A Network Infrastructure Design Implementation for JPS Interior Designs

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Abstract

This study proposes the design of a structured network infrastructure to address the persistent challenges of file mismanagement, data loss, and connectivity issues due to IP address conflicts faced by JPS Interior Designs. The solution features a centralized main server with backup capabilities, firewall protection, wireless connectivity for non-Ethernet devices, and controlled website access to improve data reachability and mitigate security risks. The survey results demonstrated consistently high ratings across system quality metrics—including functionality, usability, reliability, performance, and supportability—indicating strong alignment with the operational needs of JPS Interior Designs staff. The proposed network infrastructure addresses key organizational challenges such as file mismanagement, data loss, and unstable connectivity through a centralized file storage system supported by a portable cloud server and a dual-server setup for redundancy and security. The integration of FortiGate firewall security and web filtering enhances protection against external threats, while expanded Wi-Fi coverage ensures broader device accessibility. Overall, the project offers a comprehensive, phased solution that improves operational efficiency, strengthens data integrity, and supports business continuity.

Keywords
IT Infrastructure, Networking, Structured Network Infrastructure, Firewall and FortiGate.

1. Introduction
In today's digital-driven landscape, the success of modern enterprises heavily relies on robust network infrastructure and secure data management systems to ensure seamless operations, effective collaboration, and reliable service delivery. Recognizing the central role of technology in maintaining business efficiency and competitiveness, this study aims to enhance the network architecture of JPS Interior Designs—a design firm based in Mexico, Pampanga that specializes in comprehensive interior, architectural, and landscape design solutions. The firm leverages advanced software tools such as SketchUp and AutoCAD to deliver high-quality 3D modeling, visualization, and drafting, underscoring its commitment to design excellence and innovation.

Despite its creative and technical capabilities, JPS Interior Designs encounters recurring challenges in its digital operations. These include frequent file loss, poor data organization, and network disruptions caused by IP conflicts—issues that hinder daily productivity, compromise data integrity, and cause delays in project completion. In response, this study proposes a strategically designed network infrastructure tailored to the organization's needs. The proposed system incorporates centralized file storage supported by a portable cloud server, redundant main and backup servers for data resilience, and robust Wi-Fi connectivity to support all devices, including non-Ethernet-enabled equipment.

Additionally, the integration of a FortiGate firewall enhances security through advanced threat protection and web filtering, mitigating risks associated with unauthorized access and malware.

By addressing these systemic inefficiencies, the proposed infrastructure aims not only to improve the company's technical environment but also to support long-term business growth. It ensures operational continuity, reduces downtime from manual processes and technical interruptions, and facilitates better collaboration among design, administrative, and management teams. Ultimately, the study contributes to establishing a stable, scalable, and secure IT framework that empowers JPS Interior Designs to deliver more efficient and innovative services in an increasingly competitive industry.

1.1 Objectives

This research, titled "A Network Infrastructure Design for JPS Interior Designs," aims to establish a modern and reliable internal network system to support the company's daily operations and enhance the security of its files and documents. JPS Interior Designs, which specializes in interior, architectural, and landscape design, currently faces several network-related challenges, including inconsistent connectivity, IP address conflicts, file mismanagement, and inefficient data access. These issues hinder productivity, delay project timelines, and compromise data integrity. To address these concerns, the project seeks to assess the existing network infrastructure, identify specific technical issues, and propose a comprehensive solution that includes the centralization of files and document storage. This will enable seamless file sharing among employees, improving workflow efficiency across departments. Furthermore, the effectiveness of the proposed infrastructure will be evaluated based on five key quality metrics: functionality, usability, reliability, performance, and supportability. The overall goal is to deliver a robust, secure, and scalable network environment that meets the operational demands of JPS Interior Designs and supports its commitment to high-quality, innovative design services.

