



Research Proposal

Comparing IPv4 and IPv6 Networks

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Introduction/Background to the Proposed Research

This first section of research will include a clear background of the subject area of study, providing the reader with an understanding of IPv4 and IPv6 networks, an introduction to the networking industry at University of Wales Trinity St David Swansea and the expected outcomes of the research. This section will also compose a series of objectives that specify what the author will need to do in order to complete his research.

Research Title

The title for this research project is Comparing IPv4 and IPv6 Networks.

Background to the Subject Area of Study

Internet Protocol was designed in 1970s by 2 DARPA scientists, Vinton Gray Cerf and Robert Elliot Kahn. [1] There are two types of Internet Protocol, IPv4 and IPv6. Internet Protocol version 4 (IPv4) is the under layer of technology that makes it possible to connect all devices to the Internet and defines an IP address as a 32-bit number. Each computer is assigned a unique numerical IP address to be able to send data from one computer to another through the Internet. Without IP addresses computers would not be able to communicate.

Internet Protocol version 6 (IPv6) is the descendant to IPv4. This protocol has the same benefits and functions as IPv4, however it has more of an advantage and is the IP future because it utilises 128-bit addresses. In other words, because the use of PC's, smartphones, gaming systems, tablets, and every other system connecting to the internet, IPv4 is running out of IP addresses. So IPv6 is the answer to this solution because it is capable of 340 undecillion addresses. [2]

Internet protocol is a protocol where data is sent from one computer to another through the internet/network. Every computer has at least one IP address that uniquely identifies it from all other computers on the network. [3] How does this process work? Well when data gets sent or received, the message gets divided into packets and each of these packets contains both the senders address and the receivers address. A gateway computer is first to receive any packet, because it understands a small part of the internet. It then reads the destination address and forwards the packet to an adjoining gateway. This gateway then reads the destination address across the Internet until one gateway recognises the packet as belonging to a computer within its domain. The gateway then forwards the packet to the computer whose address is specified. [3] Internet protocol only delivers packets across the Internet, the Transmission Control Protocol (TCP) then takes place to put them in the right order otherwise they will be in a different order than the order they were sent in.

IPv6 is being pushed out across most networks and devices are being assigned IPv6 addresses, but this does not mean that they will be able to access the full extent of IPv6. For example if the enterprise network or ISP that the device connects to doesn't support IPv6 then it will not connect. [4] The Internet Engineering Task Force (IETF) have a solution to this which is called the 'Happy Eyeballs' algorithm. This detects both IPv4 and IPv6 addresses and picks which one to use regarding the best performance. [4]

Where does Internet Protocol go from here? Because of the history of IPv4 and the IPv6 adoption over the last 20 years, it is no slight action to make any hard predictions about the

future of internet protocol. Gartner predicts a total of over 20 billion devices online by 2020, which will render IPv4 and dual-stack technologies inadequate to service the internet of the near future's needs. [4]

An Understanding of the Field in Which the Study Lies and How the Study Fits Into This Field

The aim of this project will be to compare the performances of IPv4 and IPv6 Networks, describing how IPv4 is now running out of addresses for systems to connect to and how IPv6 will be the main internet protocol for the future. Readers will be satisfied with the in-depth comparison between these two protocols and understand how internet protocol works. Research into IPv6 is crucial for networking because it holds the future of the internet infrastructure and is a successor to IPv4.

Introduce the Industry/Organisation/Context that is Being Investigated

The location for this research proposal is University of Wales Trinity St David Swansea. The university provides higher education around Swansea and other areas such as Carmarthen, Lampeter, Cardiff and London. The university supplies free software for students that help reach their goals and complete research ready for deadlines. This research will be completed in the context of providing a comparison between Internet Protocol version 4 and Internet Protocol version 6 within the new SA1 Waterfront Campus.

