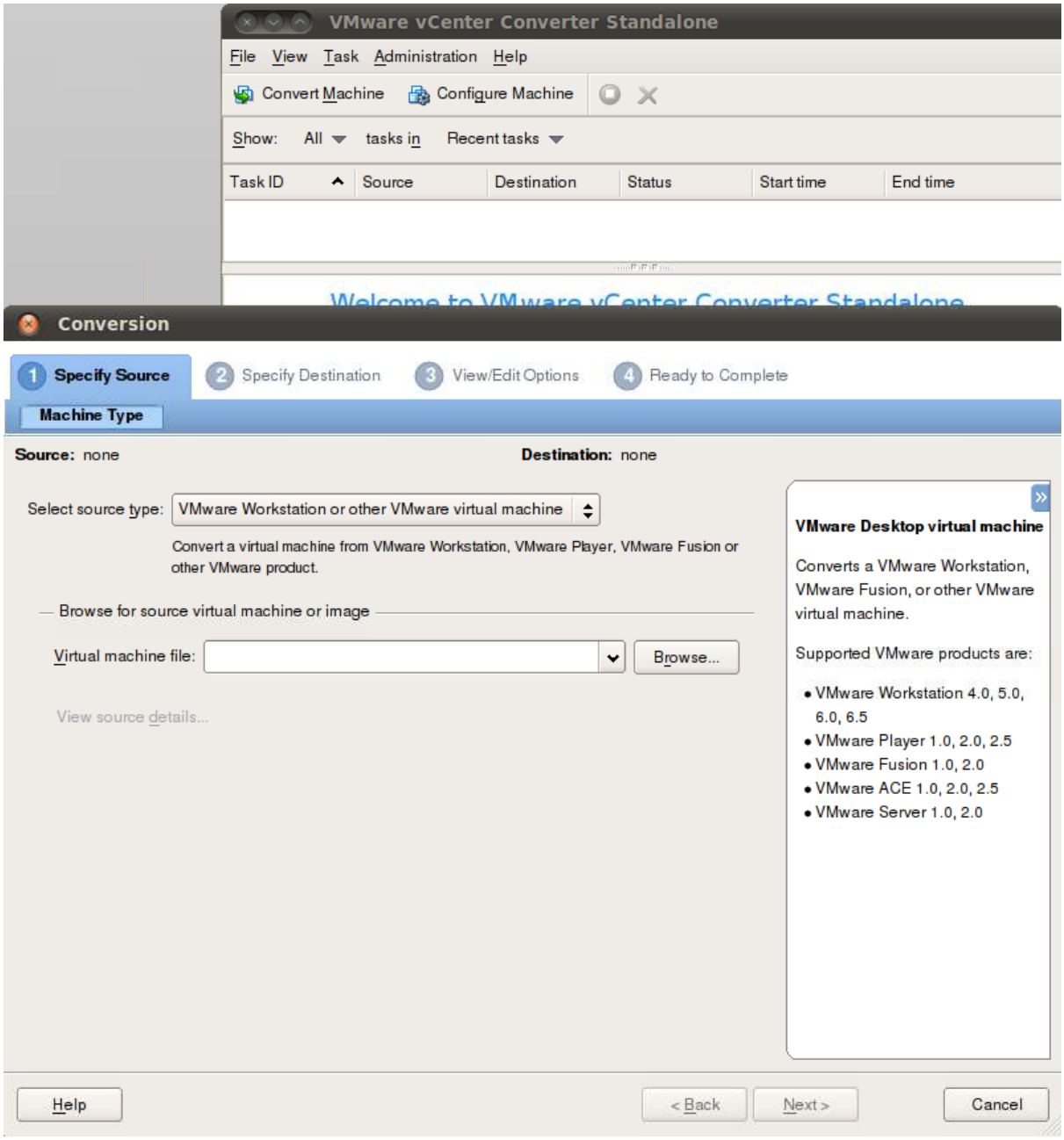
This is a problem with windows 2000 & Windows XP machines that is associated with their Hardware Abstraction Layers. It can be fixed by running a small program “mergeIDE” on the original hardware before migrating it to virtual hardware[1]. This program is available here:

https://www.virtualbox.org/attachment/wiki/Migrate_Windows/MergeIDE.zip

As the original hardware was damaged and unable to boot this solution could not be used.

