National College of Ireland

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<P-VPN method>

Technical Report

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Executive Summary

Max 300 words. Summarise the key points of the report. Restate the purpose of the report, highlight the major points of the report, and describe any results, conclusions, or recommendations from the report.

The reason I will be documenting this report is not only for others to see my progress but also for myself as it shows how I'm getting along step by step with my progress, and when I look back to this in the future, I can see how I created my work from scratch which can be a very proud moment. This report aims to evaluate two widely used VPN protocols, OpenVPN and Wire Guard, focusing on aspects such as speed, traffic management, processing power, and cost. I'm looking to highlight the dangers of using public Wi-Fi and the importance of secure VPN options by assessing real-world performance. Furthermore, the project incorporates an API to perform a real-time speed test, enhancing the practicality and relevance of the comparison.

1.0 Introduction

1.1. Background

Why did you undertake this project?

The reason I am doing this project is because there was a time when I was in one of my networking modules in 3rd year, my lecturer demonstrated to us how easy it was for him to access our IP addresses once we were connected to his mobile hotspot or even the public Wi-Fi we use in the college. Once seeing that I started researching VPN's I could use to make myself feel less vulnerable and from there I had the idea why not create something to show people the differences between two VPN's so I could save themselves the time to research and they could easily know what they want.

1.2. Aims

What does the project aim to achieve?

Something I would love to do is to raise awareness when it comes to using VPN's, so in this project I am going to analyse OpenVPN and Wire Guard by assessing their performance, costs, and resource consumption on cloud servers, ultimately identifying the optimal choice for securing public Wi-Fi. Additionally, it will investigate the possibility of leveraging machine learning to enhance VPN selection. I would like to make it easier for people to choose what VPN they would like to use from my research.

1.3. Technology

What technology will you use to achieve what you have set out to do and how will you use it?

HTML, CSS, and JavaScript (for the website)

These fundamental web technologies are used to make the user interface for the website, which showcases the VPN comparison data and offers features like a speed test.

VPN Protocols (OpenVPN and Wire Guard)

OpenVPN and Wire Guard were the two VPN protocols compared throughout the project.

Speed Test API

I'm using the API to give real time speed test results for both Open VPN and Wire Guard.

Cloud Servers (e.g., AWS,

Cloud servers will be used to host both OpenVPN and WireGuard for testing

Machine Learning Algorithms

I'm looking to add machine learning at a later stage to analyse and predict the best VPN based on various metrics (speed, cost, processing power).

MySQL or SQLite

At a later stage add a database to store the results from the speed tests and other comparative data for OpenVPN and Wire Guard.

1.4. Structure

Provide a brief overview of the structure of the document and what is addressed in each section.

Part 1

I am jus giving a summary of my report and talking about the basis of my project and what I am doing.

Part 2:

Here I am showing use cases and explaining how it works when the user is using my webapp and testing their connection. I am also showing key parts of my code and website and showing how I implemented certain features.

Part 3:

In my conclusion I am giving some advantages and some disadvantages about my project.

Part 4:

Here I am giving some ideas as to what else I could implement into my project if I had more time to work on it.

Part 5:

I linked some websites here as reference that helped me get to where im at with my project as of this this current stage.

Part 6:

2.0 System

2.1. Requirements

All requirements should be verifiable. For example, experienced controllers shall be able to use all the system functions after a total of two hours training. After this training, the average number of errors made by experienced users shall not exceed two per day.

2.1.1. Functional Requirements

This section lists the functional requirements in **ranked order**. Functional requirements describe the possible effects of a software system, in other words, *what* the system must accomplish. Other kinds of requirements (such as interface requirements, performance requirements, or reliability requirements) describe *how* the system accomplishes its functional requirements. Each functional requirement should be specified in a format similar to the following:

1:
Title: VPN Comparison Display
Description: The system shall display a comparison between OpenVPN and WireGuard based on several criteria, including speed, traffic handling, processing power, and cost. This comparison will be visually presented on the comparison page.
Priority: High
Precondition: The system contains stored data or receives data via an API regarding VPN performance metrics.
Postcondition: Comparison data is presented in table format for user analysis.

2:
Title: VPN Speed Test Functionality
Description: The system will give the user with the ability to run their own speed tests on OpenVPN and WireGuard protocols. The results, including upload and download speeds, will be displayed on the speed test page.
Priority: High
Precondition: User is logged in, and an active internet connection is available.