Define One Overarching aim of the Study. Construct a Series of Objectives That Specify What You Will do to Achieve the Aim

The aim of this study is to create a strong and in-depth comparison between IPv4 and IPv6 that will foresee the study's future to become a journal or a book and be published for readers that seek to understand networking principles. In order to achieve this aim, the following objectives will need to be reached:

1. Research and find out everything there is to know about IPv4 and IPv6 before comparing them.
2. Experiment on both IPv4 and IPv6 performances and comparing the results of throughput, delay, packet loss. Jitter, encryption etc.
3. Write a requirements list and include a brief of everything needed of these two internet protocols.
4. Over achieve and check simple things like grammar, spelling and literature skills.
5. Knowledge and understanding skills have to be spot on so that the readers can find it easy to understand the knowledge provided.

Expected Outcomes and/or Deliverables

At the end of this project, IPv4 and IPv6 would have been fully broken down and analysed ready to meet the reader's needs. All questions will be answered and the readers will have a fully debriefed report of the difference in performances of Internet Protocol version 4 and Internet Protocol version 6. This will include the background and history of internet protocol, why the world of technology needs IPv6, how IPv4 is running out of addresses and the future of networking.

Conclusion

In this section, user has provided a clear description of the background of internet protocols, an understanding of the field which the study lies in and how the study fits into that field. Where the research will take place, the objectives to complete the research and the expected outcomes. As seen in the overarching aim of study above, there are 5 main objectives to achieve the aim of publishing this research in a journal or book, these will also see through the project's completion.

The next section will include research and development methods.

Research and Development Methods

Introduction

In the previous section, the user discussed the background to the proposed research, in this section, we will be undergoing the research and development methods in order to gather data and evaluate the results. We will be identifying the risks/limitations/ethical/legal issues and how to prevent them. The data collection methods and the research methods such as strategies, reliability and validity will also be analysed. At the end of this section we will also discuss how to analyse the data collected and if the aim and objectives have been achieved.

Research Philosophy and Approach

Before commencing the research, the user will need to choose an appropriate research philosophy, and to help with this, we have the ‘Research Onion’ as shown in figure 1 below. The research onion analyses the different philosophies, approaches, strategies, choices, time horizons, techniques and procedures. Here is where we discuss the next step of the research deciding on what path to go down from the research onion.

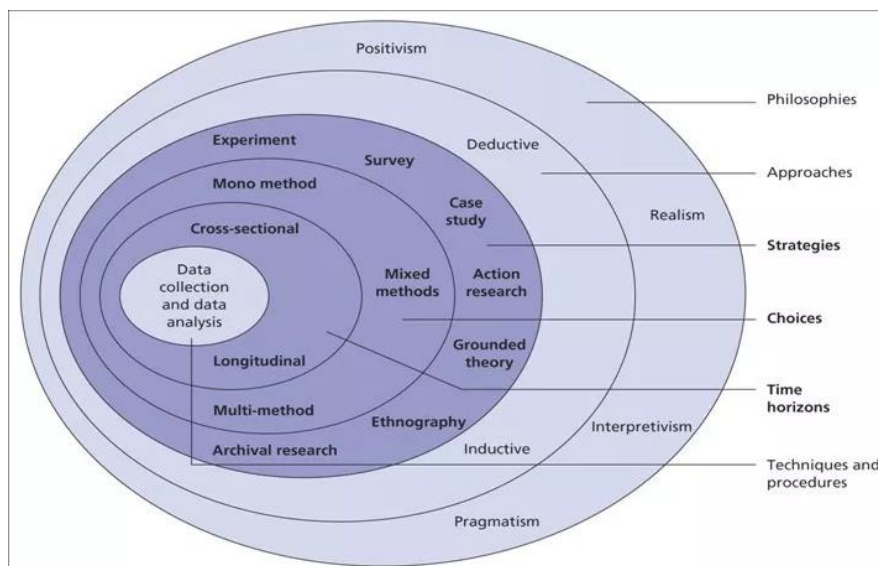


Figure 1 [5]

Because of the research proposal of comparing IPv4 and IPv6 networks, Positivism will be used as the research philosophy because it's best suited to achieve the projects aim and objectives. Positivism comes up with the research questions and hypotheses that you can test. With positivism, it is the type of body of research that other researches can also take to find the same outcome. [5] In return the data is perceptible and gives you the importance to get the significant results, this is why we are choosing positivism.