Research identified that the free VMware vCenter Convertor tool would be able to fix this problem by converting the pre-configured machine to a compatible machine for the current version of VMware. This program was downloaded and installed and was successful at converting the Virtual Machine:

[1] Found via this page: https://www.virtualbox.org/wiki/Migrate_Windows



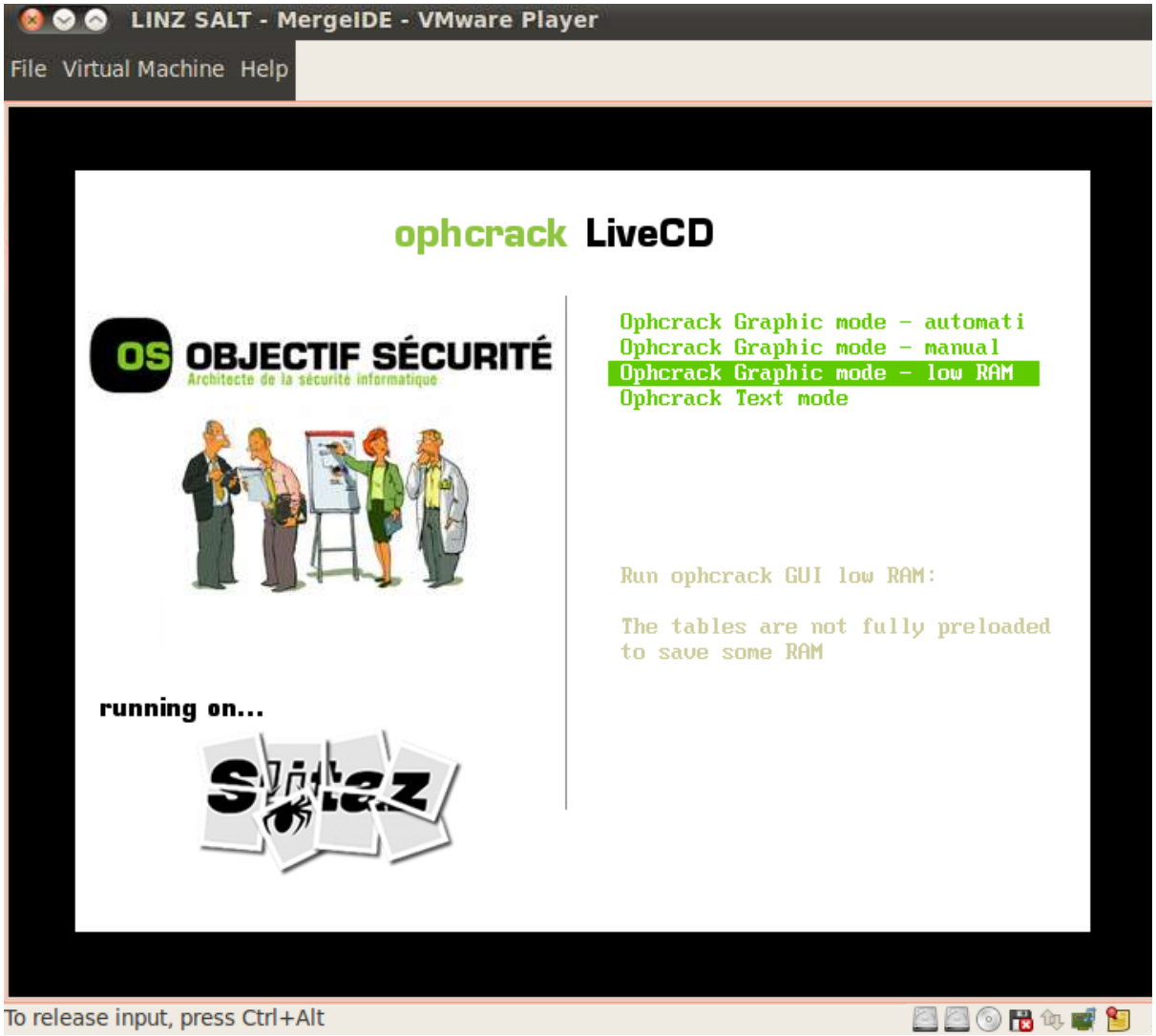
6. Recover passwords

To recover the passwords from the Operating system users two methods were trialled, both involved booting a "Live" Linux distribution on the virtual hardware. "Live" operating systems run only in the short-term RAM memory and do not use the hard disk(s). This enables them to read all