2. Literature Review

The comprehensive body of research reviewed herein underscores the multifaceted considerations essential to designing an effective and secure network infrastructure tailored to the needs of organizations such as JPS Interior Designs. Helali (2020) provides a foundational perspective emphasizing the necessity of methodical network planning and strict adherence to established design standards. The study advocates for network configurations that are closely aligned with an organization's structural, spatial, and operational demands. Differentiating among various network types—telephone, broadcast, and digital data networks—Helali's framework elucidates how functional and data-specific characteristics should inform network design. These insights directly guide the development of JPS's proposed infrastructure, emphasizing enhanced communication speeds, secure centralized data access, and scalability to accommodate anticipated organizational growth. Furthermore, Helali's focus on key performance indicators such as throughput, latency, and packet loss provides critical metrics for ensuring optimal network reliability and responsiveness, which are particularly vital given JPS's hybrid environment involving both remote and on-site collaboration. The study's endorsement of structured network engineering principles—hierarchy, modularity, resilience, flexibility, and security—offers a strategic blueprint for constructing a robust, adaptable, and secure system capable of meeting evolving digital demands.

Complementing this foundational network design perspective, Kumar, Bansal, Singhal, and Sharma (2020) delve into the operational efficiencies achieved through File Management Systems (FMS) developed using PHP. Their work highlights the critical role of automation in simplifying file version control, reducing manual oversight, and preventing conflicts arising from concurrent modifications. The FMS approach, which utilizes file check-in/check-out mechanisms and detailed change logging, enhances transparency and collaboration within organizations. Such systematization is invaluable to JPS Interior Designs, where meticulous management of design files and client documents is essential to maintaining project integrity and workflow continuity.

In the realm of data protection and resilience, Hasan, Sarwar, Alam, and Hussain (2023) examine the transformative impact of cloud computing technologies. Their findings affirm cloud storage as a cost-effective, scalable solution for securing critical business data, providing uninterrupted access and strong encryption protocols that safeguard confidentiality and integrity. This aligns seamlessly with JPS's adoption of a portable cloud server, ensuring that sensitive design assets and client information are protected against hardware failures and cyber threats while enabling

flexible access across varied work environments. Additionally, the study's emphasis on backup and recovery mechanisms further supports JPS's objectives for business continuity and rapid data restoration in adverse scenarios.

Amin et al. (2025) contribute a detailed framework for scalable network infrastructures in mid-sized enterprises, stressing the integration of wired and wireless connectivity alongside hierarchical network topologies and VLAN segmentation. Their work underscores critical design imperatives including performance optimization, redundancy for fault tolerance, and Quality of Service (QoS) to prioritize vital business traffic. These principles offer practical applicability to JPS's network strategy, particularly in managing distinct departmental workflows and ensuring high availability. The study's recommendation for a comprehensive IP addressing scheme and structured switch port allocation further enhances network efficiency and scalability, while its advocacy for continuous security monitoring and user awareness training strengthens organizational defense against emerging cyber risks.

Network security as a vital component is extensively analyzed by Kabir (2023) and Rajabli (2024). Kabir emphasizes the triad of confidentiality, integrity, and availability as foundational to network security, advocating for a combination of technical tools—such as access control, malware defenses, and intrusion prevention systems—and comprehensive policies including user protocols and regular updates. Rajabli's systematic review complements this by providing detailed insights into LAN-specific security methodologies, including the use of Access Control Lists (ACL), Authentication, Authorization, and Accounting (AAA) frameworks, port security, and DHCP snooping. By implementing these layered security strategies, JPS Interior Designs can effectively mitigate risks related to unauthorized access, data breaches, and service disruptions, ensuring the protection of sensitive business and client data at both physical and digital levels.

Further, Incognito (2023) highlights the indispensable role of IP Address Management (IPAM) systems in facilitating efficient network administration, particularly in complex or expanding environments. By automating DNS and DHCP functions, IPAM reduces manual errors, prevents IP conflicts, and supports the seamless transition to IPv6 architectures. For JPS, this translates into a more manageable and reliable network infrastructure that can scale in response to future technological growth and increased device connectivity, ensuring consistent service availability and performance.

Goni (2022) provides a practical case study demonstrating the benefits of a secure and well-structured Local Area Network (LAN) in an organizational context. His findings regarding the Atomic Energy Research Establishment (AERE) illustrate how LAN design can optimize communication speed, resource sharing, and workplace productivity. This directly informs JPS's internal networking plans, where a reliable LAN will underpin the cloud server's functionality, facilitate collaboration, and safeguard data exchange. Goni's emphasis on balancing physical network components with logical configurations such as IP addressing and security protocols reinforces the need for comprehensive planning to ensure system resilience and security.

