Vulnerable Virtual Machine Using Snapshots

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Group Project

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**Declaration**

I herby certify that this material, which I now submit for assessment on the programme of study leading to the award of Degree of **B.Sc in Computing in Digital Forensics and Cyber Security** in the Institute of Technology Blanchardstown, is entirely my own work except where otherwise stated, and has not been submitted for assessment for an academic purpose at this or any other academic institution other than in partial fulfilment of the requirements of that stated above.

Signed:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Dated: \_\_\_\_/\_\_\_\_\_/\_\_\_\_\_

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**Abstract**

*GUIDE TO STUDENTS: An abstract is a brief overview of the project. Ideally it should fit onto a single page.*

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# Introduction

## GUIDE

The first chapter of a computing project report

## sdfsd

sdfjshdfkh dsf dskhfkjsfddsf sdf sdfkh sdkfh sdkfsdffd sdf sdf kfdkhdsfkh dskf sdf dsf kjsdf kjfdsf dsf sdhf kjsf hdff dsf sdkhffsjdhf kjkf.

## Sources of information

In addition to the list of references, it is important to indicate which parts of your academic document are been supported by which referenced source. For example, below an article from the Financial Mail on Sunday is referenced in an extract from a argument about “teleworking”.

Teleworking (people working from home, usually using electronic communications to support their work), is becoming more and more a possible for smaller businesses, with the arrival of affordable, high quality communications systems such as FAXs, computer modems and high speed ISDN data transmission telephone lines. Sunderland (1997) describes recent reports from BT about their expectations for a potential £3 billion video-conferencing market.

This format is usual, with the author’s surname given first, and the year of publication given in parentheses (round brackets). If is important that this format is followed in the list of references, so a reader can easily flick to the back of the document to see the details of the source being cited. Notice that for an article within a larger publication (e.g. a newspaper, a chapter of a book, a paper in a journal), both the title of the article and the title of the overall publication are given. Page numbers can also be given, if many citations are from different parts of the same source, or to identify a specific quotation.

# Literature Review

## Overview of fields reviewed and sources consulted

thsehdfkjds hfkjsd hfkjsdfjkhdskf kshdf sdhfksf ksfkdsfkjdskfhs kdfksdfk hskdhf kfdkjhs dkhfkshd fkhsdkfh skdhfksfksdkfh sdkfh sdkhf kdf ksdf kjf ksf ksf kdsfjshdfksdfkj hsdkf sdf ksjdhf ksdhf fds sdkjhf kjf fd dsf hsdkjhf dsf.

## Review of XXX

thsehdfkjds hfkjsd hfkjsdfjkhdskf kshdf sdhfksf ksfkdsfkjdskfhs kdfksdfk hskdhf kfdkjhs dkhfkshd fkhsdkfh skdhfksfksdkfh sdkfh sdkhf kdf ksdf kjf ksf ksf kdsfjshdfksdfkj hsdkf sdf ksjdhf ksdhf fds sdkjhf kjf fd dsf hsdkjhf dsf.

## Conclusions of review

thsehdfkjds hfkjsd hfkjsdfjkhdskf kshdf sdhfksf ksfkdsfkjdskfhs kdfksdfk hskdhf kfdkjhs dkhfkshd fkhsdkfh skdhfksfksdkfh sdkfh sdkhf kdf ksdf kjf ksf ksf kdsfjshdfksdfkj hsdkf sdf ksjdhf ksdhf fds sdkjhf kjf fd dsf hsdkjhf dsf.

# Method

## Overview of method

dfjdfkljldfjglk fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg dlfkjg dlfjg ldfg df glkdjf glkd jfglkjdf jg dflkjgldfkg lkdfjglkdfj glkfjdglkdfjgfdg. fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

## Stage 1: Review of existing work

dfjdfkljldfjglk fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg dlfkjg dlfjg ldfg df glkdjf glkd jfglkjdf jg dflkjgldfkg lkdfjglkdfj glkfjdglkdfjgfdg. fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

## Stage 2: Requirements specification

dfjdfkljldfjglk fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg dlfkjg dlfjg ldfg df glkdjf glkd jfglkjdf jg dflkjgldfkg lkdfjglkdfj glkfjdglkdfjgfdg. fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

# System Requirements and Specification

## XXX

dfjdfkljldfjglk fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg dlfkjg dlfjg ldfg df glkdjf glkd jfglkjdf jg dflkjgldfkg lkdfjglkdfj glkfjdglkdfjgfdg. fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

# System Design

## XXX

dfjdfkljldfjglk fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg dlfkjg dlfjg ldfg df glkdjf glkd jfglkjdf jg dflkjgldfkg lkdfjglkdfj glkfjdglkdfjgfdg. fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

# Implementation of Prototype

## XXX

dfjdfkljldfjglk fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg dlfkjg dlfjg ldfg df glkdjf glkd jfglkjdf jg dflkjgldfkg lkdfjglkdfj glkfjdglkdfjgfdg. fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

# Testing and evaluation

## XXX

dfjdfkljldfjglk fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg dlfkjg dlfjg ldfg df glkdjf glkd jfglkjdf jg dflkjgldfkg lkdfjglkdfj glkfjdglkdfjgfdg. fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

# Conclusions and Further Work

## XXX

dfjdfkljldfjglk fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg dlfkjg dlfjg ldfg df glkdjf glkd jfglkjdf jg dflkjgldfkg lkdfjglkdfj glkfjdglkdfjgfdg. fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