information on the disks including information that may be locked if the operating system had been loaded. This involves downloading an ISO image file and attaching it to the virtual hardware by selecting it to be inserted into the CD-ROM drive in the VMware configuration. On boot the virtual BIOS had to be configured to boot from the CD-ROM drive. This was achieved by pressing F2 immediately after starting the VM. The boot-device order could then be configured to select the CD-ROM first.

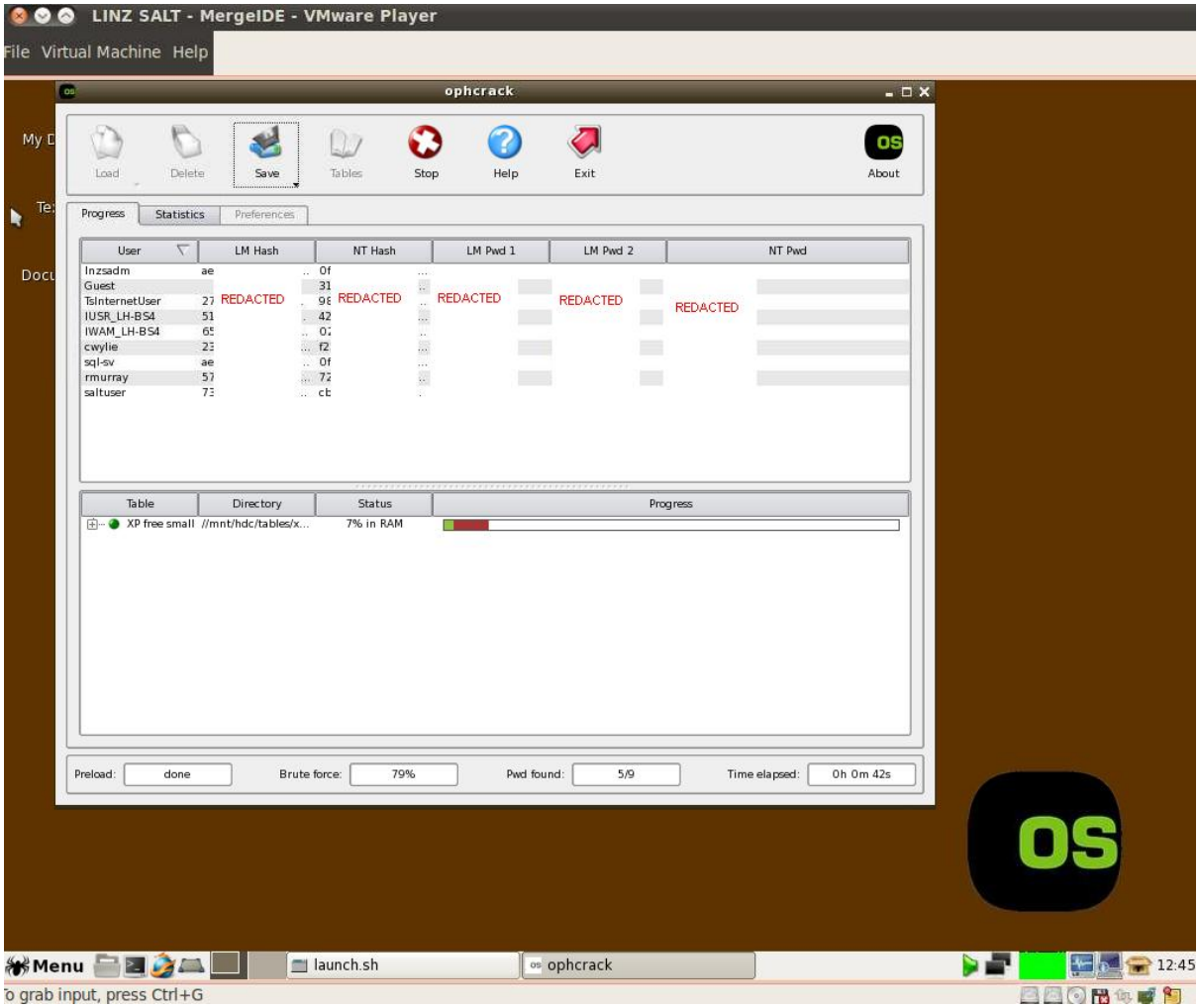
The first distribution tested was: "The Offline NT Password & Registry Editor password cracker" (http://www.pogostick.net/~pnh/ntpasswd/bootdisk.html). This enabled the configured usernames

