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SDWAN (Software Defined-WAN) Network Engineering and Project Management

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ABSTRACT

Many organizations are struggling to provide high bandwidth and reliable internet connectivity at their branch offices and business locations and getting the most out of their operational expense. The need for internet connectivity at any branch offices and business locations is not a luxury anymore but is a necessity. Let us try to understand how to plan and document the SDWAN (Software Defined- Wide Area Network) implementation in an organization. We will try to understand why it is essential to implement the new technology instead of investing in the existing MPLS (Multi-Protocol label switching) by taking an example of a retail organization. **Methods:** This project/research was performed using the abilities of Software Defined Network Technology and options available in MPLS (Multi-Protocol Label Switching). The Technical Project management principles were adopted as per PMI (Project Management Institute) waterfall methodology. **Results/Conclusion:** SDWAN technology provides an effective replacement of MPLS network connection for providing WAN connectivity for our office locations. It is essential to follow a documented process for appropriate vendor selection based on the available features and other listed attributes in the article. To be successful in the implementation it is essential to perform a POC (Proof of Concept) in a controlled environment and validate results. SDWAN provides better network performance and improves reliability as the links operate in active-active function.

1. Introduction

In a business location, a retailer has to perform several transactions, and there is a need for reliable high-bandwidth internet circuit. In the absence of a high-speed internet connection, many locations may report slow internet performance as they may be running on a single high-cost low-bandwidth circuit. This initiative targets to deploy SDWAN technology at all the business locations. IT Network engineering team will be leading this initiative but as this is a cross-functional project so we

will need help from different teams like IT Operations for Server and Storage requirements, Business Support for coordination with Business Associates, Network Administrator and Onsite Tech support team who will be responsible for device installation at all galleries. In addition to these stakeholders, we need to have a dedicated Project Manager (PM) to monitor the overall progress of the project, who will coordinate with COO for any budgetary issues and with VP - Infrastructure to allocate necessary organizational resources. The designated PM will work closely

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with Director Project Management Office to ensure the scheduled tasks for this project do not interfere with the projects in other areas of the business as the company has multiple projects going on at the same time. This Project is divided into four phases Design, Initial Implementation, Rollout, and Project Closure. We will estimate the average internet bandwidth upgrade and percentage increase in network and hardware reliability by reviewing the incident data post-upgrade to calculate the overall success of the project.

2. Needs Analysis for Project Design and Development

2.1 Problem

Let us assume that the company's e-commerce environment is hosted on a private cloud in a data center located in San Diego, California, and the organization is using Akamai as its CDN (Content Delivery Network) provider. The associate working in Business locations with the customers raises around seventy percent of orders. The Business associate can provide the customers with various options to customize their order depending on their preference. The associate needs to browse the organization's website and review different available options for the products with various features and attributes. The organization's website is full of high-resolution images that provide in-depth clarity to the content. In order to serve this requirement, there is a need for high-bandwidth and a reliable internet circuit.

Most of the business locations, especially bigger ones, have started reporting slow internet performance mostly in peak hours. On a few occasions, if there is an issue with the internet circuit, the internet connectivity of the business location goes down completely, and they cannot raise any orders. All these issues are causing a significant business loss as the locations are completely dependent on internet connectivity to perform their business.

2.2 Cause

Below factors are contributing to the poor network performance and causing unreliable network connection at all of the business locations and branch offices.

(1) Most of the Business locations have a high-cost low-bandwidth Private WAN (Wide Area Network) circuit. This circuit is very reliable but does not solve the increasing demand for high-bandwidth.

(2) Many Business locations are just operating on a single Private WAN circuit. Very few locations have a reliable secondary circuit.

(3) The Business's locations with dual circuits cannot utilize bandwidths effectively, as due to technical limitations; they are operating on Active/Passive mode. (Only one circuit can be utilized at one time).

2.3 Problem Impact

The impact of this problem is widespread and may affect multiple stakeholders. Please read below to find out how it can affect various stakeholders in an organization.

2.3.1 COO (Chief of Operations)

COO is continuously getting reports of frequent internet outages at various retail locations. Business Leadership has reported that it is getting extremely difficult to perform a business transaction using existing Network Infrastructure. He is not only worried about business loss but also about brand value.