Postcondition: Speed test results for both VPN protocols are displayed for the user.
Dependencies: None

3:

Title: Machine Learning Prediction for Best VPN
Description: The system will implement a machine learning model to predict which VPN (OpenVPN or WireGuard) would perform best under different user circumstances (e.g., speed, costs).
Priority: Low
Precondition: The system has historical performance data of both VPNs.
Postcondition: Users receive a recommendation based on their specific needs and the system's predictions.

4:
Title: User Feedback and Contact System
Description: The system will allow users to give feedback via Gmail of phone number
Priority: Low
Precondition: User has has filled out the contact form.
Postcondition: Feedback is sent and received for me to respond
Dependencies: None

Short, imperative sentence stating highest ranked functional requirement.

2.1.1.1. Use Case Diagram

2.1.1.2. Requirement 1 <Name of requirement in a few words>

The heading of this section should read, e.g., "Requirement 1: User registration" or "Requirements 1: Participant takes test"

User tests their speed

2.1.1.3. Description & Priority

A description of the requirement and its priority. Describes how essential this requirement is to the overall system.

It's important to test the user's preference between Wire Guard and OpenVPN. This is crucial because, without knowing their choice of VPN, they won't be able to determine which one is better. That's the main purpose of your website—helping users make an informed decision. By using your site, they'll be able to select their preferred VPN for their personal needs, ensuring they have a great experience and are satisfied.

2.1.1.4. Use Case

Each requirement should be uniquely identified with a sequence number or a meaningful tag of some kind.

Scope

The scope of this use case is to …….

1

The scope of this is to test your connection speed while using VPN

2

The second use case is for user to submit a response

Description

This use case describes the ……..

1

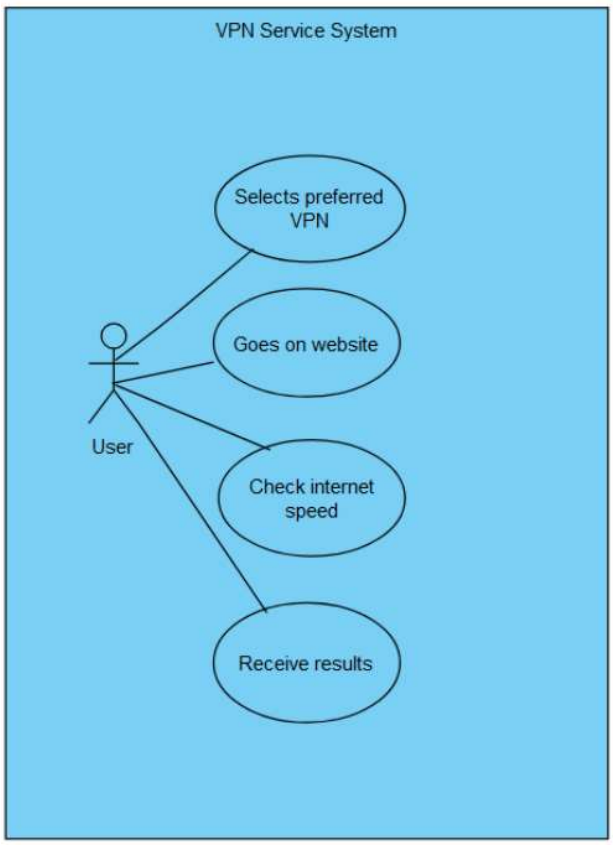
This use case describes when a user opens the webapp and uses the speed tester functionality on the web app.

