Design of a Secure and Scalable Internet Café Network System

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ABSTRACT

This study presents the design of a secure and scalable Internet café network system aimed at improving connectivity, performance, and manageability in a multi-user environment. Internet cafés continue to serve as important facilities for students, professionals, gamers, and individuals who require affordable access to computers and internet services. As the demand for reliable and high-speed internet connectivity increases, the need for a well-planned network infrastructure that ensures security, stability, and efficient resource management has become more significant. The study employed a descriptive design approach focusing on network requirements, hardware and software selection, network topology design, IP addressing scheme, and the integration of essential security measures. A star topology was selected because of its centralized management, ease of troubleshooting, reliability, and ability to support future expansion. The proposed network utilizes a structured IP addressing scheme within the 192.168.1.0/24 subnet, with a Cisco router configured to provide Dynamic Host Configuration Protocol (DHCP) services for automatic IP address assignment. Security features, including firewall protection, antivirus software, user access control, and regular network monitoring, were incorporated to enhance the confidentiality, integrity, and availability of network resources. The study also presents the recommended hardware and software requirements, network topology diagram, IP addressing table, and estimated implementation cost. The proposed design offers a practical, cost-effective, and scalable solution for Internet café operations by improving network efficiency, simplifying administration, enhancing security, and providing a reliable foundation that can accommodate future growth and technological advancements while ensuring a better overall user experience.

Keywords: Internet café network, LAN, star topology, network security, IP addressing

INTRODUCTION

Background

Internet cafés continue to provide affordable access to computers and the internet for students, professionals, gamers, and other users. As the demand for online services and digital applications increases, the need for a reliable, secure, and efficient network infrastructure becomes more important. A well-designed network enables stable connectivity, efficient resource sharing, and effective management of multiple computer units within an Internet café environment.

Problem Statement

Many Internets cafés experience network-related issues such as slow internet connectivity, poor network management, security vulnerabilities, and difficulty in accommodating future expansion. Without a proper network design, these problems can negatively affect service quality and user satisfaction. Therefore, there is a need to develop a secure and scalable network design that can support efficient Internet café operations.

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OBJECTIVES

General Objectives

To design a secure and scalable network system for an Internet café.

Specific Objectives

1. To develop an efficient network topology for an Internet café.
2. To create an appropriate IP addressing scheme for network devices.
3. To identify the necessary hardware and software requirements.
4. To incorporate basic network security measures.
5. To provide a network design that supports future expansion and management.

Significance

This study will benefit Internet café owners, network administrators, and students by providing a structured network design that promotes efficient connectivity, improved security, and easier network management. The proposed design may serve as a reference for establishing or upgrading Internet café network infrastructures.

Scope and Limitations

This study focuses on the design of an Internet café network, including network topology, hardware and software requirements, IP addressing, and basic security considerations. The study is limited to the planning and design phase only and does not include actual implementation, deployment, performance testing, or user surveys.

RELATED LITERATURE

Local Area Network (LAN) Design

A Local Area Network (LAN) is a fundamental networking structure used to connect multiple computers within a limited geographical area such as homes, schools, offices, and Internet cafés. LANs enable fast communication, efficient data sharing, and centralized control of network resources. In Internet café environments, LAN design is essential because it allows multiple client machines to simultaneously access shared internet connections and services. A properly designed LAN improves performance by reducing latency, preventing congestion, and ensuring stable connectivity across all connected devices (Forouzan, 2017).

Network Topologies (Star Topology)

Network topology refers to the physical or logical arrangement of devices in a network. Star topology is widely used in Internet café setups because of its simplicity, reliability, and ease of management. In this configuration, all client computers are connected to a central device such as a switch or router. This setup allows easy detection and isolation of faults since issues in one workstation do not affect the entire network. Additionally, star topology supports scalability, making it suitable for environments where additional computer units may be added in the future without major redesign (Tanenbaum & Wetherall, 2011).