2.3.2 VP (Vice President) - Infrastructure

Vice President - IT is seeing many incident tickets for poor Network performance from multiple locations in daily incident reports. He is aware that his team is not able to provide a timely resolution for all the reported incidents due to high incident counts and technical limitations. He is under a lot of pressure to provide a permanent fix to this problem.

2.3.3 Network

The Network team is completely occupied in providing temporary fixes to a large number of issues that are being reported to them on a daily basis. Due to the heavy workload, they are not able to provide resolution to all the incidents as per agreed SLAs.

2.3.4 IT Operations (IT Ops)

IT Operations team is observing their monitoring and incident management tool resources are completely occupied in managing the daily alert and incident counts. In order to manage the daily operational needs, they have to work extra hours almost on a daily basis.

2.3.5 Business Support

The Business Support team is helping in communicating with the gallery associates and with the Network Administrators. They have to work extra hours as the ticket count is very high, and a lot of incidents are repetitive. It is due to these large number incidents Business Support team is not able to meet its response and resolution time on not only on slow internet response

issues but also on other types of queries.

2.3.6 Business Associates

Business Associates are not able to serve their customers at the locations. In order to provide different options to the customer for any type of product, the associate has to look at the organization's website to refer to various attributes of the product. Many times when the internet is slow, the associates may struggle to provide these options, and when the internet is completely down, they cannot even raise an order in real-time.

2.4 Technology Trend

In the last few years, we have observed massive shifts in the way infrastructure and applications are built, managed, and deployed. Fueled by innovation in cloud infrastructure, new application design technologies, and pervasive low-cost Internet connectivity, seemingly anyone can deploy an entire infrastructure on a public cloud in minutes or take advantage of Software-as-a-Service (SaaS) offerings for a variety of what were once very expensive application suites that were historically deployed in a data center on expensive servers and storage. Business applications are becoming more involved, complex, and rich in content, driven by innovative experiences created in global scale consumer applications.

Software-defined WAN (SD-WAN) claims to provide a solution for these issues by allowing the user to define policies for how application traffic is forwarded. With SD-WAN, policies can be defined to specify which WAN links can be used for which applications, allowing the user to enjoy transport-agnostic connectivity amongst sites, WAN high availability for the remote office, and the cost benefits of deploying broadband Internet to reduce or eliminate private MPLS WAN links. The dirty secret for most SD-WAN vendors is that their architecture is built using some form of a packet routing or packet-processing engine. While SD-WAN functionality on the surface seems to be a natural evolution of packet routing and packet processing, packet-based systems are not equipped to understand today's applications given how both application complexity and content richness have increased, and HTTPS has become the de facto transport, which is rendered completely opaque by TLS. Packet-based systems are fundamentally unable to look at application-level transactions across multiple connections using both discrete data points and heuristics to accurately identify and understand the applications in use and how they are perform-

ing with the current connection.

AppFabric is a radically new approach to networking. With AppFabric, policies are defined by business intent for performance, security, and compliance:^[2]

Performance - specify the performance and resources required to support positive user experience, and handle flows according to actual performance metrics of the application itself rather than the packet and link metrics.

Security - define the security perimeter for the remote offices and which applications are allowed to traverse the network boundary using detection of the actual application rather than IP addresses and ports.

Compliance - specify the WAN paths that the application flows are allowed to take and make forwarding decisions accordingly.

The most important compliance to follow for the retail organization is PCI. Any organization that handles any type of payment card data, should meet the Payment Card Industry (PCI) Compliance regulations. In order to ensure the new SDWAN partner is PCI compliant, we can add this as one of our requirements in the vendor selection criteria.

To ensure both the organizations are following the laws, we can agree on a mutual Non-Disclosure Agreement (NDA) before we start any discussions and share any company information.

Once a vendor has been finalized, the organization should sign a Mutual Service Agreement (MSA) and will execute an SOW (Statement of Works) documents that will clearly state all the services along with their SLAs (Service Level Agreement that the chosen partner will provide to the organization. The MSA will also have a clause that will ensure that the vendor is following all the industry standards to provide quality service to the customer.