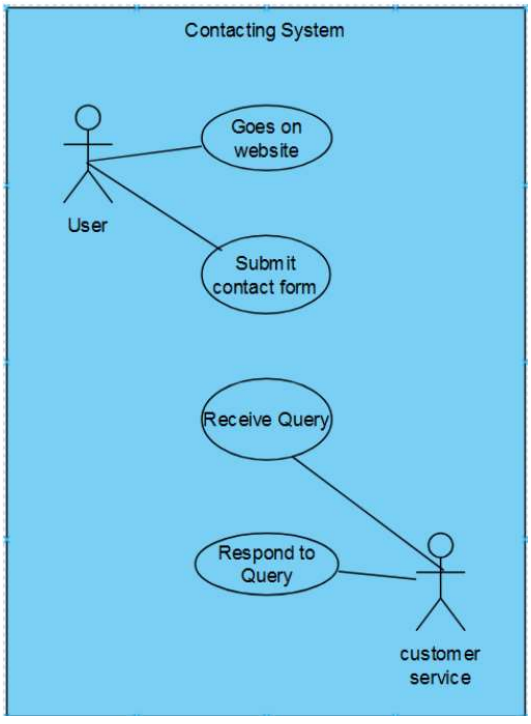
2

This use case describes describes when a user opens the webapp and uses the contact us functionlity

Use Case Diagram

Diagram should highlight actors and uses cases……..





Flow Description

1

This use case will describe how a user will test their speed on the web app

2

This use case describes how a user will communicate with the developer.

Precondition

The system is in initialisation mode……..

1

The precondition for this use case is that the user must be connected to the internet.

2

The precondition for this use case is that the user must have contact details.

Activation

This use case starts when an <Actor>……

1

This use case starts when the user opens the webapp.

2

This use case starts when when the user opens the web app

Main flow

1. The system identifies the ……
2. The <Actor> ……..(See A1)
3. The system ……..(See E1)
4. The <Actor> ……

Alternate flow

A1 : <title of A1>

1. The system ……
2. The <Actor> ……
3. The use case continues at position 3 of the main flow

1. The system identifies the User (U1) on the speed tester page, the user got to the speed tester page from most likely the home page.

2. The User (U1) presses “test your speed” button.
3. The system accepts the User (U1) request and gives them details to their connection speed
4. The user can see their results displayed

Exceptional flow

E1 : <title of E1>

4. The system ……..
5. The <Actor> ……
6. The use case continues at position 4 of the main flow

Termination

The system presents the next …….

The web app presents the user with an error message to prompts the user that their connection was “connection not established”

Post condition

The system goes into a wait state

If the user clicks the “test your speed” and it doesn’t work, the screen will display a wait state until the webpage can get a response.

List further functional requirements here, using the same structure as for Requirement1.

2.1.2. Data Requirements

2.1.3. User Requirements

2.1.4. Environmental Requirements

2.1.5. Usability Requirements

2.2. Design & Architecture

Describe the design, system architecture and components used. Describe the main algorithms used in the project. (Note use standard mathematical notations if applicable).

The project is created as a web app to compare VPNs (OpenVPN and WireGuard) and evaluate their performance, with a particular emphasis on speed. The layout of the web app is organized around a user-friendly interface featuring distinct pages for conducting speed tests and showcasing the results of the comparisons between the two VPNs.

Frontend: Built with HTML, CSS, and JavaScript.

Backend: Capable of being enhanced through API integration for real-time data.

Speed Test API: Going to have API’s for example speed test API to perform network speed tests for both OpenVPN and Wire Guard.

Results Display: Shows speed test outcomes and VPN comparisons, featuring metrics such as download/upload speeds and more.

Main Algorithm

Speed Test Algorithm (JavaScript)

The main algorithm focuses on measuring the speed of both OpenVPN and WireGuard. Heres how it will work:

The user clicks the "Start Speed Test" button on the speedtest.html page.

API Request to Speed Test Provider:

The JavaScrpt will then initiate an API call to retrieve download and upload speeds for both VPNs.

An architecture diagram may be useful. In case of a distributed system, it may be useful to describe functions and/or data structures in each component separately.

2.3. Implementation

Describe the main algorithms/classes/functions used in the code. Consider to show and explain interesting code snippets where appropriate.

Frontend (HTML/JavaScript/CSS)

The frontend code mainly focuses on user interaction, obtaining speed test results, and presenting them. It will incorporate essential functions that manage API requests and showcase the comparison results.