There are two research approaches, Inductive and Deductive. The main difference between inductive and deductive approaches to research is that whilst a deductive approach is aimed and testing theory, an inductive approach is concerned with the generation of new theory emerging from the data. [6] For this research, the deductive research approach has been chosen because the aim of the project is the find the differences/answers between IPv4 and

IPv6 and is the answer to the question at the start of the research. This approach allows for the process to be duplicated and for that the data is quantitatively measured.

Research Strategies

There are a number of research strategies that the user can use in order to collect data for the research. Some are experiment, survey, case study, action research etc. The research strategy we will be using for this project will be experiment. Experiment designs are very scientific and complex in their structure. It makes it tough for others to replicate your research. [5] In this case, it would not be that hard to replicate comparing IPv4 and IPv6 networks. However using other research strategies such as surveys and case study will not get us valid and significant results compared to an experiment.

Reliability and Validity

Research reliability is the degree to which research method produces stable and consistent results. A Specific measure is considered to be reliable if its application on the same object of measurement number of times produces the same results. [7]

The reliability of the results can be sabotaged, and according to Saunders et al, these are the following that can affect the results: [8]

1. Observer Error
2. Observer Bias
3. Subject or participant bias
4. Subject or participant error

Validity whilst collecting data means that your findings truly represent the circumstance you are claiming to measure. Alongside reliability, there are possible threats to validity and Saunders et al described them as: [8]

1. Maturation
2. History
3. Testing
4. Mortality
5. Instrumentation

Reliability and validity can affect the results so it is important to measure these in a valid and professional way. Hopefully this will ensure a purposeful project.

Identify Your Data Collection Methods

The data collection methods we will use will be a mixed collection. To begin the collection, an experiment will be performed in order to compare the performance of IPv4 and IPv6 networks. After the data has been collected, we will ask the readers to complete a short survey asking if we covered all the bases of the comparison and if we missed anything, is there anything to improve on and would they like to see another research project similar to that one. The audience we target to take these surveys will be staff and students within the university.

The data we intend to gather through the experiment are differences in throughput, delay, packet loss, jitter and more. We also want to see data which proves IPv6's complexity and efficiency, but furthermore the main differences between both IPv4 and IPv6 performances.

Identify Risks/Limitations/Ethical/Legal Issues

There are four risks that could cause the project to fail. They are:

1. Poor time management
2. Not enough time for the experiment to take place and write up the report
3. Not enough data collection
4. Poor experiment circumstance - need to make sure the experiment has full potential

All of these risks can be avoided by sticking to the project plan and with good preparation. By using the Gantt chart provided in Microsoft Access, every step in order to complete the objectives are in place to perfectly execute and finish this project in time.

There aren't really any legal or ethical issues within this project as it is a simple individual research project based on comparing two different internet protocols. The only legal issue that could come to place would be researching the comparison and inputting that data into the report without referencing of where that data come from. This can be avoided by referencing everything that did not come out of the experiment and giving the author of that data credit.

The only limitations for this project would be the lack of skill to compare the differences of IPv4 and IPv6 networks, but in this case the user study's computer networks as a degree and would have the knowledge of basic networking principles. So that problem would not be an issue. Another way to solve this problem would be to recruit another member onto this research and split the credit, or help off staff or students.

How Will You Analyse the Data/Evaluate Your Results?

We will be analysing the data by comparing it with other projects online and in university. This is a good way to see if the data is correct and significant. We will also be transforming qualitative data into quantitative data. The results from the research online about the differences in performances of IPv4 and IPv6 networks will also be a back bone to evaluate the results.

Conclusion

In this section we have discussed and analysed the use of specific research and development methods including research strategies, the risks/limitations, ethical and legal issues and the research philosophy and approach. We have also discussed the evaluation of the results and how we are going to analyse them.

In the next section we will plan the resources required to complete the project and construct a Gantt chart.