3. Cost Analysis for Project Design and Development

Please refer below Cost Analysis for developing, installing, and supporting an SDWAN appliance at a location. In order to justify the investment (project cost), we have also put together some data on how much time we are spending on the support of maintenance of existing network infrastructure and incidents that are occurring due to the bandwidth and technology limitations. It is also important to make a note of the financial loss we have to suffer in case of an internet outage at a location. A team can use below sheet for reference (cost will vary depending on the location and business functions).

Table 1. Cost - Benefit Analysis of using SDWAN as Inter-net Appliance at a location

| Projects Costs per Business Location | Amount |
|-----------------------------------------------------------------|--------|
| Hardware | |
| Data Center Hub - Product Design and Development | -- |
| Site Hardware | -- |
| Software & Licenses | -- |
| Support (May be Included in License) | -- |
| Internal - Labor (\$XX/ hour)-Installation 2 hour per location | -- |
| External - Labor (\$XX/ hour)-Installation 4 hour per location | -- |
| Internet Connection 1-Monthly Recurring Charge per location | -- |
| Internet Connection 2-Monthly Recurring Charge per location | -- |
| | |
| Total Capital Expense for each location (Only First Year) | -- |
| Total Operational Expense for each location | -- |
| | |
| Current Costs (Project Cost Justification) | |
| Current Site Hardware Support | -- |
| Current Data Center Hardware Support & Maintenance | -- |
| Internal - Labor (\$XX/ hour) - To solve Incidents | -- |
| External - Labor (\$XX/ hour) - For Technician | -- |
| Internet Connection 1 | -- |
| Loss in revenue due to internet outage (per hour) | |
| Big Business Locations | -- |
| Small Business Locations | -- |
| | |
| Total Operational Expense | -- |
| Revenue Loss per hour for each Business Location | -- |

Cost Justification

In order to solve the increasing demand for more internet bandwidth at all our locations, as an IT department, we completely understand that there is a demand for high bandwidth circuits at all of our retail locations, but at the same time, we need to increase reliability. The monthly re-occurring cost (MRC) of existing MPLS (Multiprotocol label switching) connections is already on a higher side, and the high bandwidth MPLS circuit is completely out of our operational budget. In addition to this, with existing MPLS network architecture, we are backhauling all internet traffic to our Datacenter that further introduces more latency due to round-trip time.

The existing technology using traditional network architecture is, for sure, not able to provide a solution that can solve our needs and still be affordable. The time has come to explore the capabilities of the SDWAN (Software Defined - Wide Area Network) solution. According to Wikipedia (n.d.), an SD-WAN simplifies the management and operation of a WAN by decoupling (separating) the networking hardware from its control mechanism [5]. This concept is similar to how software-defined networking implements virtualization technology to improve data center management and operation.

A key application of an SD-WAN is to allow companies to build higher-performance WANs using lower-cost and commercially available Internet access, enabling businesses to partially or wholly replace more expensive private WAN connection technologies such as MPLS

According to Imagineiti (n.d.), the organization that is supported by internal IT staff or vendors who use a break-fix methodology will generally pay the following hourly rates [4] :

Individual Techs :\$65 to \$100 per hour

Vendor Support :\$75 to \$125 per hour

It should become very clear from the above Cost-Benefit Analysis that the organization is not only spending huge amounts in supporting the existing technology, but they are not getting any benefits in return. The truth is due to the current network setup, and the organization is not only losing a lot in revenues but also our customer confidence in our brand. It makes total sense to invest in the new technology and avoid these outages so that we can run our business smoothly. The new technology architecture is centrally managed through a cloud-based controller and needs minimum operational expenditure once it is implemented.

4. Risk Assessment

4.1 Qualitative Risk Analysis

Please refer to the Qualitative risk analysis of the SD-WAN implementation project.