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <meta name="viewport" content="width=device-width, initial-scale=1.0" />
    <link
      href="https://cdn.jsdelivr.net/npm/remixicon@4.1.0/fonts/remixicon.css"
      rel="stylesheet"
    />
    <link rel="stylesheet" href="styles.css" />
    <title>Which VPN is best</title>
```

JavaScript Function for Initiating a Speed Test.

A key component of the code is the function that sends requests to a third-party speed test API to gather data for OpenVPN and Wire Guard. Here is some java script code that implements fake data to my web app for the time being:

```
<script>
    document.getElementById("start-test").addEventListener("click", function() {
  // making a fake speed test
  const openvpnSpeed = Math.floor(Math.random() * 100) + 50; // Random speed between 50 and 150 Mbps
  const wireguardSpeed = Math.floor(Math.random() * 100) + 100; // Random speed between 100 and 200 Mbps

  // showing the results
  document.getElementById("openvpn-speed").textContent = openvpnSpeed;
  document.getElementById("wireguard-speed").textContent = wireguardSpeed;
});
```

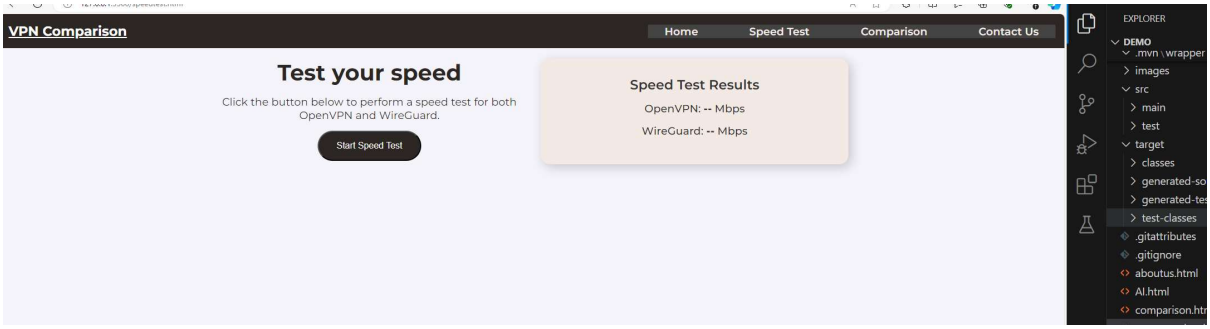
For my contact us page it is important that users can send some feedback about how theyre experience using my web page henche to why I have added a featurenon on my ontact page where once they submit theyre feedback, I then receive it to the email added into my code from the back end, with the help of a site called form submit.

