NETWORK DESIGN DOCUMENTATION

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CONTENTS

EXECUTIVE
SUMMARY

Issue

M&H Solutions is undertaking a strategic office relocation, necessitating the design and deployment of a resilient and redundant business network. As a digital marketing and brand management firm, uninterrupted connectivity and data integrity are paramount to ensuring seamless service delivery. Insufficient network redundancy poses a significant risk of operational downtime, which could adversely impact productivity, client satisfaction, and overall business performance.

To maintain a competitive edge, M&H Solutions must ensure that its infrastructure is capable of supporting high-speed, secure, and scalable network operations. Furthermore, as the company grows, the network must be capable of adapting to increased demand without compromising efficiency or security. Implementing a robust, redundant network will be instrumental in sustaining business continuity, reinforcing reliability, and enabling long-term operational success.

RECOMMENDATION

It is recommended that M&H Solutions implement a highly redundant business network. This solution should encompass enterprise-grade networking equipment, and a structured cabling system designed for scalability and future growth. Additionally, a managed IT service should be engaged to provide proactive maintenance and continuous security monitoring.

The proposed solution will include a highly redundant and scalable network architecture designed to be cost-effective while meeting all operational objectives. A dedicated server room will be established to house critical network infrastructure, ensuring security, accessibility, and proper environmental controls. Network segmentation will be achieved through the implementation of Virtual Local Area Networks (VLANs), ensuring optimal performance, security, and streamlined network management across different departments.

To ensure high availability, the network will incorporate two core switches and two distribution layer switches, providing seamless failover capabilities and

eliminating single points of failure. This dual-layer architecture will enhance network reliability, enabling continuous data flow even in the event of hardware malfunctions or connectivity disruptions.
Additionally, a secure wireless network will be deployed, featuring multiple strategically positioned access points to provide consistent and high-speed wireless connectivity across the entire office space.

JUSTIFICATION

A redundant network infrastructure will significantly mitigate the risks associated with ISP failures, hardware malfunctions, and cybersecurity threats. Given the company's reliance on digital platforms for client engagement and service delivery, network disruptions could result in substantial financial losses and reputational harm. Investing in a robust, resilient network architecture will enhance operational efficiency, safeguard business continuity, and facilitate a seamless digital experience for both employees and clients.

DESIRED OUTCOME

The successful implementation of a highly redundant business network will yield the following key benefits:

- Near-zero downtime, ensuring uninterrupted workflows and service delivery.
- Enhanced operational efficiency through reliable connectivity and secure data transmission.
- Scalable infrastructure to support business expansion and evolving technological requirements.
- A solid foundation for future digital transformation initiatives.

