

Proposal report

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INDEPENDENT PROJECT

Explore the performance of different network topologies within
the company's network

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Introduction

In modern enterprises, computer networks form the cornerstone of organizational operations, providing support for communication, data exchange, and collaboration among various departments and remote work locations. Network efficiency is largely dependent on its topology - the layout of nodes and communication links - which directly determines network performance, scalability, and fault tolerance.

How enterprises, organizations or departments select and construct a reasonable and appropriate network topology is of great significance. After an organization or a large enterprise department has been in operation for some time, it needs to adjust the network topology (such as adding or deleting links). This behavior will significantly affect performance indicators such as network latency, throughput, and fault recovery capabilities[1]. Therefore, how to improve network performance, enhance the overall reliability and fault tolerance of the network, and support the subsequent expansion of the network is of paramount importance. This means optimizing the transmission path of the network, reducing latency and increasing throughput, avoiding link bottlenecks, distributing traffic evenly, reducing packet loss rates, and also avoiding single-point failures affecting the entire network. For example, a mesh topology structure can ensure that data is transmitted through backup paths when nodes or links fail, ensuring the continuity of business[2]. At the same time, deploying a network topology structure that is in line with the usage area will significantly reduce the maintenance cost, time cost, and management difficulty in the later stage.

Take Ethernet as an example. Ethernet has been widely used in society and has participated in human life and production activities. The main reason for this is that it has high bandwidth, scale economy effect and flexibility [3]. The reason for this phenomenon is that in practical applications, Ethernet adopts a star network topology structure, although logically Ethernet should adopt a bus topology structure[4]. Although the bus topology is superior to the star topology in terms of network setup and cost, that is, the bus topology has better layout advantages and cost advantages. However, in the subsequent maintenance and management of this bus topology network, the cost will be relatively higher because in this network, if a device on one of the main cables fails, the entire network will be affected; and when a failure occurs, the bus address is not convenient for fault troubleshooting, and the network scalability of the bus topology structure is poor. Once a device is added to the bus, the performance of all devices in the entire network will decrease [5].

Furthermore, considering the issue of network security, although it is not the focus and area of this research, network security is a key concern for all fields related to the Internet. Although this research is not intended to design or write scripts or codes for security protocols for network topology devices, in network security, the prevention of network attacks is not solely dependent on the protection provided by network security personnel; it also requires physical support. Here, the physical aspect is not only about the selection of equipment, but also includes configuration commands for the equipment, such as configuring access control tables in routers, dividing different VLANs, and enabling firewalls on servers [6]. At the same time, a clear topology structure also facilitates the use of third-party software for detection and data collection. A network that is less prone to packet loss and has stable transmission will provide a foundation for SecOps, and after a certain period of time, monitoring will form a clear and standard log stream by configuring Syslog or enabling SNMP Trap for network devices[7]. At the same time, through these data, the efficiency of anomaly detection, such as DDoS and internal lateral

movement threats, will be improved. Preventing and minimizing the possibility of organizations, departments, or enterprises' equipment being attacked by network attacks.

As enterprise networks evolve towards cloud computing, virtualization, and software-defined networking (SDN), the traditional static topology structure is no longer suitable for dynamic traffic management and high reliability requirements. However, most existing research is based on theoretical models or data center simulations, and empirical performance evaluation of different topology structures in enterprise environments is still relatively lacking. Taking data center research as an example, the fat-tree topology can maintain high throughput and low latency under medium load and link failure conditions[9], while the BCube topology performs better under high load conditions, but the path delay increases[9]. This indicates that topology selection has a significant impact on the performance, reliability, and scalability of enterprise networks.

This study aims to fill this gap by systematically evaluating the performance of star, bus, ring, and hybrid topologies in enterprise networks. The research objectives include: designing and simulating different topological structures, measuring latency, throughput, packet loss rate, and fault recovery capabilities; analyzing the performance differences of each topological structure under expansion and failure conditions; proposing optimization suggestions for enterprise networks. This experiment will involve a 30-day observation period and recording of network communication after configuring the basic network using the Cisco packet tracker. Comparisons will be made and recommendations will be provided. The expected outcomes include: detailed performance comparison reports, data visualization results, and a repeatable simulation environment, which will provide a data-based and practically constructed reference for network topology design in the IT department of enterprises.