Resources and Planning

Introduction

In the previous section, the user identified the research methods that would be used to gather data such as philosophy, research strategies, reliability and validity. Data collection methods such as interviews, questionnaires and surveys were identified, development methods, risks/limitations/ethical/legal issues also.

In this section, the user will identify the resources required and construct a Gantt chart that demonstrates evidence of project planning and management.

Identify Any Resources Required

The following resources will be required in order to complete the project:

- PC/Laptop – to conduct research on
- Networking components such as router, switch, cables, and a PC – in order to conduct a research on performances of IPv4 and IPv6
- Staff and students to complete surveys and questionnaires
- A word processing software that helps check the spelling, grammar and literature of the notes and report being written
- Microsoft Project – In order to create project management table and Gantt chart

Construct a Gantt chart That Demonstrates Evidence of Project Planning and Management. Identify the Timescales for Each Component of the Study

Project management was key for this project to be successful, every objective had a time scale. Microsoft Project benefited us by providing a software that can create Gantt charts and help you manage your projects by offering duration scales, start to finish timelines, resource names, etc.

In order to manage each step of this project, a Gantt chart was created (see figures 2-5). There are 3 sections in the project, requirements, research and experiment. Each task includes sub-tasks with duration days, deadlines and resources required in order to complete the tasks. These tasks collaborate with team members in real time, the software offers communication tools that can assist teams in discussing issues in real time.