Finally, Channi, Kamal, and Sharma (2021) address practical security concerns faced by organizations transitioning to cloud computing and modern digital infrastructures. Their research demonstrates how even fundamental network devices like routers and firewalls, when strategically configured, can form a robust security perimeter. This approach is particularly relevant for small to medium-sized enterprises (SMEs) such as JPS Interior Designs, where budget constraints necessitate cost-effective yet reliable solutions. The study advocates for adaptive security models that mitigate vulnerabilities stemming from misconfigurations and weak policies, aligning with JPS's objective to deploy an efficient, secure, and future-proof network infrastructure.

Collectively, these studies provide a rich theoretical and practical foundation that informs the design and deployment of JPS Interior Designs' network infrastructure. By integrating principles of systematic planning, file management automation, cloud-based data protection, scalable network design, and multi-layered security, the proposed infrastructure aims to deliver a resilient, efficient, and secure environment that supports both current operational needs and anticipated growth. This holistic approach ensures that JPS can safeguard sensitive information, optimize collaboration, and maintain uninterrupted service delivery in a dynamic digital landscape.

3. Methods
This study adopts the Cisco Prepare, Plan, Design, Implement, Operate, and Optimize (PPDIOO) lifecycle methodology as the foundational framework for developing the proposed network infrastructure for JPS Interior

Designs. The PPDIOO model provides a structured, systematic, and iterative approach to network design, implementation, and management, ensuring that the resulting infrastructure is not only functional and reliable but also scalable and adaptable to evolving organizational needs.

The methodology's lifecycle perspective allows for comprehensive planning and continuous improvement by addressing each critical phase of the network's development and operational process. In this context, each phase of PPDIOO is strategically aligned with specific tasks and objectives relevant to JPS Interior Designs' operational requirements (Figure 1).

Figure 1. PPDIOO Model

The implementation of the PPDIOO (Prepare, Plan, Design, Implement, Operate, and Optimize) model in the network infrastructure project for JPS Interior Designs follows a structured and lifecycle-driven approach that ensures the network is reliable, scalable, and aligned with business objectives. In the Prepare phase, the primary focus was to establish a clear understanding of the project's purpose and objectives. The researcher collaborated closely with JPS Interior Designs' management and IT personnel to identify the core requirements—enhancing communication, enabling remote access to design files, improving collaboration, and ensuring data security. Key stakeholders, including internal teams and external vendors, were engaged to gather insights into current infrastructure and limitations.

During the Plan phase, a comprehensive project roadmap was developed, outlining tasks, timelines, and milestones to guide implementation. Resource allocation, including budget, personnel, and equipment, was clearly defined. Potential risks—ranging from budget constraints to technical compatibility issues—were identified and mitigation strategies were put in place. Additionally, structured communication channels were established using regular meetings, status updates, and reporting systems to keep stakeholders informed and involved throughout the project lifecycle.

In the Design phase, the researcher created a robust blueprint for both the network infrastructure and portable cloud server. Cisco Packet Tracer and AutoCAD were used to simulate network behavior and visualize the physical layout of components like routers, switches, and access points. The design addressed IP addressing schemes, VLAN configurations, and subnetting strategies to ensure both security and scalability. Furthermore, a detailed plan for the portable cloud server was formulated, specifying the use of virtualization technologies, such as VMware or Hyper-V, to support flexible resource allocation and efficient connectivity.

The Implement phase transitioned the design into reality, with physical installation and configuration of network devices and virtual environments. Each device was configured according to the design specifications and tested thoroughly in Cisco Packet Tracer to validate connectivity and routing functionality. The portable cloud server was set up with virtual machines hosting essential services and applications, with resources like memory and CPU allocated

based on projected usage. Connectivity and performance tests were conducted to ensure optimal operation and to resolve any issues encountered during deployment.

Following implementation, the project entered the Operate phase, where the focus shifted to maintaining stable day-to-day operations. Personnel responsible for network management were trained on system monitoring, troubleshooting, and configuration updates. Monitoring tools were deployed to oversee network performance, bandwidth usage, and security events. Incident handling protocols were developed, and a support system with a ticketing process was established to assist users in resolving network-related issues effectively.