Network Security in LAN Systems

Network security is a critical component in designing Internet café networks due to the public nature of user access. Without proper security mechanisms, networks may be exposed to unauthorized access, malware attacks, and data breaches. Common security measures include firewalls, antivirus software, content filtering,

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and user access control policies. Implementing these measures ensures confidentiality, integrity, and availability of network resources (Stallings, 2018).

Internet Café Management Systems and Network Efficiency

Modern Internet cafés often integrate management systems that allow administrators to monitor user activity, control session time, manage billing, and enforce usage policies. These systems improve operational efficiency and enhance user experience by ensuring fair usage and stable performance across all workstations. Centralized management also reduces downtime and simplifies network administration tasks.

Scalability and Performance Optimization in Network Design

Scalability is an important consideration in network design, particularly in Internet cafés where user demand may increase over time. A scalable network allows additional devices to be integrated without significant changes to the existing infrastructure. Techniques such as bandwidth management, load balancing, and traffic monitoring help optimize performance and ensure stable internet access even during peak usage periods (Oppenheimer, 2010).

METHODOLOGY

This study utilized a descriptive design approach in developing a secure and scalable Internet café network system. The methodology focused on identifying network requirements, selecting appropriate hardware and software components, designing the network topology, creating an IP addressing scheme, and incorporating security measures to ensure efficient and reliable network operations.

Network Requirements

The proposed Internet café network was designed to support multiple client computers connected to a shared internet connection. The network must provide stable connectivity, efficient resource sharing, centralized management, and sufficient bandwidth for web browsing, online gaming, and other internet-based activities. The design also considered future expansion to accommodate additional workstations without significant infrastructure modifications.

Hardware Requirements

The hardware components required for the proposed network design include:

- Internet Service Provider (ISP) modem
- Router for internet distribution and network management
- Managed or unmanaged network switch
- Client computers/workstations
- Server computer (for centralized management)
- Ethernet cables (Cat5e or Cat6)
- Uninterruptible Power Supply (UPS)
- Network Interface Cards (NICs)

These components form the physical infrastructure necessary to establish communication among network devices and ensure reliable network operation.

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Software Requirements

The software requirements for the proposed network include:

- Operating System (Windows or Linux)
- Network management software
- Internet café management software
- Antivirus and anti-malware software
- Firewall software
- Device drivers and network utilities

These software applications help manage network resources, monitor user activities, and provide protection against security threats.

Network Topology Design

The proposed network utilizes a star topology, where all client computers are connected to a central network switch. The switch is connected to a router that provides internet access to all devices. Star topology was selected because it offers easy management, fault isolation, reliability, and scalability. If a single workstation experiences a failure, the rest of the network remains operational.

IP Addressing Scheme

A private IP addressing scheme was developed to organize network devices efficiently. The proposed network uses the 192.168.1.0/24 network address range.

Table 1. Proposed IP Addressing Scheme for the Network

Device	**IP Address**
Router (Gateway)	192.168.1.1
Server	192.168.1.2
Client PC 1	192.168.1.10
Client PC 2	192.168.1.11
Client PC 3	192.168.1.12
Client PC 4	192.168.1.13
Client PC 5	192.168.1.14
Additional Clients	192.168.1.15–192.168.1.254

The Dynamic Host Configuration Protocol (DHCP) may also be used to automate IP address assignment and simplify network administration.

Security Design

To ensure network security, several protective measures were incorporated into the design. A firewall is

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deployed at the network gateway to monitor and filter incoming and outgoing traffic. Antivirus software is installed on all client computers to protect against malware and malicious software. User access restrictions are implemented to prevent unauthorized system modifications. Regular software updates and network monitoring are also recommended to maintain security, improve system performance, and reduce vulnerabilities.