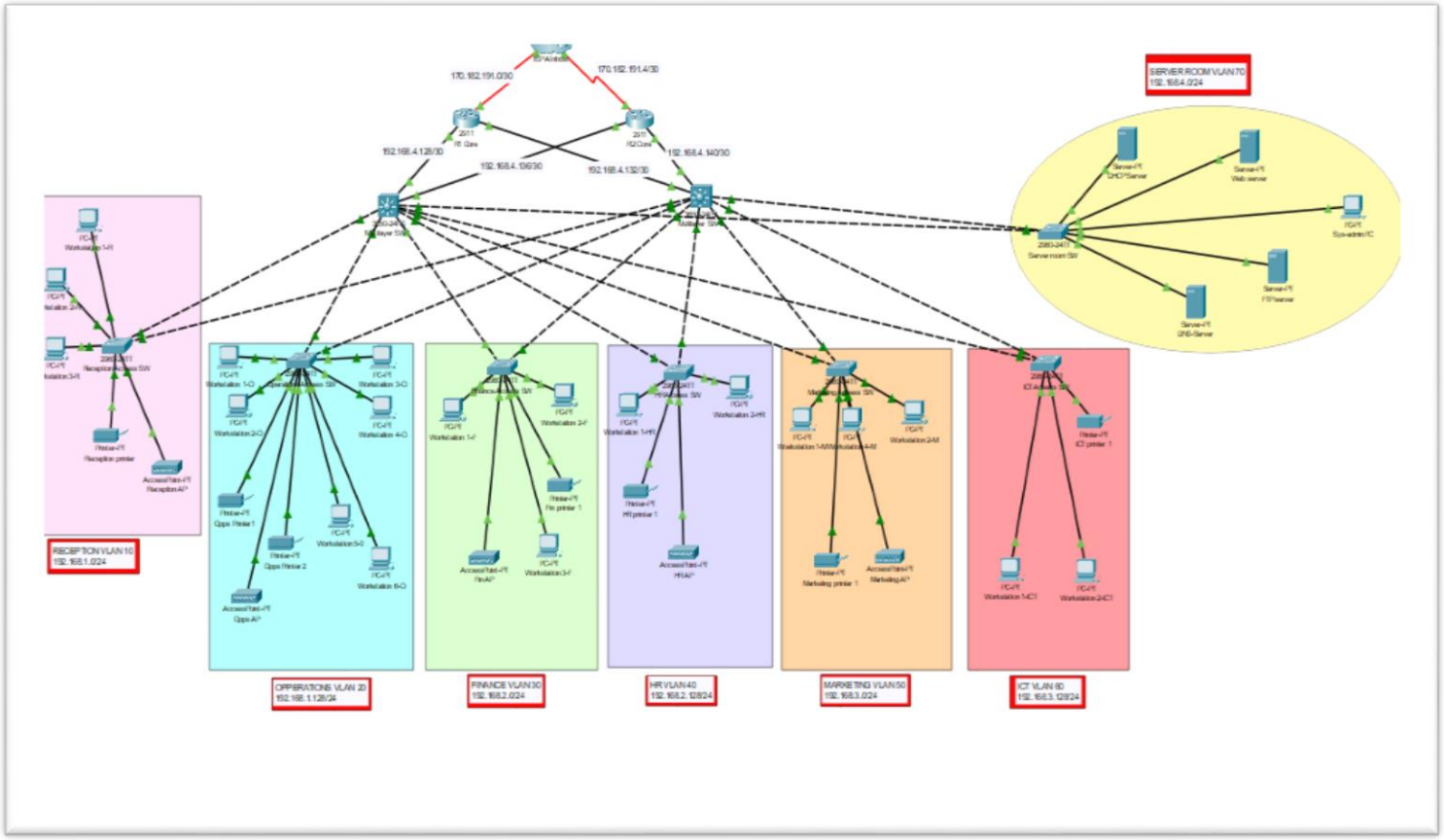
By investing in a high-availability network infrastructure, M&H Solutions will reinforce its position as a trusted and innovative digital marketing and brand management leader in Cape Town.

SOLUTION **OVERVIEW**

The network has been meticulously designed to prioritize reliability, scalability, and efficiency, incorporating a highly redundant architecture to ensure seamless operations and business continuity. At the core of this infrastructure are two core routers and two multilayer switches, strategically deployed to provide redundancy and mitigate the risk of single points of failure. This dual-layer design enhances network resilience, ensuring uninterrupted connectivity and optimal performance.
The network is structured with seven distinct VLANs, each corresponding to a specific business unit. This segmentation enhances security, improves traffic management, and optimizes overall network performance by ensuring logical isolation of departmental resources. To support wireless connectivity, multiple strategically placed access points have been deployed within the relevant departments, providing consistent and reliable Wi-Fi coverage throughout the office space.
Additionally, the network is supported by a dedicated server room that houses critical infrastructure, including DHCP, FTP, Web, and DNS servers. This centralized approach ensures efficient network management, streamlined service delivery, and enhanced security by keeping essential IT resources within a controlled environment.
By implementing this robust and future-proof network architecture, the organization has positioned itself to support current operational demands while ensuring scalability for future growth and technological advancements.

VISUAL OVERVIEW

The following is an image of the prototype network solution.