Lastly, the Optimize phase emphasized continuous performance evaluation and improvement. Real-time data from monitoring tools was analyzed to identify areas for enhancement, such as adjusting configurations for improved resource utilization or refining security policies. Regular reviews ensured that the infrastructure adapted to evolving demands and business growth. Configuration updates and tuning of virtual machine resources were performed based on usage patterns, thereby sustaining the network's reliability and efficiency.

4. Data Collection

The population of the research titled *"A Network Infrastructure Design for JPS Interior Designs"* comprises the key stakeholders and individuals directly involved in the daily operations of JPS Interior Designs. This includes the company's CEO and a total of 20 employees with varying roles such as managers, HR personnel, accounting staff, sales representatives, and interior designers. Understanding this population is crucial to tailoring the network infrastructure to meet their specific communication, collaboration, and operational needs. The company is located at 500 3, Mexico, 2021 Pampanga, and offers a range of services, including interior, architectural, and landscape design, as well as 3D modeling, SketchUp, AutoCAD drawings, rendering, and walkthroughs. An in-depth understanding of both the population and the locale allows for the design of a network infrastructure that aligns with the company's workflows and service delivery requirements.

The locale of the research is centered around the operational environment of JPS Interior Designs in Mexico, Pampanga. This physical location houses the facilities and infrastructure supporting the company's diverse design services. Given the company's reliance on digital tools for design, rendering, and collaboration, the locale presents specific technological challenges and needs. The research aims to address these by improving aspects such as network connectivity, data security, file management, IP address configuration, and overall system optimization. By focusing on the actual working environment, the study ensures that the proposed network infrastructure and portable cloud server are practical, efficient, and suited to the company's day-to-day operations.

Data instrumentation for the project involves a blend of qualitative and quantitative methods, including internet research, interviews, surveys, document analysis, and the review of scholarly library resources. Internet research will be used to examine current trends, best practices, and case studies related to network infrastructure and portable cloud server implementation. This includes analyzing credible sources such as academic articles, whitepapers, and technology websites. Interviews will be conducted with critical stakeholders such as the CEO, IT staff, and employees involved in data handling and security, in order to obtain firsthand insights into the existing infrastructure, challenges, and improvement goals. These conversations will guide the practical aspects of the design and implementation.

In addition to interviews, surveys will be distributed to a broad range of employees to gather feedback on topics such as file access, data security, network speed, and user experience. This approach enables the collection of both quantitative and qualitative data, helping to customize the design based on actual user needs. Document analysis will involve reviewing internal documentation, such as network diagrams, policies, and technical protocols, along with relevant industry standards and compliance requirements. This provides a foundational understanding of the current system and any legal or technical constraints. Complementing these methods, scholarly research from academic journals, books, and library databases will offer theoretical and methodological guidance, enriching the framework of the study.

The data analysis process will follow a systematic and structured approach. For interview data, recordings will be transcribed and analyzed to identify recurring themes, challenges, and user requirements. This qualitative analysis will help the researcher extract meaningful insights about the expectations and pain points related to network usage and cloud services. Survey data will be compiled, organized, and analyzed statistically to detect trends, user preferences,

and common concerns across different roles within the company. By combining these analytical techniques, the researcher will develop a comprehensive understanding of the technological needs of JPS Interior Designs and ensure the network infrastructure design is both responsive and future-ready (Table 1).

Table 1. Likert Scale Weighted Mean

Rate	Verbal Interpretation	Score Range
5	Strongly Agree (SA)	4.20 - 5.0
4	Agree (A)	3.40 - 4.19
3	Neutral (N)	2.60 - 2.39
2	Disagree (D)	1.8 - 2.59
1	Strongly Disagree (SD)	1.0 - 1.79