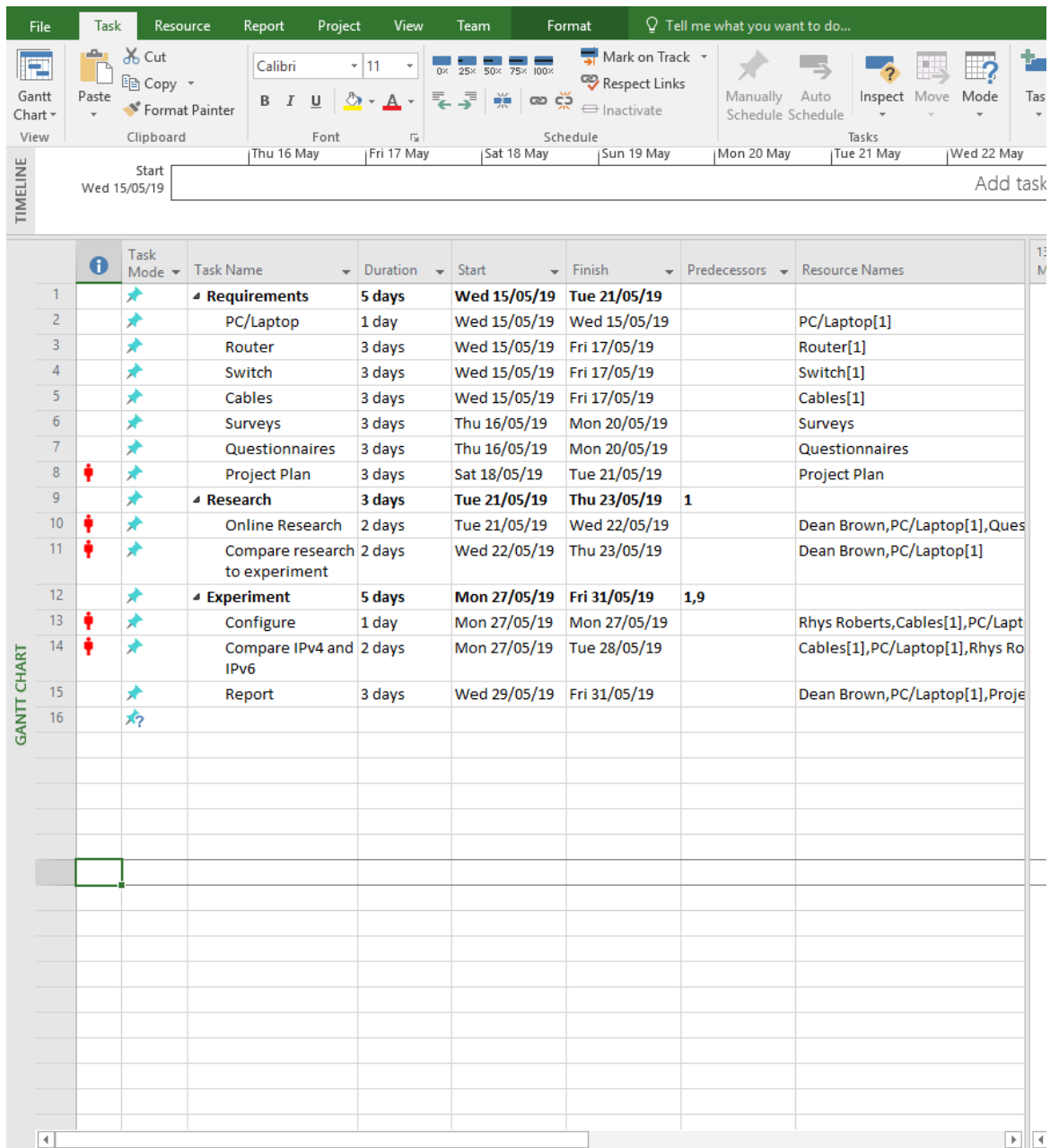


Figure 2 – Gantt chart

This Gantt chart represents the entire project that is going to take place. Including the duration of each task, the start to finish date for each task and the resources applied to every task in order to make the project succeed. The predecessors have also been applied to show that research cannot take place until the requirements have been bought and the experiment cannot take place until the research has been complete.

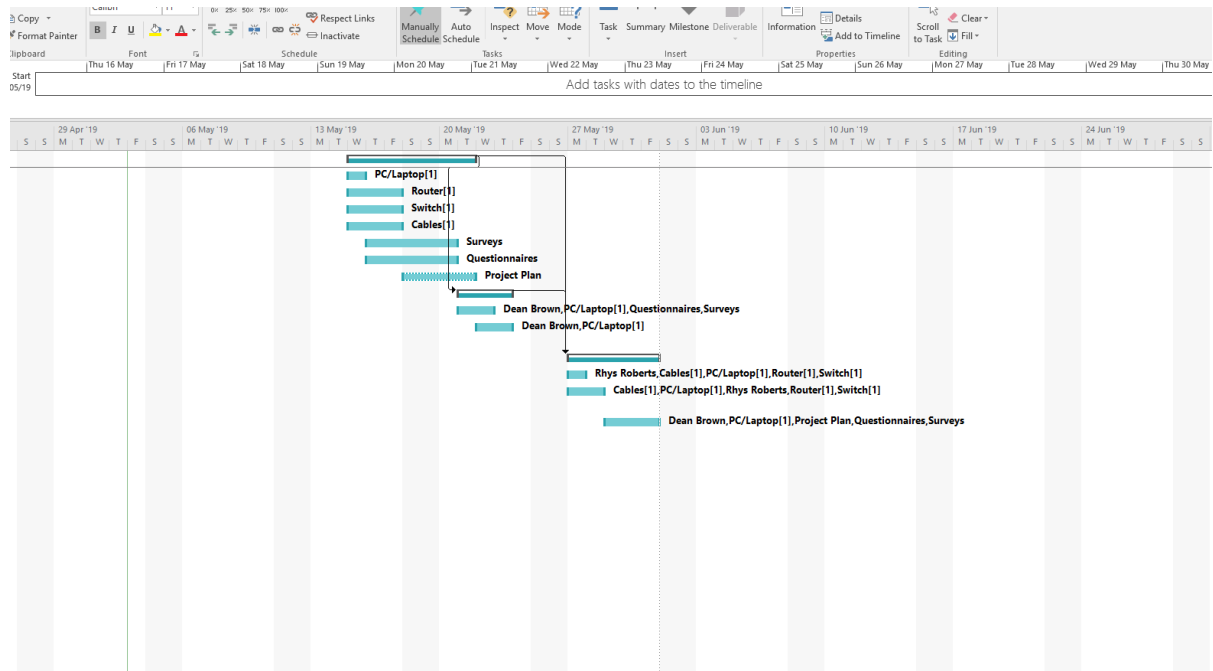


Figure 3 – Timescale of the tasks required to achieve the aim of the project

This figure displays the timescale of the project, how long each task will take along with the resources required to complete the tasks.