to be identified and the passwords to be reset. It was successful in enabling access to the desktop however having reset all the passwords the SQL Database server no longer accepted the login credentials. It was decided not to pursue this route further although there were options: the password of an administrator user other than the sql-sv user could have been reset and this may have enabled the other steps to be undertaken without affecting the SQL database.

The second distribution tested was: “OPHCrack” (http://ophcrack.sourceforge.net/). Once the live CD initially booted options were given for loading the password recovery program. Choosing “Automatic, low-ram” mode seemed to give the best results:



While booting the program, selections on language, keyboard layout and screen resolution had to be made (“English”, “USA” and 1024*768 24bit were chosen). Once that program had booted into the desktop it immediately started identifying the passwords of the users configured on the Windows 2000 Server installation:



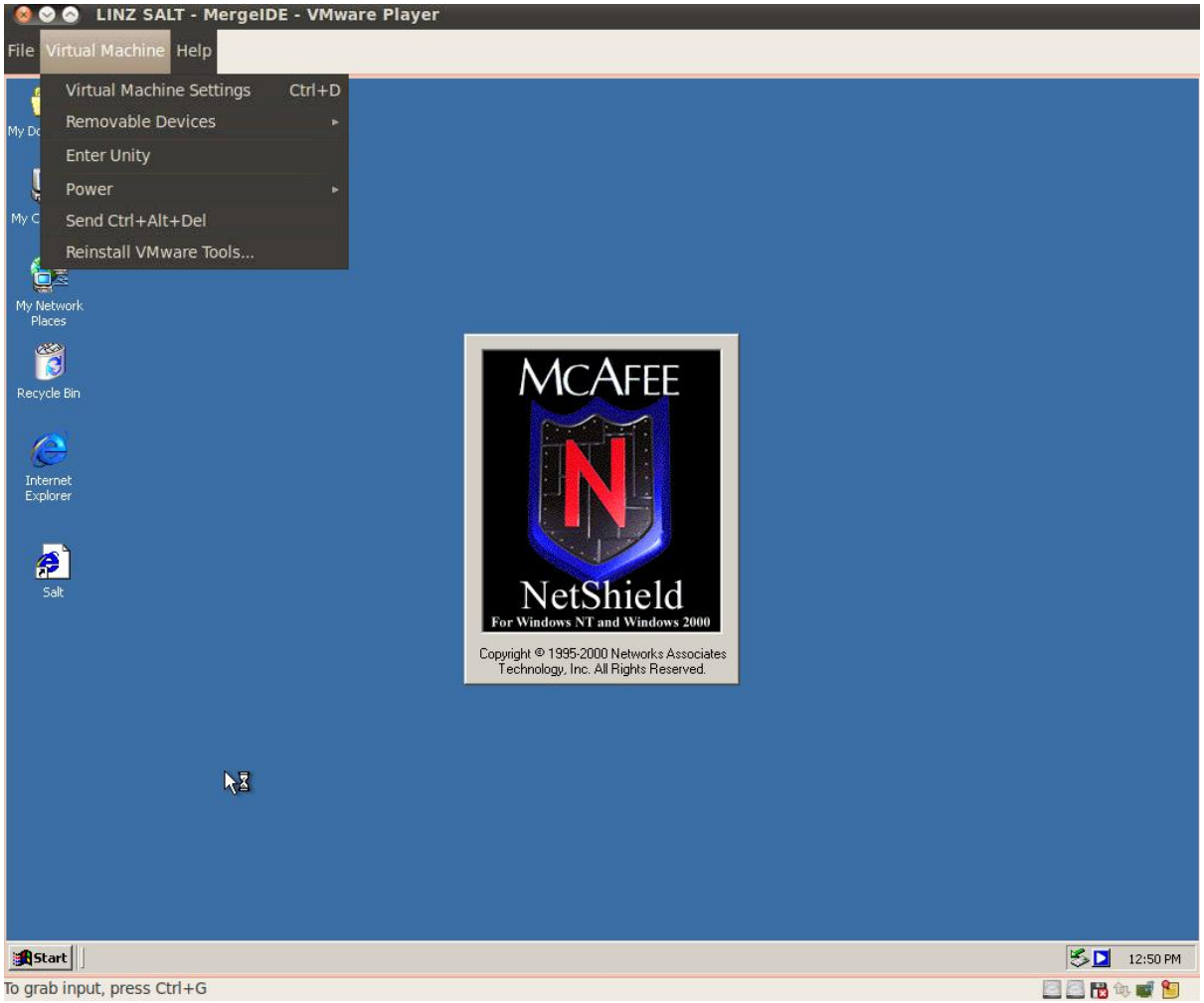
The most important users and their passwords were:

Username	Account Type	Password
cwylie	ADMIN	[REDACTED]
lnzsadm	ADMIN	[REDACTED]
sql-sv	ADMIN	[REDACTED]
saltuser	User	[REDACTED]
rmurray	ADMIN	[REDACTED]

After noting the passwords the program could be shut down by clicking a shutdown button which prompted the user to confirm the shutdown of the entire (virtual) machine.

7. Boot with admin & install VMware tools

Once the passwords had been recovered the system could be booted with the "lnzsadm" Administrator account in order to install the correct drivers for the new virtual hardware. The driver installation was done by selecting "(re)install VMware tools" in the VMware GUI.



This inserted a CD into the virtual drive and automatically loaded the installation program from it. Once the program was complete the system had to be restarted. Post-restart one driver (a USB driver) still had not installed and had to be ignored. This did not seem to cause any issues.

8. Re-configure drive letters

After installing VMware Tools the CD Drive had been configured as D: and the second hard drive as E:. This caused problems as the MSSQL Software had been installed on d: with hard coded references to d: in the configuration. This was fixed by following these steps (from: http://www.techrepublic.com/blog/window-on-windows/change-drive-letters-in-windows-2000-professional/489):

To change a drive letter for a volume:

1. Right-click My Computer and choose Manage to open the Computer Management console.

2. Click the Disk Management node. In the right pane, right-click the volume you want to modify and choose Change Drive Letter And Path. Windows 2000 Professional will display a dialog box with the ID currently assigned to the volume.

3. To change a drive letter, click the letter and choose Edit, then select the drive letter you want to use. To add a drive letter to a volume currently mounted to an NTFS folder, click Add instead.

9. Re-identify front-end location.

Once the system was booting and we were able to login it was then necessary to attempt to load the SALT database. The desktop shortcut that had been included for some users linked to a site that no longer existed due to a different network configuration:

"http://lhbs4/salt/xhtml/default.xhtml"