5. Results and Discussion

The researcher conducted a survey at the office of JPS Interior Designs to evaluate the proposed network infrastructure project. A total of 10 questionnaires were distributed among the respondents, which included 7 designers and 3 administrative staff members. The survey focused on assessing key aspects of the proposed system, including functionality, usability, reliability, performance, and supportability. The questionnaires were adapted and prepared by the researcher using templates and references from reputable online sources related to IT and network infrastructure and were customized to align with the specific context and needs of JPS Interior Designs. Although not externally validated, the researcher ensured the internal consistency and clarity of the instrument through a pilot test and subsequent revisions of ambiguous items. The collected responses were then subjected to statistical analysis to determine whether the feedback was predominantly positive or negative. This analysis aimed to assess the effectiveness and feasibility of the proposed enhancements and to gauge how well the system meets the expectations of the employees. The findings provide valuable insights into the strengths of the proposed infrastructure and highlight areas that may require further development or refinement (Figure 2).
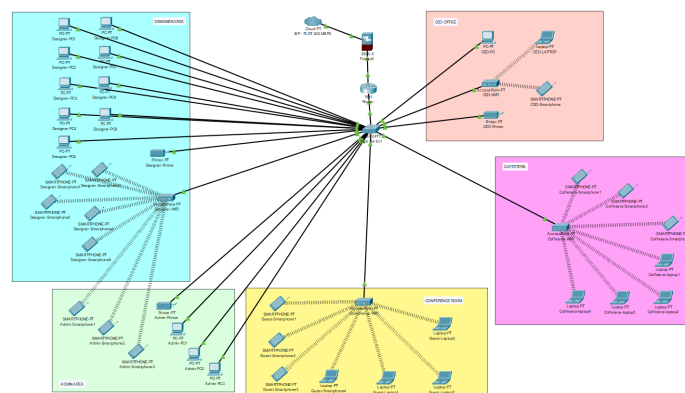

Figure 2. Proposed Physical Network Layout

The network infrastructure is designed to create a more organized, stable, and secure environment for the office of JPS Interior Designs. This setup outlines how all essential devices—13 desktop computers, 9 laptops, 15 mobile phones, and 3 printers—are connected to the network. The internet connection from the Internet Service Provider (ISP) first passes through a firewall, which serves as the initial layer of defense, protecting the network from unauthorized access and potential online threats. From there, the connection proceeds to the main router, which is configured with Dynamic Host Configuration Protocol (DHCP) to automatically assign IP addresses to all connected devices, streamlining the setup process and improving efficiency. The router connects to a 24-port Ethernet switch,

acting as the central hub that distributes the network connection to various wired devices. LAN cables extend from the switch to the 13 desktop computers and 3 printers, providing fast and reliable wired connectivity. Meanwhile, the 9 laptops have the flexibility to connect via LAN or through Wi-Fi. To accommodate wireless devices such as the 15 mobile phones and any laptops using wireless access, strategically placed Wi-Fi access points are connected to the Ethernet switch, ensuring stable, broad wireless coverage throughout the office.

5.2 Graphical Results

Figure 3 illustrates that the majority of respondents expressed agreement with the statement that the implemented system significantly enhanced both file-sharing capabilities and data security. This indicates a substantial improvement in the system's functional performance, particularly in facilitating more efficient collaboration and safeguarding sensitive information. The positive feedback suggests that the network infrastructure redesign effectively addressed previous shortcomings related to data accessibility and protection, thereby contributing to a more secure and streamlined digital environment within the organization.
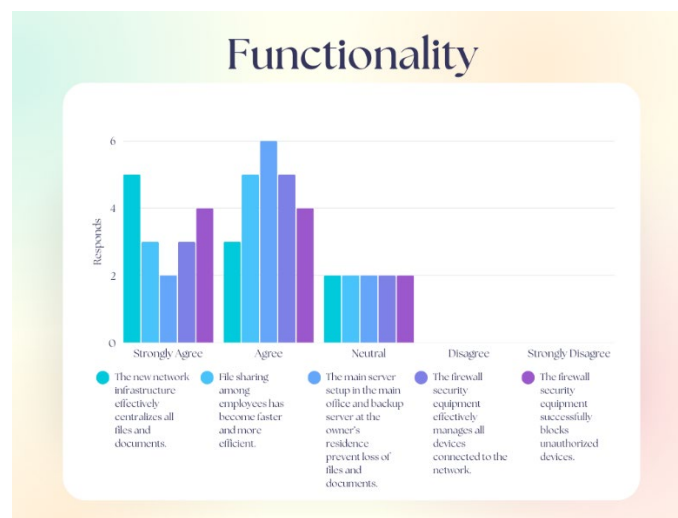

Figure 3. Functionality

Figure 4. Usability

Figure 4 indicates that users found the system easy to use, reflecting the user-friendly and accessible nature of the newly implemented setup. The results suggest that the design prioritized intuitive navigation and simplicity, which likely contributed to a smoother user experience and minimized the need for extensive training or technical support. This usability is essential for promoting efficient adoption and consistent usage among staff members.