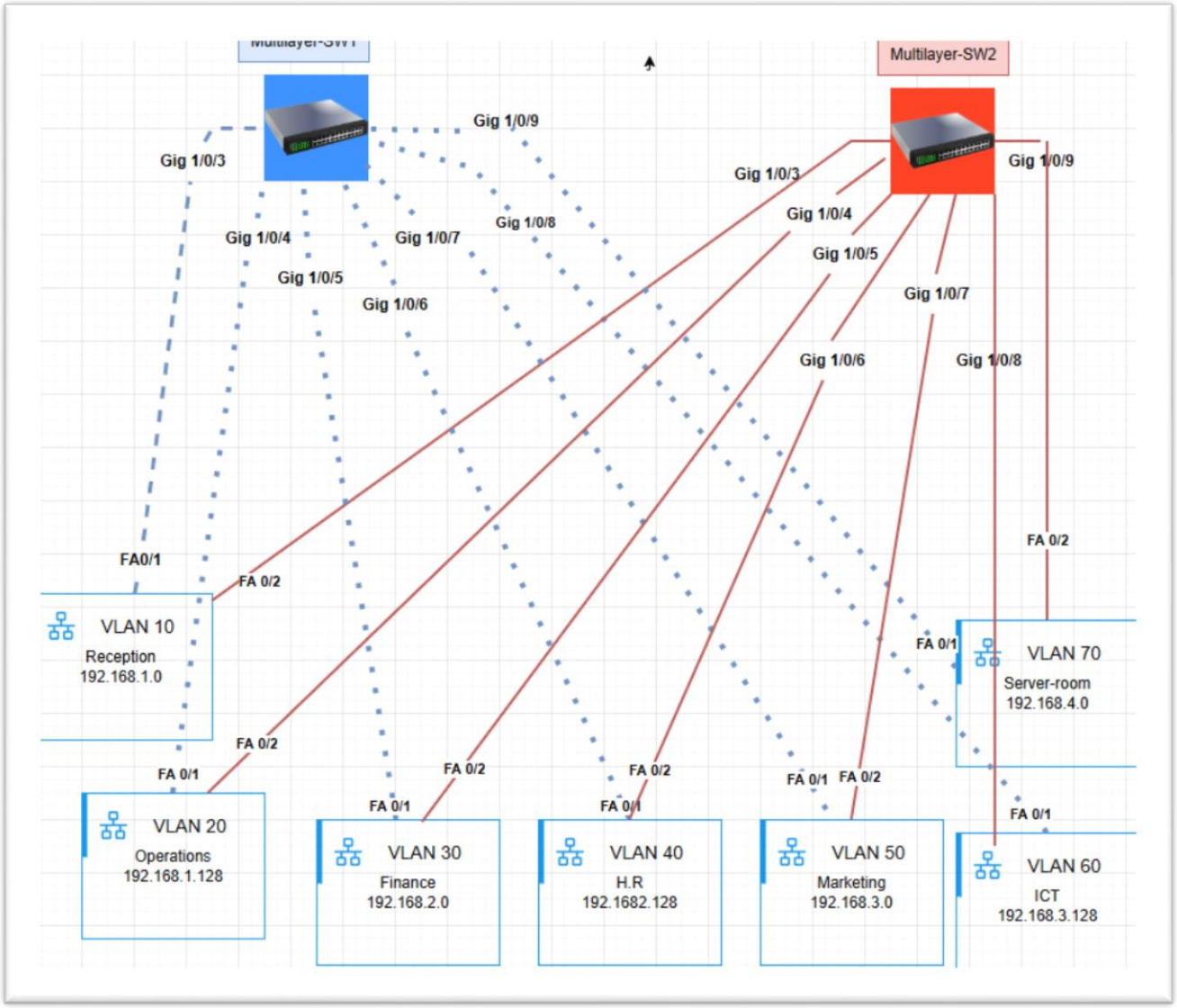


BUDGET AND BILL OF **MATERIALS (B.O.M)**

Device	Quantity	Price per unit	Total cost
2911 Router	2	R 8000	R 16 000
3650-24ps Switch	2	R 11 000	R 22 000
2960 Switch	7	R6 000	R42 000
Hp M30F Printer	6	R12 000	R72 000
Hp Pro 290 desktop	20	R16 700	R334 000
Hp e27 monitor	20	R5 300	R106 000
Peripherals	25	500	R12 500
Hp pro x360 laptop	5	R19 800	R99 000
Cabling	500m	R9	R4500
Dell power edge servers	4	R 30 000	R120 000
Miscellaneous	-	-	R35 000
Labour	-	-	R148 000
TOTAL			**R 1 011 000**