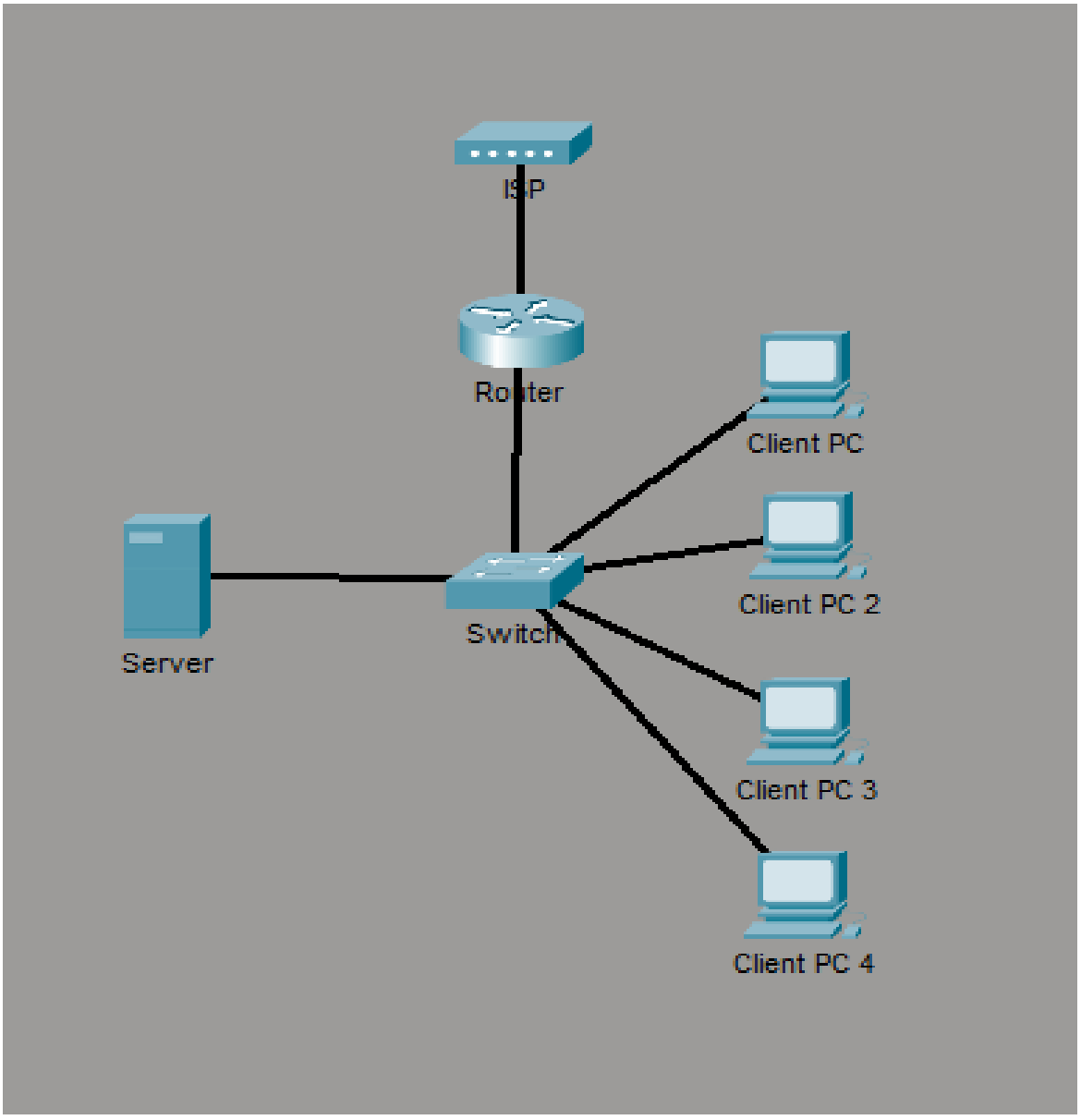
The integration of these security measures helps protect network resources, maintain operational stability, and provide a safer computing environment for Internet café users.

RESULTS

Network Topology Diagram

The proposed Internet café network uses a **Star Topology**, where all client computers are connected to a central switch. The switch is connected to a router that provides internet access through an ISP modem. This design ensures centralized control, easy troubleshooting, and efficient expansion.