Table 2. Qualitative risk analysis of the SD-WAN implementation project

| Risk | Description | Qualitative Analysis | |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------|
| | | Likelihood | Rating |
| Device Stability | We will be installing new hardware in our network that we have not tested. We are relying on SDWAN partner to ensure device stability and performance | Moderate | 3 |

| | | | |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|
| Technology Reliability | SDWAN is a new technology which we haven't used in our network architecture so far, and we don't have any in-house expertise to support the technology | Moderate | 3 |
| Technology Adaption | The new SDWAN is completely software-driven, and we don't know how other enterprise application will be affected | Low | 2 |
| Software Vulnerabilities | The new technology may have introduced new security vulnerabilities to our network infrastructure | Moderate | 3 |
| Hardware & Software Support | The new SDWAN partner may not be able to provide the required support as per our expectations | Very Low | 1 |
| Aggressive Schedule | In order to solve the issue we need to deploy the new hardware quickly, and it may impact existing location operations | High | 4 |
| Resource Crunch | As we are planning to install the new appliance at a very fast pace, we may run short of resources if we encounter any issue during the deployment | Very High | 5 |

In this analysis, we have used a relative scale as per below definition:

Table 3. Relative scale

| Rating | Likelihood | Description |
|--------|------------|------------------------------------------------------------------------------------------------------------|
| 1 | Very Low | Highly unlikely to occur. May occur in exceptional situations. |
| 2 | Low | Most likely will not occur. Infrequent occurrence in past projects |
| 3 | Moderate | Possible to occur |
| 4 | High | Likely to occur. Has occurred in past projects |
| 5 | Very High | Highly likely to occur. Has occurred in past projects and conditions exist for it to occur on this project |

4.2 Quantitative Risk Analysis

Please refer to the Quantitative risk analysis of the SD-WAN implementation project.

Table 4. Quantitative risk analysis of the SD-WAN implementation project

| Risk | Description | Quantitative Analysis | | |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------|-----------------|
| | | Probability of Occurrence | Impact (Cost Analysis) | |
| | | | Cost | Schedule |
| Device Stability | We will be installing new hardware in our network that we have not tested. We are relying on SDWAN partner to ensure device stability and performance | 35 -50% | >20% increase in development Cost | 1-2 weeks delay |
| Technology Reliability | SDWAN is a new technology which we haven't used in our network architecture so far, and we don't have any in-house expertise to support the technology | 35 -50% | >20% increase in development Cost | 1-2 weeks delay |
| Technology Adaption | The new SDWAN is completely software-driven, and we don't know how other enterprise application will be affected | 10-25% | 5-10% increase, to deploy more time and resources for testing | 1-2 weeks delay |
| Software Vulnerabilities | The new technology may have introduced new security vulnerabilities to our network infrastructure | 10-25% | 5-10% increase, to deploy more time and resources for testing | 1-2 weeks delay |
| Hardware & Software Support | The new SDWAN partner may not be able to provide the required support as per our expectations | 5-10% | < 5% increase to deploy more resources for support | < 1-week delay |
| Aggressive Schedule | In order to solve the issue we need to deploy the new hardware quickly, and it may impact existing Business operations | 50-60% | >30% increase to deploy more resources | >2 weeks delay |
| Resource Crunch | As we are planning to install the new appliance at a very fast pace, we may run short of resources if we encounter any issue during the deployment | 60-80% | >30% increase to deploy more resources | >2 weeks delay |

4.3 Cost/Benefit Analysis

We have observed in the previous section where we performed the Cost/Benefit Analysis for the SDWAN implementation project that if we continue to use existing technology to provide network connectivity at our Business locations we may have to suffer around \$XX in revenue loss. We are also spending around \$XX in support and maintenance for each location. We are planning to spend around \$XX per location to implement the new technology, and we will only spend around \$XX in support and maintenance per location, which is a significant reduction in the support cost.

It will become clear by the analysis results that investing in new technology is beneficial for the company, as it will significantly improve internet reliability and network performance at our locations. All the reported risks can be mitigated by taking some proactive measures.

This initiative will help the organization to improve in below areas:

- (1) Internet bandwidth upgrade for all branch offices and business locations.
- (2) The use of SDWAN technology will provide effective utilization of dual internet circuits.
- (3) SDWAN technology will improve the reliability of internet connectivity at all the business locations by the easy transition from one internet circuit to the other in case of any failures.
- (4) We can achieve a lower network downtime in case of any hardware failures caused by Primary network hardware (Router).
- (5) The new SDWAN platform is completely based on software-based routing which significantly reduces the time for network management
- (6) The network policies for all the Branch Offices and Business Locations will be centrally managed through a cloud-based controller.

