

# KV6003 Individual Computing Project - Terms of Reference

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## 1 Background

The modern technological landscape demands much from innovation. We must find new ways of solving existing and new problems in the world. This is amazing for convenience, and quality of life, but does pose a problem for security. There is Hypponen's law in IOT that states, the more you add in terms of functionality, the more that must be secured. A concrete cube may be secure, but is not overly functional. I am incredibly interested in the duality between attack and defence. It seems to be a constant cat and mouse game of which defence is paramount. I hope that by looking at both sides with a purple team perspective, I can gain a deep understanding of the landscape we have currently and moving forwards.

Cybersecurity is really "Managed insecurity", I intend to discover where cyber attacks are at, and how they have innovated over the years. Cyber threats are growing, how can we detect them? How can we proactively block them? These are questions that must be answered in order to get a good overview. I must be able to show my understanding in a theoretical and practical way to be able to potentially apply it to a real life scenario. I will have to develop my understanding of infrastructure, networking, semi low-level programming and penetration testing.

Developing realistic solutions for smaller businesses is really important. They are arguably more at risk, with less resources for security. I dispise the idea of security snakeoil and scareware, and value defence-in-depth rather than a supposed all-in-one solution. With the detection work, I hope to show the importance of the human element to security, how it can be the weakest link, or the strongest asset. I must look at current solutions with a critical eye with care to be realistic about defence.

Malware has evolved over time, what was once an exercise of freedom and curiosity, is now a platform for theft and crime. Defences catch up over time, it will be eye-opening to see the different methods historically that the two sides try to out-smart each other. Malware analysis is something I haven't really touched on before, though I have been interested for a long while now. It will benefit my defence greatly.

## 2 Proposed Work

I aim to create documentation in the form of my dissertation to describe the Cybersecurity landscape in regards to infrastructure. This will involve talking about infrastructure directly, it's use, implementation and potential pitfalls, but more importantly, how it can be secured. On the other side, I will be looking at the common ways that infrastructure is compromised, in a network setting. I do think that a good comparison is important for this.

I will be investigating how threats have evolved as a whole, whether that be malware, obfuscation and clever exfiltration. I believe it is important to at least touch on how this was done in the past, to understand how the future may follow similar foundations. Naturally an investigation into threats would be pointless without a practical defence, I hope to compare both endpoint and infrastructure defences in relation to both a sample of threats, and to one another. I will then analyse this data and draw sensible conclusions based upon it.

I also hope to create a rudimentary intrusion detection system written in C. This will be a proof of concept to show my understanding, rather than a product. My hopes are that by developing network defence myself, I can gain an even deeper understanding.

## 3 Aims and Objectives

### 3.1 Aims

To understand the theory behind defence in relation to common threat vectors. To develop attack and defence to aid the theory, in a practical manner.

### 3.2 Objectives

1. Explanation of entry vectors   profiling
2. Exploitation of exploitation
3. Analysis of historic threats   malware
4. Exploitation of obfuscation
5. Exploitation of exfiltration
6. Investigate IDS/IPS systems w/ comparison
7. Illustrate proof of concept IDS
8. Investigate antivirus systems w/ comparison
9. Analyse modern attack: defence landscape
10. Describe meaningful defence (defence-in-depth, social engineering resilience)

## 4 Skills

1. Programming in C (KF5006)
2. Networking Technology 3 (KF6005)
3. Advanced Operating Systems II (KF6003)
4. Cybersecurity Awareness
5. Reverse-Engineering
6. Data Analysis

## 5 Resources

### 5.1 Hardware

- Computer - Home Lab PCs
- Hard Drive - Loaned

### 5.2 Software

- CIS Lab Equipment - Routers, Switches etc..
- VMware Workstation - To host vulnerable attacker infrastructure
- VSodium - IDE for IDS development
- Packet Libraries - Undetermined at the time of writing, likely scapy and libpcap
- Various Antivirus Licences - Prefer free or monthly subscription
- IDS/IPS/SIEMs Licences - Will have to prefer free or cheap ones (as a small company would)

## 6 Structure and Contents of the Report

### 6.1 Report Structure

**Introduction** Sets out the background and motivation for the project. Summarises the work done, the results, the conclusions, and the recommendations for future work. It is a one chapter summary of the *entire* project.

**Defining the problem** Objective ?? requires a precise definition of the problem you are solving. Don't forget to reference good source material [Schulzrinne, 2017] and [Talbot, 2013]. See section 2.

**Possible Solutions** Discuss the possible solutions, compare the alternatives, and select the one to use for the implementation.

## 6.2 List of Appendices

What Appendices you will include. A copy of the TOR should be the first, followed by the Ethics form and the Risk Assessment.

Others might include design documentation, code listings, tables of results (if too large to include in the main text).

## 7 Marking Scheme

The marking scheme sets out what criteria we are going to use for the project.

**Project Type** General Computing or Software Engineering projects

**Project Report** State which chapters constitute the *Analysis*, the *Synthesis*, and the *Evaluation*. This help me when marking to know when to stop reading one section and put a mark down for it.

**Product** List the deliverables that make up the *Product*. Code, design, requirements specifications, test plans, etc.