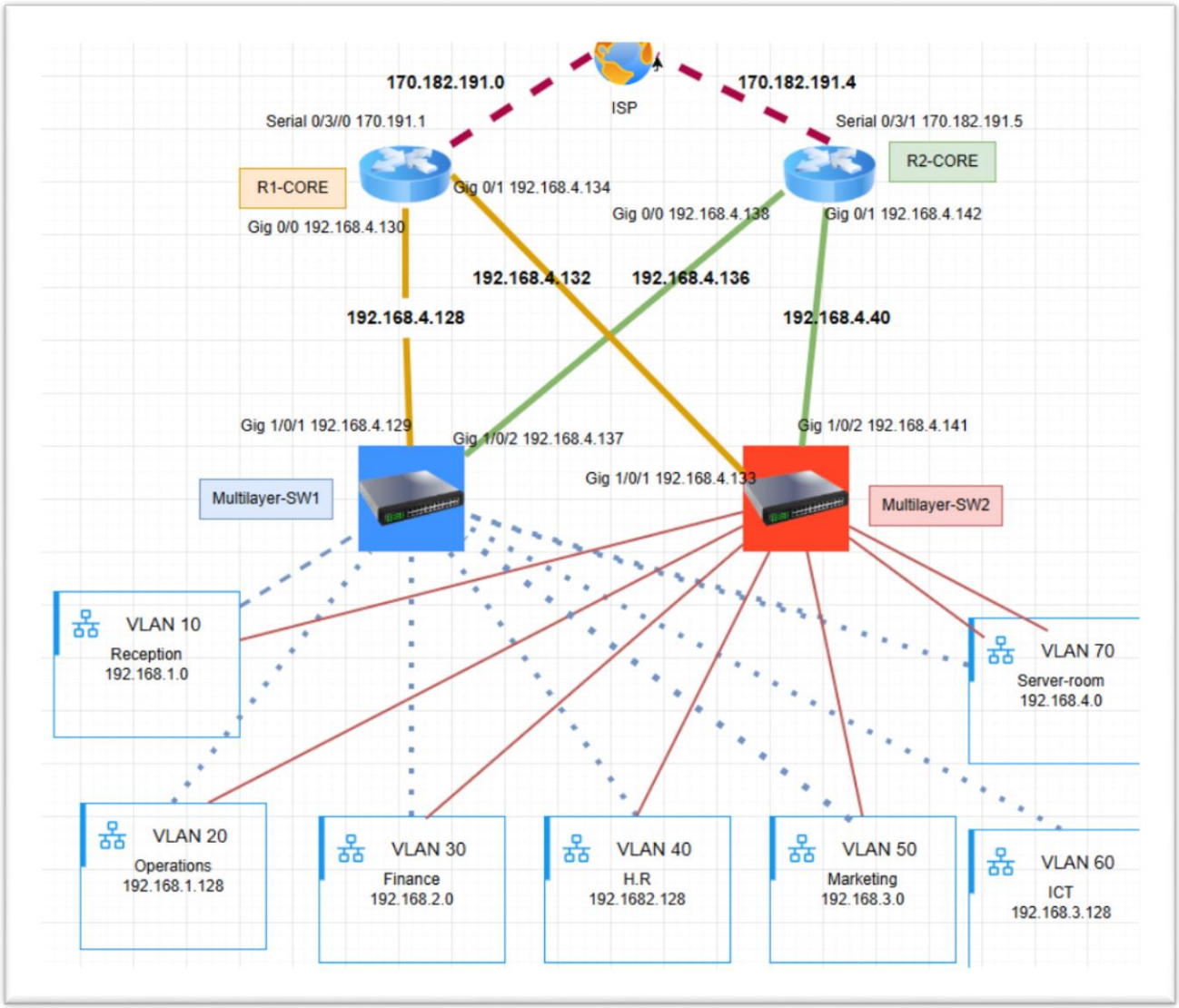
PROPOSED NETWORK DESIGN

LAYER 2 DIAGRAM



IP ADRESSING AND **SUBNETTING**

LAYER 3 DIAGRAM



IP ADRESS SCHEME

Link	Network	Outbound Interface Name (From)	Outbound Interface IP	Inbound Interface Name (To)	Inbound Interface Name
ISP-R1	170.182.191.0/30	Serial 0/3/0 (ISP)	170.182.191.2	Serial 0/3/0 (R1)	170.182.191.1
ISP-R2	170.182.191.4/30	Serial 0/3/1 (ISP)	170.182.191.6	Serial 0/3/1 (R2)	170.182.191.5
R1-MSW1	192.168.4.128/30	Gig 0/0 (R1)	192.168.4.130	Gig 1/0/1 (MSW1)	192.168.4.129
R1-MSW2	192.168.4.132/30	Gig 0/1(R1)	192.168.4.134	Gig 1/0/1 (MSW2)	192.168.4.133
R2-MSW1	192.168.4.136/30	Gig 0/0 (R2)	192.168.4.138	Gig 1/0/2 (MSW1)	192.168.4.137
R2-MSW2	192.168.4.140/30	Gig 0/.1(R2)	192.168.4.142	Gig 1/0/2 (MSW2)	192.168.4.141