```
<!-- making a form submit so i can recieve emails from the website -->
<form action="https://formsubmit.co/9affc27e1550862f50fedad6b4cbf007" method="POST" onsubmit="myFunction()">
```

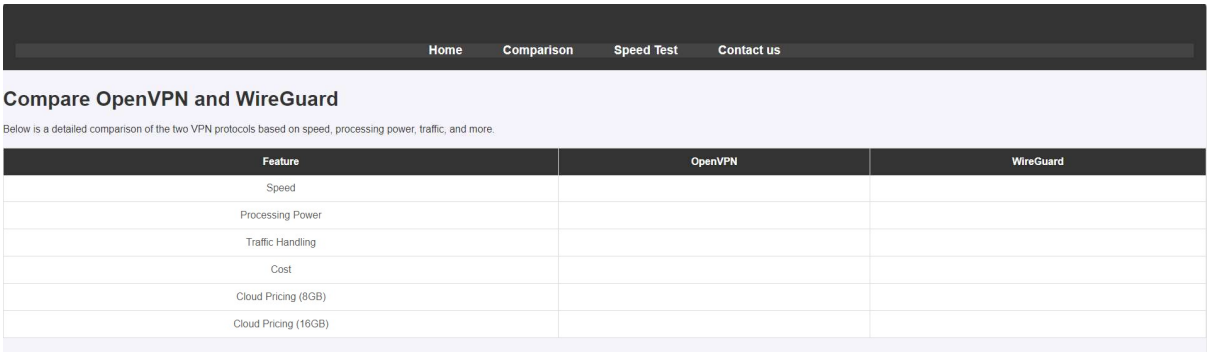
2.4. Graphical User Interface (GUI)

Provide screenshots of key screens and explain what can be seen in each one.

Here on the screenshot below is my speed testing page where users can test their own upload and download speed when connected to their VPN, once the users clicks Start speed test they will then receive a live update on the right hand sign giving them their results.



Here is my comparisons page where users can come see some comparisons between the two VPN's including, they're upload speed, their download speed, their traffic handling, cost and more.



2.5. Testing

Describe any testing tools, test plans and test specifications used in the project. Provide evidence for and results of all Unit, Integration and End User testing that is carried out.

In my VPN speed testing and comparison project, testing is essential to ensure that the system operates correctly and fulfils all requirements.

2.6. Evaluation

How was the system evaluated and what are the results? This may consist of usage data. It may also include performance evaluations, scalability, correctness, etc. depending on the focus of the project. Quantative results may be reported in tables or figures.

3.0 Conclusions

Describe the advantages/disadvantages, strengths and limitations of the project

Advantages:

Enhanced Security Awareness:

• This project highlights the security risks of public Wi-Fi and mobile data hotspots, it lets users grasp a better understanding of the dangers linked to unprotected internet access. It lets them know how important VPN's can be in certain situations.

Comparative Analysis of VPNs:

My project evaluates OpenVPN and WireGuard by comparing the two popular VPN protocols. It helps users make informed choices about which VPN is best for their needs, looking at factors like speed, traffic management, and cost.

Disadvantages:

Cloud Dependency:

My project mainly depends mainly on cloud servers for its comparisons, which users that don't use cloud services not interact or prefer on-premises solutions. Additionally, cloud pricing models can fluctuate, impacting the validity of cost comparisons over time.

4.0 Further Development or Research

With additional time and resources, which direction would this project take?

Something I could definitely add with more time would be

User-Centered Design and Usability Improvements:

So basically, adding a better User Interface and Experience With extra resources, the comparison website could be upgraded with a sleek, intuitive, and mobile-responsive design. Incorporating interactive visualizations—such as graphs, charts, and dynamic results could make data like speed tests and traffic management more accessible and visually engaging for users.

5.0 References

Please include references throughout your document where appropriate. See here for a guide on referencing from the NCI library.

www.geekforgeeks.org

W3Schools Online Web Tutorials

www.google.com

www.css-tricks.com

6.0 Appendices

This section should contain information that is supplementary to the main body of the report.

6.1. Project Proposal

Proposal at very end.

6.1. Ethics Approval Application (only if required)

6.2. Reflective Journals

6.3. Invention Disclosure Form (Remove if not completed)

Please fill in the following sections, if you think your idea is innovative:

1. Title of Invention

2. Inventors

Name	School/Research Institute	Affiliation with Institute (i.e. department, student, staff, visitor)	Address, contact phone no., e-mail	% Contribution to the Invention

3. Contribution to the Invention

Each contributor/potential inventor should write a paragraph relating to his/her contribution and include a signature and date at the end of the paragraph.

4. Description of Invention

(Please highlight the novelty/patentable aspect. Attach extra sheets if necessary including diagrams where appropriate). What is novel, the 'inventive step'? For more information on patents, please look at http://www.patentsoffice.ie/en/patents.aspx

5. Why is this invention more advantageous than present technology?

What is its novel or unusual features? What problems does it solve? What are the problems associated with these technologies, products or processes? Explain how this invention overcomes these problems (*i.e*. what are its advantages).

6. What is the current stage of development / testing of the invention?

7. List the names of companies which you think would be interested in using, developing or marketing this invention

8. Funding Partner(s)

Government Agency & Department	
% Support	
Contract/Grant No.	
Contact Name	
Phone No.	
Address	

Industry or other Sponsor	
% Support	
Contract/Grant No.	
Contact Name	
Phone No.	
Address	

9. Where was the research carried out?

10. What is the potential commercial application of this invention?

11. Was there transfer of any materials/information to or from other institutions regarding this invention?

If so please give details and provide signed agreements where relevant.

12. Have any third parties any rights to this invention?

If yes, give names and addresses and a brief explanation of involvement.

13. Are there any existing or planned disclosures regarding this invention?

Please give details.

14. Has any patent application been made? Yes/No

If yes, give date: _____ Application No.: _____

Name of patent agent: _____

Please supply copy of specification.

15. Is a model or prototype available? Has the invention been demonstrated practically?