For the *Fitness for Purpose* and *Build Quality* list the criteria used to asses the product by

### Fitness for Purpose

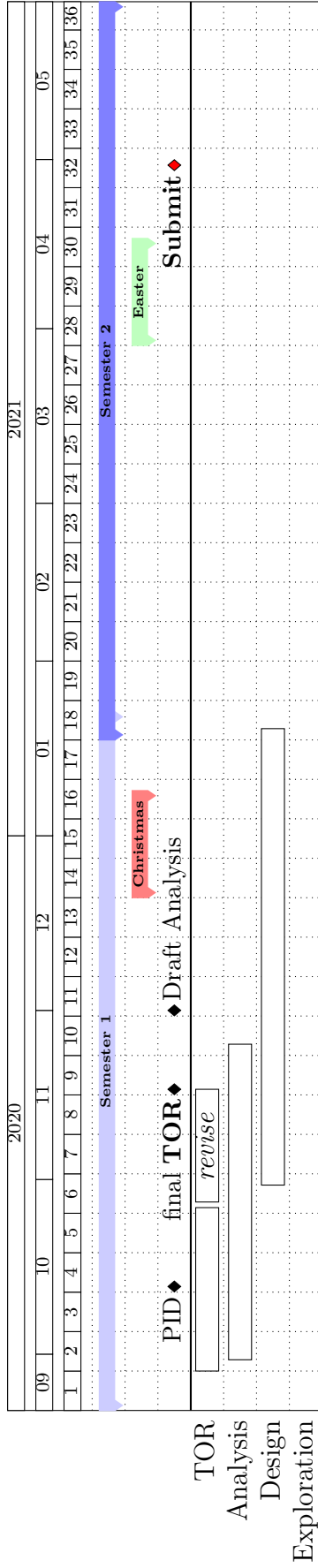
- meet requirements identified
- other appropriate measures

### Build Quality

- Requirements specification and analysis
- Design Specification
- Code quality
- Test plan and Results



# 8 Project Plan



## 9 Bibliography

Henning Schulzrinne. Writing systems and networking articles, 2017. URL <http://www.cs.columbia.edu/~hgs/etc/writing-style.html>.

Nicola L. C. Talbot. *Using L<sup>A</sup>T<sub>E</sub>X to Write a PhD Thesis*, volume 2 of *Dickimaw L<sup>A</sup>T<sub>E</sub>X Series*. Dickimaw Books, Norfolk, UK, 2013. ISBN 978-1-909440-02-9. URL <http://www.dickimaw-books.com/latex/thesis/>.

## A Ethics Form

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\includepdf[pages=1-3]{ethics.pdf}
```

Ethical category of project  
[Complete after approval]

|       |                          |
|-------|--------------------------|
| Red   | <input type="checkbox"/> |
| Amber | <input type="checkbox"/> |
| Green | <input type="checkbox"/> |



Department of Computer Science and Digital Technologies

UNDERGRADUATE COMPUTING PROJECTS: ETHICS REGISTRATION AND APPROVAL  
FORM

**Section One: Registration [To be completed by student]**

|  |  |
|--|--|
| Title of research project/dissertation |  |
| Researcher's name                      |  |
| Programme of study                     |  |
| Academic Year                          |  |
| Module code                            |  |
| Supervisor's name                      |  |
| Second marker's name                   |  |
| Start Date of Project                  |  |
| Brief outline of research topic:       |  |
| <div></div>                            |  |



**Short description of proposed research methods including identification of participants:**

| <b>Ethical considerations in the research project</b>  | <b>YES</b>               | <b>NO</b>                |
|--|--------------------------|--------------------------|
| 1. Does your research involve an external organisation or partner?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Does your research involve human participants?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. If yes to Q.2, will you inform the participants about the research?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Will you obtain their consent using the standard consent form?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Is any deception involved?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Do any participants constitute a 'vulnerable group'?<br>(refer to definition of Vulnerable People)  | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Will the research involve the following information?  |                          |                          |
| Commercially sensitive   | <input type="checkbox"/> | <input type="checkbox"/> |
| Personally sensitive   | <input type="checkbox"/> | <input type="checkbox"/> |
| Politically sensitive  | <input type="checkbox"/> | <input type="checkbox"/> |
| Legally sensitive  | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Is the research likely to have any significant environmental impacts?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Are there likely to be any risks for the participants in your research?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Are there likely to be any risks for you in conducting the research?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. If yes [to 5, 6, 7, 8, 9 or 10 above] have you identified steps to address the issues and mitigate any risks to participants, yourself or the environment? | <input type="checkbox"/> | <input type="checkbox"/> |

**Statement to explain how any issues identified above will be addressed and what steps will be taken to mitigate such risks or adverse impacts**

**Ethical category of research project**

Based on the above Ethical Considerations and with reference to the University's Ethical Scrutiny Risk Assessment tool identify the Ethical category of your research project (refer to <http://www.northumbria.ac.uk/static/5007/respdf/riskassessmenttool> for further guidance):

*[Please tick as appropriate]*

|              |                          |   |
|--------------|--------------------------|---|
| <b>Red</b>   | <input type="checkbox"/> | vulnerable participants; human tissue; sensitive data; risks to participants & researchers etc. |
| <b>Amber</b> | <input type="checkbox"/> | human participants requiring informed consent; commercially sensitive information etc.          |
| <b>Green</b> | <input type="checkbox"/> | no participants involved; secondary data only; no sensitive data                                |

I have read the University and the Faculty Ethics Policy and Procedures and confirm that the answers I have given above are correct. Where issues arise under items 5, 6, 7, 8, 9 or 10 [above] I have described in writing how I intend to approach these issues in the research.

Researcher's signature

.....

Date

.....

**Section 1 Ethics Registration to be submitted to Principal Supervisor or Module Tutor and allocated to a reviewer as follows:**

**Green risk - may be approved by Supervisor**

**Amber risk - to be submitted for approval by one independent reviewer (second marker)**

**Red risk - to be submitted for approval by two independent members of Faculty Research Ethics Committee**

## B Risk Assessment Form

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