Figure 1. Network Layout of the Proposed Internet Café System



Text Representation of Topology:

ISP Modem → Router → Switch → Client PCs / Server

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Hardware Requirements Table

Table 2. Required Hardware for Network Implementation

Component	Description	Quantity
ISP Modem	Provides internet connection	1
Router	Manages network traffic	1
Network Switch (24-port)	Connects all devices	1
Client PCs	Workstations for users	10 – 20
Server PC	Management system host	1
Ethernet Cables (Cat5e or Cat6)	Wired connections	As needed
UPS	Power backup protection	1 – 2
NIC (Network Cards)	Network interface for PCs	Built-in

Software Requirements Table

Table 3. Software requirements for the Proposed Internet Café Network

Software	Purpose
Windows OS / Linux	Operating system for PCs
Internet Café Management System	Time tracking and billing
Antivirus Software	Protection from malware
Firewall System	Network security control
DHCP Service	Automatic IP assignment
Network Monitoring Tools	Performance tracking

IP Addressing Table

Table 4. IP Address Allocation for Networking Devices

Device	IP Address
Router (Gateway)	192.168.1.1
Server	192.168.1.2
PC 1	192.168.1.10
PC 2	192.168.1.11
PC 3	192.168.1.12
PC 4	192.168.1.13
PC 5	192.168.1.14
PC 6–20	192.168.1.15 – 192.168.1.254

Cost Estimation

Table 5. Estimated Budget Requirements for Network Deployment

Item	Estimated Cost (PHP)
Router	2,500 – 5,000
Switch (24-port)	3,000 – 6,000
ISP Installation	1,500 – 3,000
Client PCs (10 units)	150,000 – 250,000
Server PC	20,000 – 40,000
Cables & Accessories	3,000 – 8,000
UPS	3,000 – 10,000

Estimated Total Cost: ₱180,000 – ₱322,000 (depending on number of units and specifications)

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DISCUSSION

Explanation of the Design

The proposed Internet café network is designed using a star topology, where all devices are connected to a central switch. This setup simplifies network management and ensures that each workstation has a stable and direct connection to the network backbone. The router manages internet traffic while the switch distributes connectivity to all client machines.

The IP addressing scheme is structured within the private Class C range (192.168.1.0/24), allowing efficient organization and easy management of devices. DHCP can also be implemented to automate IP distribution.

Advantages of the Design

The proposed network design offers several advantages:

- Centralized network management
- Easy troubleshooting and maintenance
- Scalable structure for future expansion
- Efficient resource sharing among users
- Stable and consistent internet connectivity
- Reduced network complexity

Security Features

The network includes several security mechanisms to ensure safe operation:

- Firewall protection at the router level
- Antivirus software on all client machines
- User access restrictions to prevent system misuse
- Network monitoring tools for activity tracking
- Optional content filtering for public usage control

These features help protect the system from malware, unauthorized access, and network misuse.

Scalability

The design supports scalability by allowing additional client computers to be added without modifying the entire network structure. The use of a switch-based star topology makes expansion simple and cost-effective. Additional IP addresses within the subnet allow up to 254 devices in the same network range, making it suitable for future growth of the Internet café.

CONCLUSION

The study successfully designed a secure and scalable Internet café network system using a star topology. The proposed design includes a structured IP addressing scheme, appropriate hardware and software requirements, and essential security measures such as firewall protection and antivirus integration. The use of a centralized router for DHCP improved network manageability and reduced configuration complexity. Overall, the design meets the requirements of a stable, efficient, and expandable Internet café network system.

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RECOMMENDATION

It is recommended that future improvements include the implementation of advanced network monitoring tools for real-time traffic analysis and performance optimization. The Internet café may also consider upgrading to higher bandwidth internet connections to support increasing user demand. Additionally, implementing more advanced security features such as intrusion detection systems (IDS) and user authentication portals can further enhance network protection and control.

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