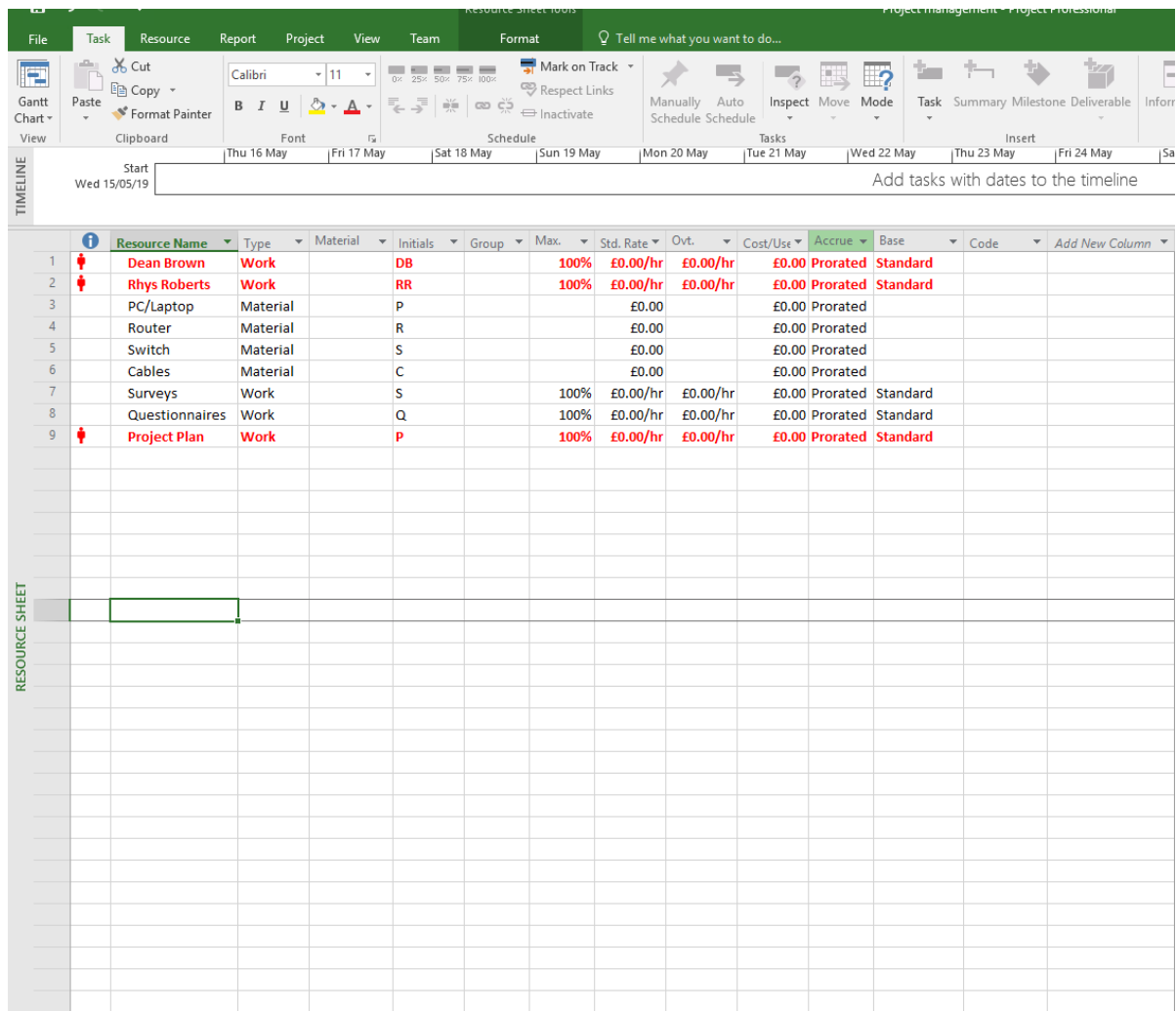


Figure 4 – Resource sheet. This figure shows the number of workers and material required for the project