# Appendix A: Project Planning

## XXX

dfjdfkljldfjglk fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg dlfkjg dlfjg ldfg df glkdjf glkd jfglkjdf jg dflkjgldfkg lkdfjglkdfj glkfjdglkdfjgfdg. fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

# Appendix B: Program listings

## Summary of included program listings

This appendix comprises the following program listings:

* PROG1.JAVA This class / program module is the class that presents the VIEW of the state of the XXX component of the system
* PROG2.JAVA This class / program module is the class that presents the VIEW of the state of the XXX component of the system

## PROG1.JAVA[[1]](#footnote-1)

The following is a commented listing of the Java source code for the class XXX

///////////////////////////// your code must be well COMMENTED !!!!

import java.awt.\*;

import Cecil;

import java.awt.event.\*;

import javax.swing.\*;

import java.lang.reflect.\*;

class LEDPanel extends JPanel

{

int width = 100;

int height = 100;

boolean ledOn[] = new boolean[10];

LEDPanel()

{

setMinimumSize( new Dimension( width, height ) );

setMaximumSize( new Dimension( width, height ) );

setVisible( true );

// set all LEDs to OFF

int t;

for (t=9; t>=0; t--)

{

ledOn[t] = false;

}

}

public void paintComponent( Graphics g )

{

super.paintComponent( g );

int radius = 20;

int xstart = 10;

int spacer = 5;

int t;

for (t=9; t>=0; t--)

{

if( ledOn[t] )

g.setColor( Color.red);

else

g.setColor( Color.black );

g.fillOval( xstart + ((9-t) \* (spacer + radius)), 10, radius, radius );

}

}

public void updateLEDdisplay(int memValue)

{

int t;

for (t=9; t>=0; t--)

{

if( (memValue & (1<<t)) > 0)

ledOn[t] = true;

else

ledOn[t] = false;

}

repaint();

} // method

} // class

## PROG2.JAVA

The following is a commented listing of the Java source code for the class XXX

# Appendix C: FDFF

## XXX

dfjdfkljldfjglk fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg dlfkjg dlfjg ldfg df glkdjf glkd jfglkjdf jg dflkjgldfkg lkdfjglkdfj glkfjdglkdfjgfdg. fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg fdjg ld fglk dfg lkd fjg ldkfglkdfgld jfg dfjg.

# List of References

**Balzano (1982)** G. J. Balzano, The pitch set as a level of description for studying musical pitch perception, In *Music, Mind and Brain: the neuropsychology of music*, M. Clynes (Ed.), Plenum, New York, USA.

**Deutsch (1982)** D. Deutsch, The processing of pitch combinations, in D. Deutsch (Ed.): *The Psychology of Music*, Academic Press, NY, USA.

**Deutsch & Feroe (1984)** D. Deutsch & J. Feroe, The internal representation of pitch sequences in tonal music, *Psychological Review*, 88:503-522.

**Holland (1989)** S. Holland, *Artificial Intelligence, Education and Music*, Unpublished PhD thesis, IET, Open University, UK, 1989., Perceptual structures for tonal music, In *Perception*, 1(1):28-62.

**Krumhansl et al. (1982)** C. Krumhansl, J. J. Bharucha & E. Kessler, Perceived harmonic structure of chords in three related musical keys, In *Journal of Experimental Psychology: Human Perception and Performance*, 8:24-36.

**Krumhansl & Kessler (1982)** C. Krumhansl & E. Kessler, Tracing the dynamic changes in perceived tonal organisation in a spatial representation of musical keys, In *Psychological Review*, 89:334-368.

**Krumhansl & Shepard (1979)** C. Krumhansl & R. Shepard, *Quantification of the hierarchy of tonal functions within a diatonic context*, Presented at the Conference on Music and the Cognitive Sciences, 17-21 September, Cambridge, UK.

**Lerdahl (1988)** Fred Lerdahl, Tonal Pitch Space, *Music Perception*, 5 (3):351-350.

**Lerdahl and Jackendoff (1983)** Fred Lerdahl & Ray Jackendoff, *A generative theory of tonal music*. Cambridge, MA: The MIT Press, 1983.

**Longuet-Higgins (1962)** H. Christopher Longuet-Higgins, Two letters to a musical friend, In *The Music Review*, November 1962, 23: 244-228 & 271-280.

**Schoenberg (1911/1978)** Arnold Schoenberg, *Theory of Harmony*, originally published 1911. Translated by R. Carter, University of California Press, Berkley, CA, USA.

**Shepard (1982)** R. N. Shepard, *Mental images and their transformations,* The MIT Press, Cambridge, MA, USA.

**Shneiderman (1982)** Ben Shneiderman, The future of interact systems and the emergence of direct manipulation, In *Behaviour and Information Technology*, 1:237-256.

**Smith & Cuddy (1997)** Nicolas A. Smith & Lola L. Cuddy. Patterns of tension/relaxation in music: A consideration of psychoacoustic and cognitive influences. *Canadian Acoustics*, 25(3):38.

**Sunderland (1997)** Ruth Sunderland. “Go to Work on a Keyboard”, p5, *Financial Mail on Sunday*, Associated Newspapers Ltd., London, UK.

**Weber (1830/1851)** G. Weber, *The theory of musical composition,* Mainz: B. Schotts Sohne. (originally published as *Versuch einer Geordneten Theorie der Tonsetzkunst,* 1830).

**Yahoo (1997)**  Yahoo Ltd. “*UK and Ireland home page*”, Yahoo Ltd., London, UK.  
URL: http://www.yahoo.ac.uk

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