Project design

This project will commence on 23/9/2025 and end on 1/5/2026. The experimental part will run from 20/10/2025 to 1/5/2026. Regarding the implementation of the entire project, this experiment will directly use the Cisco Packet Tracer (hereinafter referred to as CPT) software to build the overall network topology structure. This is a software that is very convenient for network administrators to adjust the topology design of the network. Based on the title "Exploring the Performance of Different Network Topology Structures in the Company Network", this experiment will face multiple adjustments to the network topology structure, and it is expected to observe the network changes over a period. Therefore, a software that can directly build and observe the changes in the overall network situation is very convenient. Although Cisco Packet Tracer does not have the function of real-time prediction of network behavior, it has the Simulation Mode function, which means it supports displaying the transmission process of all data packets in the network. By gradually adjusting the traffic load, disabling links, or adding nodes, the state of the network can be simulated, thereby studying the performance of different topologies under high load or partial failure conditions, providing insights into the scalability and fault tolerance of the network [9]. And from a physical perspective, CPT not only can simulate the construction of a department or a small-scale organizational network topology, but also depicts the scale and location of network devices such as routers, switches, and hosts in the actual environment. This software also provides the geographical representation of the network, including multiple buildings, cities, and distribution centers. From a logical perspective, the Logical Work Area shows the logical network topology structure of the network constructed by the user. It represents the placement, connection, and clustering of virtual network devices [10].

Through this experiment, although the built-in functions of CPT are already sufficient to meet the expectations of the experiment, during the testing process, it is still expected to use network tools such as Activity Wizard and Wireshark for auxiliary observation and data collection.

It is important to note here that since Wireshark cannot be directly integrated into Cisco Packet Tracer, it may not be possible to successfully complete the traffic observation step using Wireshark. This is because Wireshark cannot observe the network topology environment simulated by the software. Therefore, in this experiment, the data packet interaction process will be observed through the simulation mode of Packet Tracer, while Wireshark will be used to capture and analyze the corresponding traffic characteristics in a small real or virtual network. However, since the experiment will be conducted in a real department, organization, or company, the test results of Wireshark will be used to assist in verifying the authenticity of the data in the simulator.

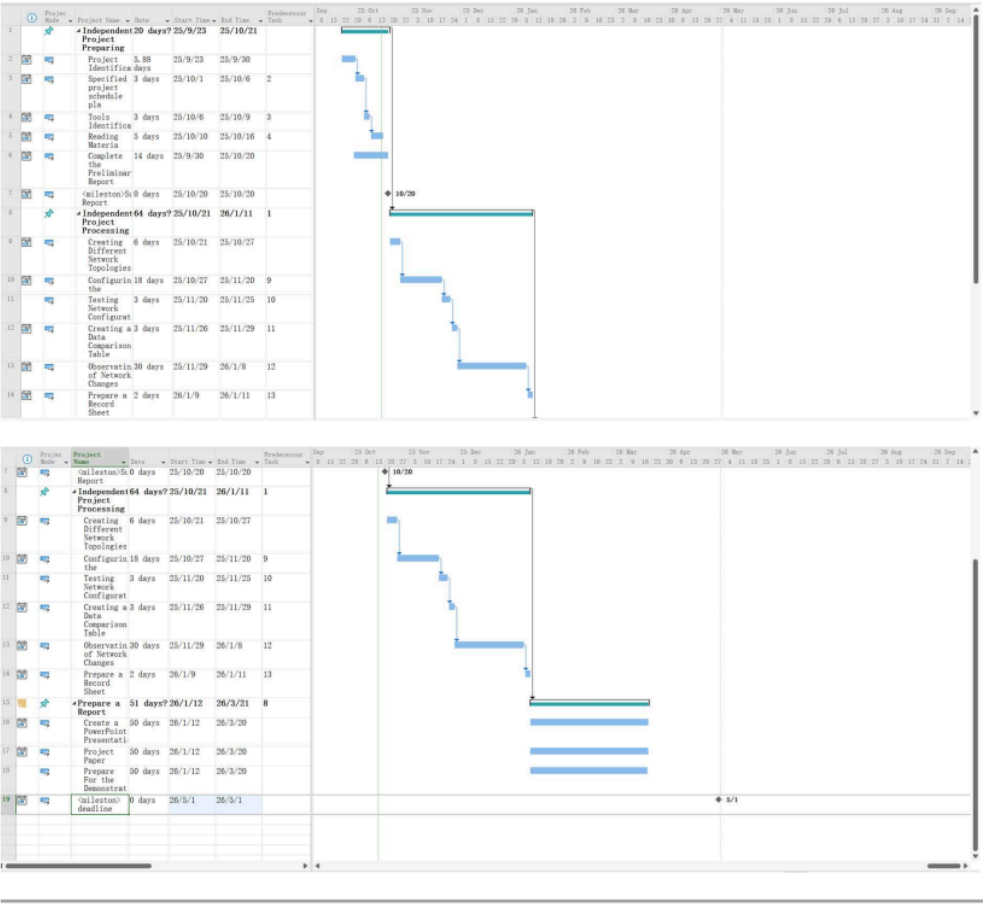
Since this is a complete simulation of a real-world network topology experiment, security configurations will also be made for the devices in the configuration commands. In the CPT, the access control lists of the routers are set through commands such as: 'rule permit source <IP address> '& 'rule deny source any'.