4.4 Risk Register

Table 5. Risk Register

| Asset | Threat/Vulnerability | Existing Controls | Likelihood | Consequence | Level of Risk | Risk Priority |
|----------------|----------------------|-----------------------------------------------------------------------------------------------------------------|------------|-------------|---------------|---------------|
| SDWAN Hardware | Threat | Protection Clause in agreement .The new technology will be implemented only after QA (Quality Analysis) testing | Possible | Moderate | Medium | Level 2 |

| | | | | | | |
|---------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------|---------|---------|
| SDWAN Software | Threat | Protection Clause in agreement .The new technology will be implemented only after QA (Quality Analysis) testing | Possible | Moderate | Medium | Level 2 |
| SDWAN Software | Vulnerability | Protection Clause in agreement. The new technology will be implemented only after running vulnerability scans and reviewing support documentation | Rare | Minor | Low | Level 4 |
| Resources (People) | Threat | Onsite Tech will provide additional support as and when needed | Almost Certain | Major | Extreme | Level 1 |
| Budget | Threat | Project Manager to include buffer to accommodate any extra expenditure | Almost Certain | Major | High | Level 1 |
| Revenue | Threat | Hardware should be deployed in the production only after significant testing to minimize any outages in production environment | Possible | Minor | High | Level 3 |

4.5 Risk Mitigation

Table 6. Risk Mitigation

| Risk | Description | Mitigation |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Device Stability | We will be installing new hardware in our network that we have not tested. We are relying on SDWAN partner to ensure device stability and performance | The new hardware will be thoroughly tested in the QA environment before we deploy it in the production network |
| Technology Reliability | SDWAN is a new technology which we haven't used in our network architecture so far, and we don't have any in-house expertise to support the technology | The new technology will be tested in the QA environments using different scenarios before we deploy to the production network |

| | | |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Technology Adaption | The new SDWAN is completely software-driven and we don't know how other enterprise application will be affected | Application compatibility with other enterprise applications will be tested in QA environments using different scenarios |
| Software Vulnerabilities | The new technology may have introduced new security vulnerabilities to our network infrastructure | The new technology will be implemented only after running vulnerability scans and reviewing support documentation |
| Hardware & Software Support | The new SDWAN partner may not be able to provide the required support as per our expectations | The technology partner has to follow the agreed SLA as per the service agreement. There will be significant penalties in case of any SLA breach. |
| Aggressive Schedule | In order to solve the issue we need to deploy the new hardware quickly, and it may impact existing Business operations | Onsite Tech will provide additional support as and when needed to ensure it doesn't impact existing operations. In case any outage is involved, that work will be performed in off- hours. |
| Resource Crunch | As we are planning to install the new appliance at a very fast pace, we may run short of resources if we encounter any issue during the deployment | Onsite Tech will provide additional support as and when needed |

5. Justification

In our business scenario, let us assume around seventy percent of orders are raised by the Business associate working in the business locations with the customers. The Business associate can provide the customers with various options to customize their order depending on their preference. The associate needs to browse the organization's website and review different available options for the products along with various features. The website is full of high-resolution images that provide in-depth clarity to the content

Most of the Business locations have started reporting slow internet performance, mostly in peak hours. On a few occasions, if there is an issue with the internet circuit the internet, connectivity of these locations goes down completely, and they cannot raise any orders. All these issues are causing a significant business loss, as the business locations are completely dependent on the internet connectivity to perform their business.

In the cost-benefit analysis, we observed that we are paying a lot of money for the current low bandwidth T1

(MPLS) circuit. In order to solve the increasing demand for more internet bandwidth at all our locations, as an IT department, we completely understand that there is a demand for high bandwidth circuits at all of our retail locations, but at the same time, we need to increase reliability. The monthly re-occurring cost (MRC) of existing MPLS (Multiprotocol label switching) connections is already on a higher side, and the high bandwidth MPLS circuit is completely out of our operational budget. In addition to this, with the existing MPLS network architecture, we are backhauling all internet traffic to our Datacenter that further introduces more latency due to round-trip time.