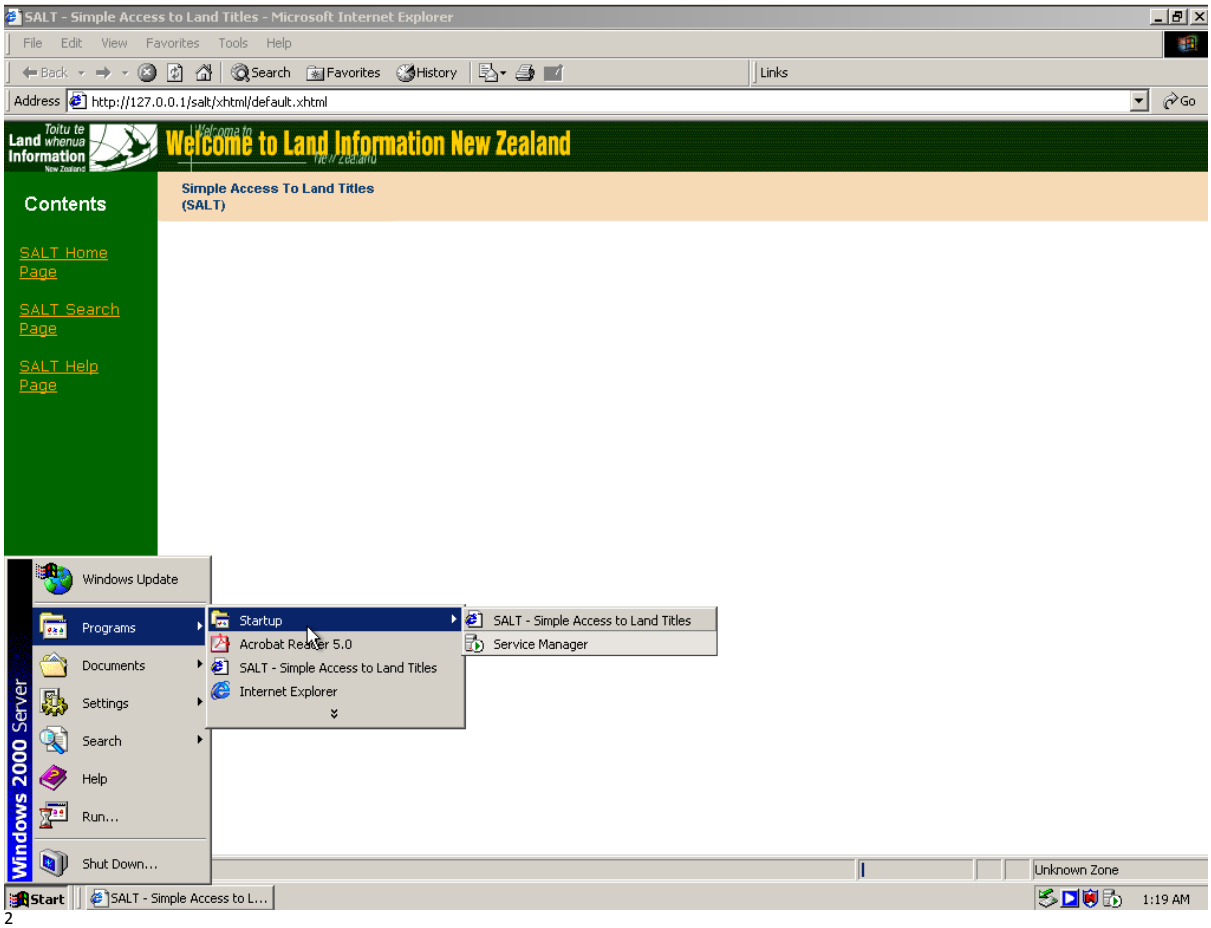
Through investigating the server configuration using the built-in Microsoft GUIs it was possible to identify the correct location of the database GUI at:

127.0.0.1/SALT/XHTML/default.xhtml

The shortcut was then updated to reflect this address.

10. Configure the Operating System to automatically load SALT GUI

The SALT Graphical User Interface (GUI) is a web based application. In order to reduce the burden on future users it was decided that it would be useful to have this application load automatically. This was achieved by creating a shortcut to the SALT GUI HTML page and copying that shortcut file to the "startup" folder in the Windows start menu. This causes Internet Explorer to be opened to the SALT GUI when the operating system starts:

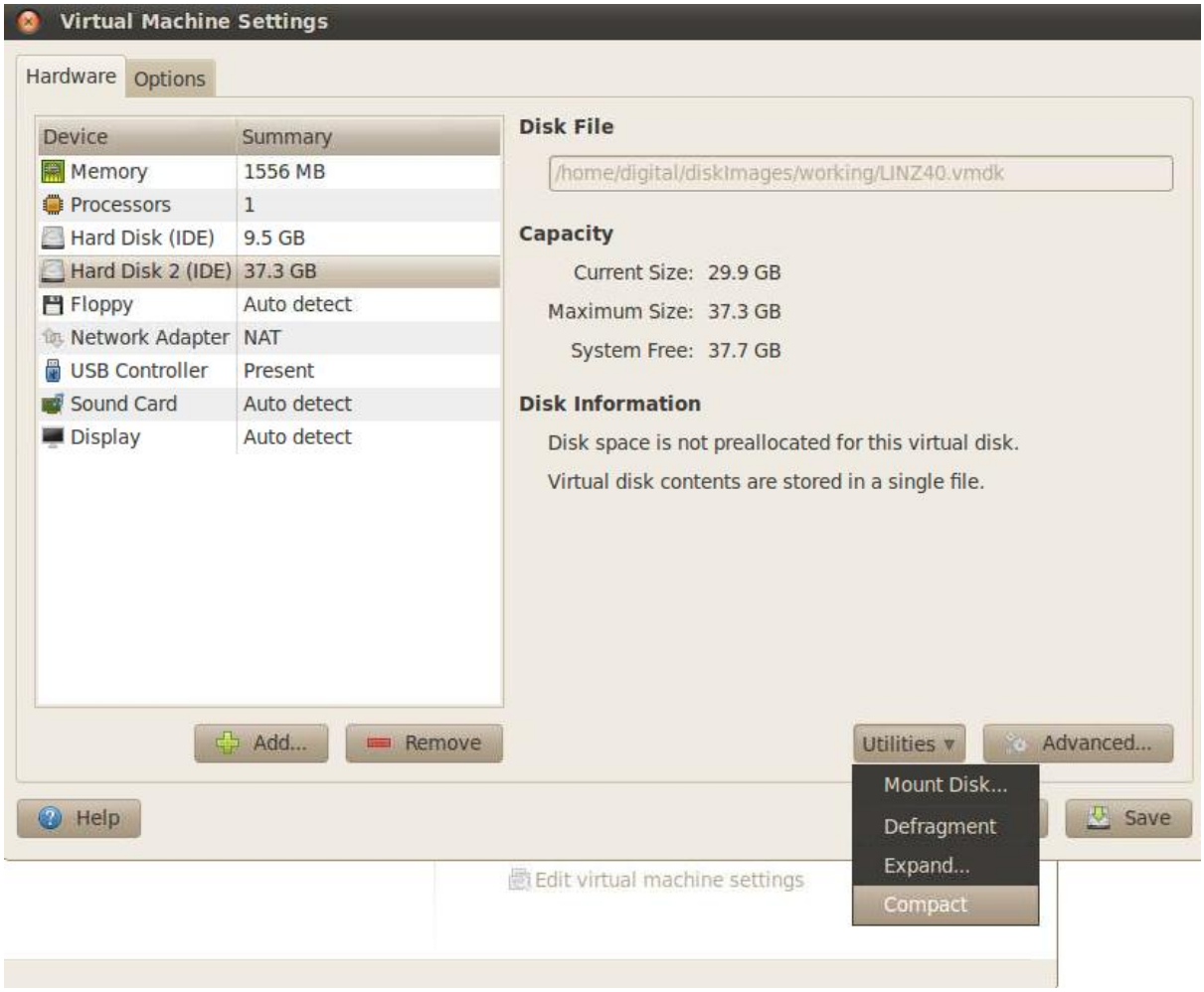


[2]

11. Resize ("compact") virtual disks.

The VMware configuration GUI allows for users to resize disks to compact them in order to save space. This procedure was run on the 40 GB drive and appeared to have little impact even though the disk was mostly empty:

[2] Easter Egg: the default screen saver was a flying marque text screensaver that had the following text displayed: ""the vampire of the world is only yourself...turn and consume it..your spirit is your own!!"