Figure 5. Reliability

Figure 5 shows that the system is significantly more reliable, as indicated by user responses highlighting improved stability and reduced instances of downtime. This enhanced reliability contributes to uninterrupted operations, minimizes workflow disruptions, and supports the consistent delivery of services. The findings suggest that the system effectively meets organizational demands for dependable network performance.
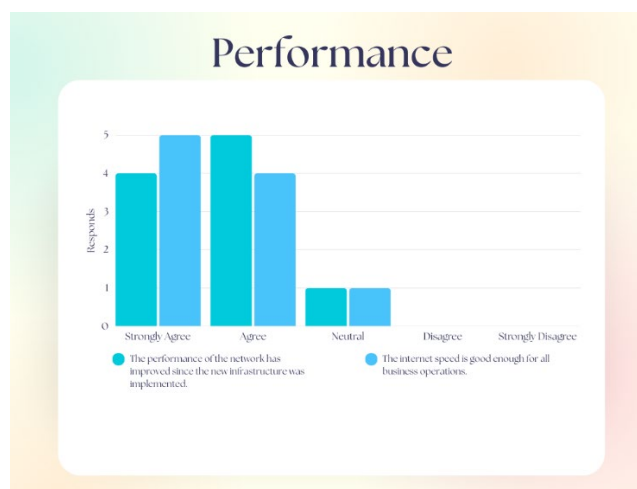

Figure 6. Performance

Figure 6 indicates that employees observed a noticeable increase in network speed and overall operational efficiency. This perceived enhancement in performance signifies a substantial improvement in the system's capacity to handle tasks more swiftly and effectively, thereby supporting higher productivity and streamlined workflow across the organization.

Figure 7. Supportability

Figure 7 illustrates that the provided support and documentation were generally effective in assisting users with system adoption and troubleshooting. While the majority of respondents expressed satisfaction, the data also suggests that there is potential for minor enhancements to further optimize user support and ensure comprehensive understanding of the system's features and functionalities.

6. Conclusion

The survey yielded high mean scores across essential system quality metrics—namely functionality, usability, reliability, performance, and supportability—with low standard deviations, indicating a strong consensus and positive perception among respondents. These respondents, comprising interior designers, IT personnel, administrative staff, and management, provided feedback that confirms the project's relevance and alignment with organizational needs. The proposed infrastructure adopts a phased implementation strategy, ensuring a systematic and methodical deployment from initial planning to full optimization.

A central feature of the design is the implementation of a portable cloud server and centralized file storage, aimed at resolving persistent issues related to data loss and file mismanagement. The inclusion of both primary and backup servers ensures data redundancy and enhances system resilience. The deployment of enterprise-grade Wi-Fi access points further supports connectivity for all devices, including mobile phones and laptops, thereby improving accessibility and collaboration across departments. Moreover, the project addresses existing deficiencies in network stability, data management, and access control.

The integration of advanced firewall technologies—such as FortiGate or Cisco security appliances—strengthens the network's defense mechanisms against external threats through functionalities including intrusion prevention, web filtering, and traffic monitoring. Emphasis on secure data encryption protocols and scheduled backups adds an additional layer of protection, contributing to data integrity and business continuity. Collectively, these measures aim to minimize operational disruptions, reduce system downtime, and safeguard sensitive organizational information.

In summary, the proposed network infrastructure design presents a robust and scalable solution to the current technological challenges faced by JPS Interior Designs. Its structured implementation, combined with the integration of modern network technologies and security frameworks, is expected to enhance the organization's operational efficiency, improve data management, and support long-term digital transformation. This initiative positions the company to better adapt to the evolving demands of the interior design industry and sustain its competitive advantage through reliable and secure IT infrastructure.

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