The existing technology using traditional network architecture is, for sure, not able to provide a solution that can solve our needs and still be affordable. The time has come to explore the capabilities of the SDWAN (Software Defined - Wide Area Network) solution. According to Wikipedia (n.d.), an SD-WAN simplifies the management and operation of a WAN by decoupling (separating) the networking hardware from its control mechanism. This concept is similar to how software-defined networking implements virtualization technology to improve data center management and operation.

A key application of an SD-WAN is to allow companies to build higher-performance WANs using lower-cost and commercially available Internet access, enabling businesses to partially or wholly replace more expensive private WAN connection technologies such as MPLS.

SDWAN is a new technology of network management that provides the following capabilities:

- (1) Support and use of multiple connection types (active/active).
- (2) Dynamic path selection for applications.
- (3) A simple interface for managing the WAN policies.

Fundamental benefits of these capabilities are lower WAN costs, better application performance/reliability, and far less complex centralized control function for provisioning and management.

I believe that investing in SD-WAN technology is beneficial for the organization, as it will significantly improve internet reliability and network performance at our locations. All the reported risks can be mitigated by taking some proactive measures.

6. Project Management Plan

6.1 Resources

IT Network engineering team will be leading this initiative, but we will need help from different teams to complete this project. We will need help from below internal teams:

- (1) IT Network Engineering
- (2) Network Architect
- (3) Network Administrators

6.2 Justification: IT Network Engineering

Network Architect will work closely with the SDWAN technology partner to design the network. Network administrators will be responsible for switch and appliance configurations. The network team will work as per the agreed schedule tasks and implementation plan:

- (1) IT Operations (Server & Storage)
- (2) Server Administrator
- (3) Storage and Backup Administrator

6.3 Justification: IT Operations Team

IT Operations team will provide necessary compute storage for hosting the application in the Datacenter. Server Administrator will work on integrating the SDWAN platform with other enterprise applications like OKTA for single sign-on or monitoring tools like Solarwinds for alert monitoring purposes. Storage and Backup Administrator will provide the necessary storage for the servers and will be responsible for adding any servers to backup policy.

- (1) Business Support
- (2) Technical Support Analyst
- (3) Support Center Leader

6.4 Justification: Business Support

The Technical Support Analyst will work closely with the Network Team and Project Manager for the installation of the SDWAN hardware in all galleries will help in coordinating any tasks with the project manager and will also collect feedback from the Business associates. Support Center Leader will be responsible for providing the necessary resources to the support staff and will conduct training on the new technology.

- (1) Project Management Office
- (2) Project Manager
- (3) Director PMO

6.5 Justification: Project Management

The Project Manager will be responsible for the overall progress of the project. He will be responsible for preparing the Project Plan, tasks scheduling, and coordinating resources. He will also maintain the project budget and will regularly update on the overall progress to all the project stakeholders. He will also review the overall Project portfolio for the organization along with the Director PMO to ensure any scheduled tasks doesn't clash with the other major activities going on in other business areas.

In order to provide additional help and support below partners will be helping us in the design and implementation of the project:

Onsite Tech

6.6 Justification: Onsite Tech

The Onsite Tech support team will be responsible for providing the necessary resources and tools for the installation of SDWAN hardware at all the Branch Offices and outlet locations. They will provide the necessary Hands & Feet support to the Network administrator who will be making the required configuration changes remotely:

SDWAN Technology Partner

6.7 Justification: SDWAN Technology Partner

The SDWAN partner will work closely with the Network Architect during the initial network design. They will also provide support to the Project Manager and Network Administrator for preparing any training materials or making decisions on any configuration changes:

Business Associates

6.8 Justification: Business Associates

A Business associate will provide feedback on the overall hardware installation service during implementation and on network performance improvement after installation.

He will also provide any special access or permissions required for the installation of a new internet circuit or any hardware device.

In addition to the above-listed teams/resources, the Project Manager will also have below Stakeholders in this project.

COO (Chief of Operations)

COO will approve the budget allocated to the project and will be responsible for providing any financial resources for the completion of the project. The PM and VP-Infrastructure will update COO on the overall progress of the project.^[1]

VP (Vice President) - Infrastructure

The VP Infrastructure will work closely with all IT teams and PM to allocate the necessary organizational resources required for project task completion. He will also approve any changes required in the network and application architecture that may be necessary to complete the project.