I/we acknowledge that I/we have read, understood and agree with this form and the Institute's *Intellectual Property and Procedures* and that all the information provided in this disclosure is complete and correct.

I/we shall take all reasonable precautions to protect the integrity and confidentiality of the IP in question.

Inventor: _____ _____

Signature Date

_____

Signature

6.4. Other materials used

Any other reference material used in the project for example evaluation surveys etc.

Proposal –

National College of Ireland

Project Proposal

< Title>

<10/10/24>

<P-VPN Method>

<Cyber Security>

<Academic Year i.e. 2020/2021>

<Price Asemota>

<X21445372>

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7.0 Objectives

(Max half Page)

What does this project set out to achieve?

Something I would love to do is to raise awareness when it comes to using VPN's, so in this project I am going to analyse OpenVPN and Wire Guard by assessing their performance, costs, and resource consumption on cloud servers, ultimately identifying the optimal choice

for securing public Wi-Fi. Additionally, it will investigate the possibility of leveraging machine learning to enhance VPN selection.

8.0 Background

(Max half Page)

Why did you choose to undertake this project? How will you meet the objectives set out in Section 1.0?

The reason I had thought of this idea is because there was a time when I was in one of my networking modules in 3rd year, my lecturer demonstrated to us how easy it was for him to access our IP addresses once we were connected to his mobile hotspot or even the public Wi-Fi we use in the college. Once seeing that I started researching VPN's I could use to make myself feel less vulnerable and from there I had the idea why not create something to show people the differences between two VPN's so I could save themselves the time to research and they could easily know what they want.

9.0 State of the Art

(Max half page)

What similar applications exist already? What makes your project stand out? How does it differ from similar work of others?

There are many other applications like what I am creating, "X-VPN", "Nord VPN" and many more, what I think makes mine different tis that mine showings many differences between the two specific VPN's making it easier for different businesses to choose from.

10.0 Technical Approach

(Max 1 page)

What approach will you take to development? How will you identify requirements? How will you break down requirements into project tasks, activities and milestones?

My first step I will take to develop this project is to plan with a great mindset by breaking my project into smaller more manageable pieces so I can focus on one step at a time and won't be unorganised. Identifying my requirements is a very key aspect to complete when doing this project.

Phase 1: research and planning

Research the two VPN protocols and install development tools.

Phase2: Core development

Set up a server for tunnelling and write codes for data encryption and decryption.

Phase 3: Testing and

Comparing and contrasting.

Phase 4: Development

Create Web page

Add AI to project

Phase 5: Documentation

Write a documentation for the code and user manual, create slides for a demo presentation and rehearse till ready.

11.0 Technical details

(Max 1 page)

Implementation language and principal libraries. What are the important algorithms or approaches under consideration for this work?

For language use within my project, I think I am going to use python as from my research it is a strong choice for VPN related projects, and it would be good to develop my python language skills. For principals and libraries, I still am not too sure what I will use although going through my research I did see using wire guard is very good when creating a VPN.

12.0 Special Resources Required

(Max half page)

What special resources, if any will be required for this work?

I will need access to different cloud servers like AWS or google cloud etc.

13.0 Project Plan

(Max 2 pages)

Project plan with details on implementation steps and timelines. This project plan should provide as much detail as possible for now and will be revised with more detail with the mid point documentation.

Phase 1: For the first month I brainstormed as much as I could to try improving and my project different to others similar out there.

Phase 2: I will next start to download features needed to create my project alongside documentation.

Phase 3: Next step I will start implementing and setting up both VPN's

Phase 4: My next step will be seeing if the VPN's work on different servers

Phase 5: Creating the webapp to display these comparison.

Phase 6: The next Phase will be comparing on contrasting some differences between them.

Phase 7: Document a midpoint review, write up testing results.

Phase 8: Implementing some AI and set up a machine learning system.

Phase 9: Finalise my project and my report/ documentation and prepare for the demonstration.

Phase 10: Present my work and submit the final product and project

14.0 Testing

(Max 1 page)

Describe how you will evaluate the system with real technical data using system tests, integration tests etc. If applicable describe how you will evaluate the system with an **end user. (be careful here re Ethics etc)**

Performance testing –

I'm going to use tools like Iperf to Measure download/upload speeds with and without the VPN to compare how each protocol impacts network performance.

Network Routing –

Verify that both VPNs properly route traffic from clients to the internet and that there are no leaks

Reflective Journal –

Sep

18845_Price_Asemot
a_report_20581_6685

Oct

18845_Price_Asemot
a_x21445372_20581_

Nov

18845_Price_Asemot
a_x21443372_20581_