12. Migration to QEMU

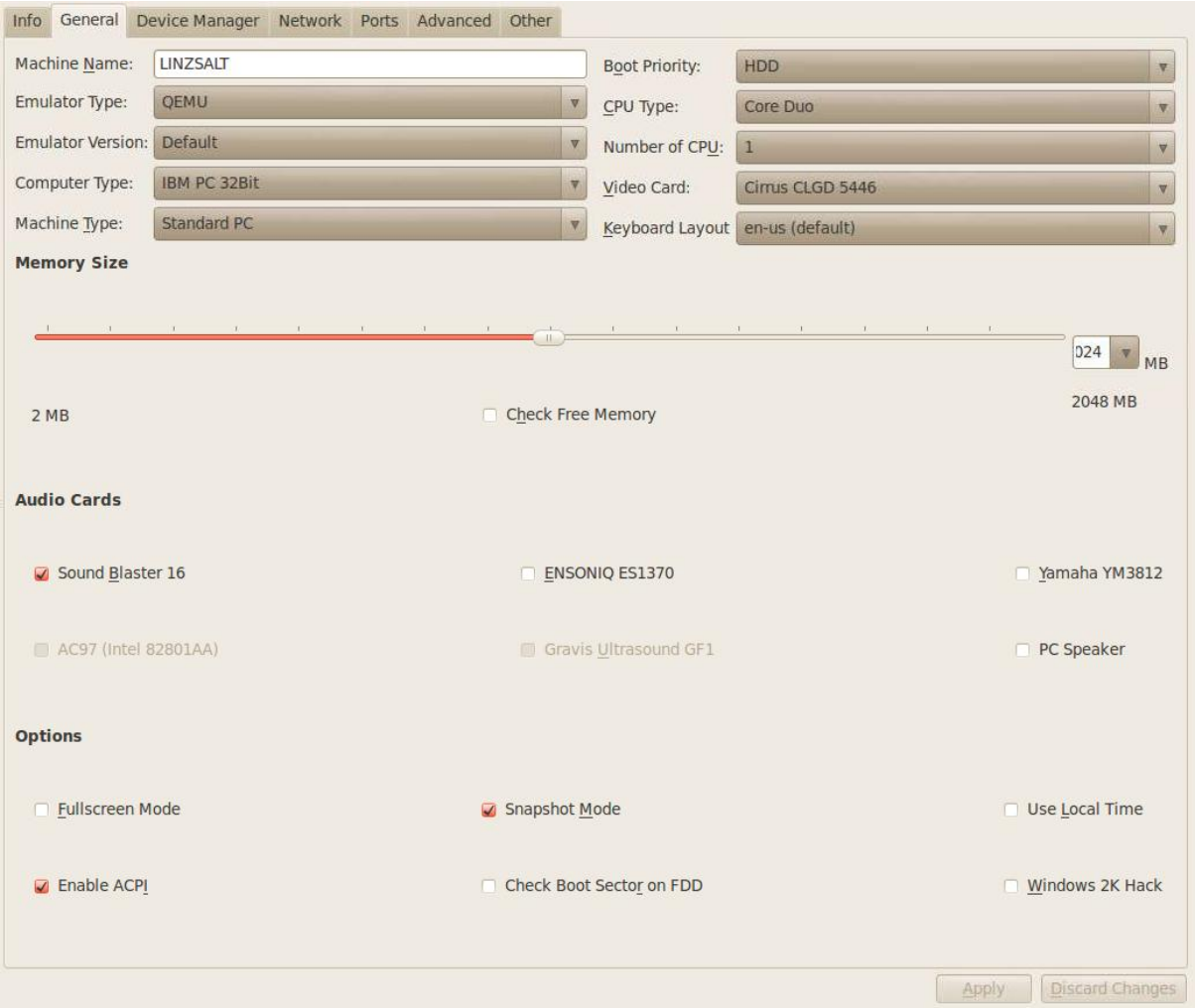
VMware is a really practical option for use in the current technology environment at Archives New Zealand. The DIA IT support team support VMware and have experience implementing it. Over the long term VMware may not be sustainable however as it relies on virtualisation which (in this case) requires an x86 compatible processor for the host machine to run on. A more sustainable approach to preserving access to this database and its GUI would be to run it on fully emulated hardware (some of the VMware hardware is emulated). The best emulation software available at the moment for Windows 2000 Server is the open source software: QEMU (www.qemu.org). For this reason a version of the environment was also made for QEMU.

To migrate the virtual machine to emulated hardware a few steps had to be followed:

1. The machine had to be booted in VMware and have the MergeIDE program run on it to stabilise the IDE drivers/registry configuration & Windows HAL (see above).

2. The hard disk image had to be copied for use in QEMU

3. The QEMU emulated machine had to be configured (easily achieved through the AQEMU GUI):



Once this was completed the machine was then booted and the drivers for the changed hardware were installed automatically by the system (requiring a restart after installation).