The steps of this experiment will be divided into the following parts: Using Cisco Packet Tracer to build and analyze different network topology diagrams: bus type, star type, ring type, tree type, mesh type and mixed type, which are common topological structures. After that, the testing phase, the experimental

results will be compiled into a questionnaire, which will be distributed to professionals and the results will be sorted out. Meanwhile, after forming a complete network architecture, maintain communication and observe and collect its data. After obtaining complete data, combine personal analysis and reference materials to form a proposal on the use of enterprise networks, and complete an independent project report.

Resources and Planning

Gantt Chart



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Completed ethics form

The link for ethics form file:

Proposal report

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

60/100

PROJECT PROPOSAL – ACCA6020 INDEPENDENT PROJECT

Student Zeyu Xie **Mark**
60 %

Intro / A&O (400 words)		
Project title; Identification of a specific problem to be investigated; Well-defined aims and SMART objectives; Explaining why this project is worth doing; Discussion of what the project needs to do in order to be a success; Description any deliverables that will be produced at the end of the project	20	11
You have an idea that you want to do a networking project, but at the moment your aim and objectives are not clearly defined. This should be the starting point, extract the aim and objectives from your introduction and ensure that these objectives can be measured. Otherwise, the project is worth doing.		

I can see that the Aim and objectives are better presented in the Ethical form than in your main document proposal document which is not supposed to be the case		
Background to the Project / Literature Review (400 words)		
Description of how the work to be done by in the project relates to the work identified in the literature review; Discussion of any ethical issues raised by the project Identifying what has already been done within the field; Topic familiarity; Brief literature review using appropriate sources – 6-8 journal papers and book chapters rather than just websites; Selection of relevant models & concepts You have shown that you have looked into some literature sources and how your work relates to what you reviewed in the literature. Instead of having only two sections in your proposal that is Introduction and Project Design, you could have included a separate section specifically for the literature review. I have seen your discussion on ethical issues, and I think that, given the nature of your project, you will not need to distribute questionnaires to participants.	20	12
Project Design (500 words)		

Clear statement of which development methods are to be used and why they are appropriate; Clear statement of which tools are to be used and why they are appropriate; Clear description of how data collected will be analysed This is the area that has room for improvement. There is a need to consider whether this project will be more developmental or experimental. Since most of the work will be conducted in Packet Tracer, it may be challenging to obtain valid data for accurate analysis. Taking a developmental approach might be a good idea.	30	16
Resources / Planning (200 words)		
List of any deliverables; Clear diagram showing both timing and resource use; Completed ethics form; Limited and relevant appendices You completed the ethics form, but you selected information that is not necessary for this type of project. I believe you do not need to obtain views through	15	10

formal questionnaires from any participants. It is good that you produced a Gantt chart, but some of the tasks and their durations still need further review.		
Document Presentation		
Correct spelling, grammar and punctuation; Flow of narrative/fluency; Coherence; Word processed ; Correct use of referencing with bibliography; Strict word limit You could have improved the flow of the narrative and the overall fluency by subdividing your document into shorter, distinct sections instead of having two long sections where the reader must extract relevant information. I also noticed that some authors' names were not written using the English alphabet.	15	11
TOTAL	100	60

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