6.9 Resources Utilization Plan

Please refer below matrix to review resource utilization in each phase:

Table 7. Resource utilization in each phase

| Skills | Project Phases (Estimated hours) | | | |
|------------------------------|----------------------------------|------------------------|-----------|-----------------|
| | SDWAN Design | Initial Implementation | Roll Out | Project Closure |
| Phase Duration | 2 weeks | 1 week | 2-3 weeks | 1-2 weeks |
| Project Manager | 40 | 30 | 30 | 70 |
| Network Architect | 60 | 30 | 10 | 40 |
| Network Administrator | 20 | 50 | 200 | 50 |
| Business Support | 10 | 20 | 100 | 60 |
| IT Operations | 10 | 20 | 70 | 20 |
| SDWAN Partner | 30 | 20 | 100 | 50 |

In addition to the above resource estimate, we anticipate that we will need support from Onsite Tech - 4 hours per store.

The leadership team like Branch Office Leader will be engaged as per the requirements for coordinating resources.

6.10 Existing Gaps that Current Project Plan will Fulfill

(1) Ensure IT Infrastructure Requirements are captured at the right stage of the Project.

(2) All requirements are captured for different tracks (Network, Servers, End-User Computing)

(3) Ensure the right product is selected to support the application and business, which is essential to support the growth for the near future.

(4) Ensure the right vendors are selected with appropriate experience/expertise in the necessary field.

(5) All Stakeholders have adequate visibility from the initial stage, and they can help in scope determination/ make appropriate changes.

What all is in scope with this new Project Implementation approach:

(1) Any new initiative that is driven by the Application or Infrastructure team requiring any IT infrastructure changes with 50+ hours of cross-functional project work.

(2) Different teams should review any new implementation that will significantly influence the current operations before being implemented.

How this will help in other active or upcoming projects:

(1) Provides adequate time to the IT infrastructure team to size the infrastructure appropriately.

(2) Helps IT Network and Operations team in choosing the correct vendor/technology as they have the complete picture and feedback from cross-functional team.

(3) IT Support Staff is well prepared to support the new technology and processes once the handover is given to them.

7. Project Plan in Detail

7.1 Scope

The goal of the project is to improve network performance and reliability at all of our retail locations, and we plan to achieve this goal by fulfilling the below objectives.

(1) Finalize an SDWAN Technology partner.

(2) Integrate new technology with our enterprise network

(3) Deploy this technology in all of our locations

(4) Install dual high bandwidth direct internet access circuits at all the locations.

(5) Effectively utilize dual internet connections in Active-Active configuration.

7.2 Assumptions

(1) Architecture & Design: SDWAN partner will be able to successfully integrate new technology with our existing production network.

(2) Infrastructure: Our existing infrastructure at Branch Offices and Data Center will be able to host the new hardware.

(3) Technology: Our existing enterprise applications, like monitoring tools and communication systems, will be able to integrate with the new technology.

(4) Business: Site Operations/Property management will allow relevant access to the Branch Offices/devices to perform necessary changes.

(5) Methodology & Standards: Our Project Management methodology will help in executing various phases of the project smoothly.

7.3 Project Phases

Please refer below to review various phases in the project and the major objectives of each phase.

7.3.1 SDWAN Design

(1) Identify what SDWAN has to offer

(2) Research available SDWAN vendors

(3) Finalize an SDWAN Vendor

(4) Shortlist a vendor and perform a POC

7.3.2 Initial Implementation

(1) Implement the solution in the first location and evaluate results

(2) Implement solution in five more locations

7.3.3 Roll out

- (1) Implement final solution in remaining Branch Offices and outlet locations
- (2) Review results with the Site operations team and Management
- (3) Prepare Training and Documentation

7.3.4 Project Closure

- (1) Conduct Training for Operations and Support Team
- (2) Handover to Operations
- (3) Update Integrations with Incident Management Tool
- (4) Prepare Project Closure Documentation