SUBNETTING

DETAILS

Vlan Name	Vlan Number	Network Address	Default Gateway	Subnet Mask
Reception	10	192.168.1.0	192.168.1.1	/24
Operations	20	192.168.1.128	192.168.1.129	/24
Finance	30	192.168.2.0	192.168.2.1	/24
Humane Resources	40	192.168.2.128	192.168.2.129	/24
Marketing	50	192.168.3.0	192.168.3.1	/24
ICT	60	192.168.3.128	192.168.3.129	/24
Server-room	70	192.168.4.0	192.168.4.1	/24

DHCP

CONFIGURATION

DHCP Pool Name	Default Gateway	Starting IP	Max Number of Users	Subnet Mask
Reception	192.168.4.3	192.168.1.10	118	/24
Operations	192.168.4.3	192.168.1.129	120	/24
Finance	192.168.4.3	192.168.2.10	118	/24
Humane Resources	192.168.4.3	192.168.2.128	120	/24
Marketing	192.168.4.3	192.168.3.10	118	/24
ICT	192.168.4.3	192.168.3.130	120	/24
Server-room	192.168.4.3	192.168.4.10	118	/24

ROUTING AND SWITCHING

- The OSPF routing protocol has been successfully implemented across all routers and multilayer switches to ensure efficient network communication.
- Network Address Translation (NAT) has been configured to facilitate internet access for all subnets, with the exception of the server room.
- As a security precaution, the server room has been air-gapped from external networks to prevent unauthorized access.
- Additionally, default static routes have been deployed on the appropriate Layer 3-enabled devices to serve as a failsafe mechanism for network routing.

For comprehensive details regarding the network configurations, please refer to the configuration document located within this folder.

WIRELESS NETWORK DESIGN

- A dedicated wireless access point (AP) has been deployed within each subnet, corresponding to the respective physical departments within the building.
- Due to the physical separation of departments in the office space, each department is assigned its own AP to ensure optimal wireless coverage.
- However, for security reasons, the server room and ICT department do not contain wireless access points.
- All systems utilized by the ICT department are securely connected to the network via physical cabling.
- The wireless network is configured with WPA2 encryption and a secure password, which is updated weekly in accordance with company security protocols.

SCALABILITY AND FUTURE GROWTH

The overall network architecture has been strategically designed with a strong emphasis on scalability, ensuring that the organization can seamlessly accommodate future growth. The structured subnetting approach allows for the effortless integration of new devices and employees within each department without necessitating modifications to VLAN configurations. This proactive design minimizes administrative overhead while enhancing operational efficiency.

Furthermore, the network's built-in redundancy aligns with the organization's broader strategic objectives, supporting uninterrupted operations and consistent service delivery. By implementing a resilient network infrastructure in conjunction with the company's physical relocation, M&H has proactively positioned itself for sustained growth and scalability, ensuring that future expansion initiatives can be executed with minimal disruption.

CONCLUSION

The successful design and implementation of a highly redundant, scalable, and secure network infrastructure will play a critical role in ensuring M&H Solutions' seamless transition to its new office location. By leveraging enterprise-grade networking equipment, structured VLAN segmentation, and robust security protocols, the organization is well-positioned to maintain operational continuity, enhance service delivery, and support future growth.

This network strategy aligns with M&H Solutions' long-term business objectives, enabling the company to scale efficiently as it expands its workforce and service offerings. By investing in a future-proof and highly available network infrastructure, M&H Solutions reaffirms its commitment to innovation, digital excellence, and maintaining a competitive edge in the market.

With this network foundation in place, M&H Solutions is strategically positioned to drive operational efficiency, enhance security, and support business growth in an increasingly digital landscape.