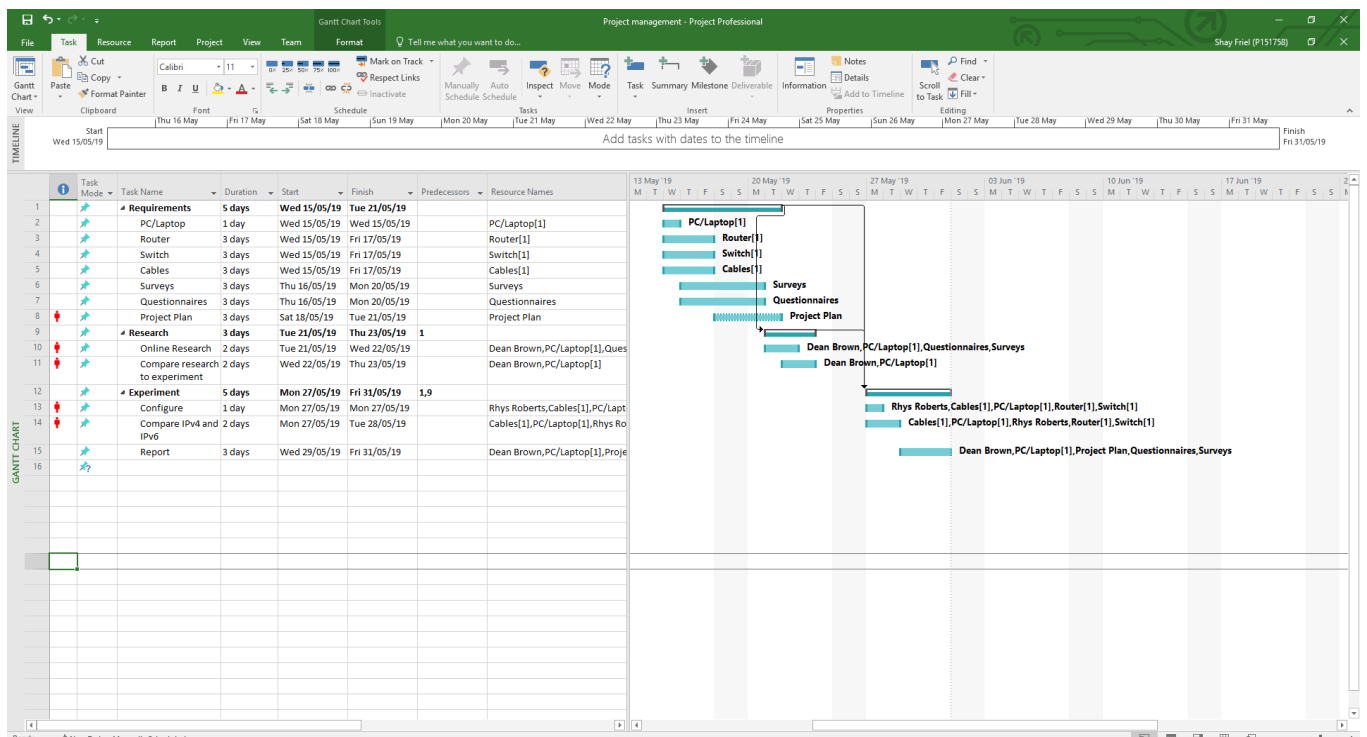


Figure 5 – Microsoft Project plan in whole

Conclusion

Throughout this section, user has discussed the resources needed in order to complete the project and set up the planning and project management so that the research and experiment of the project runs smoothly and gets completed within the timescale given.

To conclude, Microsoft Project has been very helpful setting up the project management for the project, but it also over complicated the project a little. However the intuitive to use the software is simple and if anything needs adapting, for example a missing resource is required or the timeline needs to be changed then it can be easily done. Microsoft Project requires little training to use. This is an advantage because something little such as a missing resource or a late deadline can lead the project to fail.

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