7.4 Timelines

Project Launch: Date

Table 8. Timelines

| Duration | Week1 | Week2 | Week3 | Week4 | Week5 | Week6 | Week7 |
|------------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Phases | | | | | | | |
| SDWAN Design | | | | | | | |
| Identify what SDWAN has to offer | | | | | | | |
| Research available SDWAN vendors | | | | | | | |
| Finalize an SDWAN Vendor | | | | | | | |
| Shortlist a vendor and perform a POC | | | | | | | |
| Initial Implementation | | | | | | | |
| Implement the solution in the first location and evaluate results | | | | | | | |
| Implement the solution in five more locations | | | | | | | |
| Roll out | | | | | | | |
| Implement the final solution in remaining Branch Offices and locations | | | | | | | |
| Review results with the Business Operations team and Management | | | | | | | |
| Prepare Training and Documentation | | | | | | | |
| Project Closure | | | | | | | |
| Conduct Training for Operations and Support Team | | | | | | | |
| Handover to Operations | | | | | | | |
| Update Integrations with Incident Management Tool | | | | | | | |
| Prepare Project Closure Documentation | | | | | | | |

7.5 Important Milestones

- (1) Finalize an SDWAN Vendor
- (2) Finalize Network Design with SDWAN Vendor
- (3) Implement SDWAN technology in the first location
- (4) Review performance results with Project team and management
- (5) Approval to proceed with the rollout
- (6) Implement SDWAN technology in all the office locations
- (7) Handover to Operations

7.6 Project Launch Details

According to Aston, B (2016), the project kick-off meeting is the first meeting between a project team and the sponsor of a project when kicking off a new project. We will be inviting the Executives and Leaders from all the relevant business areas to brief them on the project scope, objectives, and timelines ^[1].

We will also schedule a deep dive meeting with all the stakeholders involved to introduce the team, understand the project background, understand what success looks like, understand what needs to be done, and agree on how to work together effectively.

We will also schedule a meeting with Onsite Tech to review their responsibilities, and this meeting is an opportunity to get the key information they need to succeed and demonstrate their enthusiasm and understanding of the project.

The Project Manager will schedule regular meetings to keep the team members and stakeholders up to date on the progress. He will also work with IT Operations to create a distribution list of all the team members involved and will send weekly updates. IT Operations team is also planning to create a new #slack channel for collaboration purposes.

7.7 Project Strategy- Explanation

In our Project Management methodology, we are primarily managing three areas to achieve the desired project goals.

- (1) People
- (2) Process
- (3) Technology

- (1) People

During the SDWAN Design Phase, we are planning to involve all the stakeholders from the beginning of the project. The leadership and the technical teams will be involved in the product demonstration and vendor selection process. The collective feedback will be gathered from the team members, and they will be asked to rate the tech-

nology and product on a Google form. This will give all the project members an opportunity to provide feedback and will help the project team to make the right decision. During the implementation phase, we are planning to install the new appliance at a very fast pace, and we may run short of resources if we encounter any issue during the deployment, to mitigate that risk we have partnered with Onsite Tech to provide additional resources.

(2) Process:

This project involves the implementation of new technology in the organization, and we need to have thorough process checks at every stage to make sure we are giving a tried and tested input to the next processes in the task list. In order to ensure the technology is well received in the production network, the technical and the SDWAN partner will work very closely during the SDWAN Design and Initial Implementation phase. The testing team will follow a complete checklist of expected outcomes for various scenarios and will document the same. The IT Operations team will ensure that the new software integrates with the existing enterprise applications like monitoring tools and communication systems before it is deployed in the production environment. The changes to the production environment will be performed only in off- hours, and all of the production changes will have to go through a change control process.

(3) Technology:

In order to solve the increasing demand for more internet bandwidth at all our locations, as an IT department, we completely understand that there is a demand for high bandwidth circuits at all of our Business locations, but at the same time, we need to increase reliability. The monthly re-occurring cost (MRC) of existing MPLS connections is already on a higher side and the high bandwidth MPLS circuits are completely out of our operational budget. In addition to this, with existing MPLS network architecture, we are backhauling all internet traffic to our Datacenter that further introduces more latency due to round-trip time. The existing technology using traditional network architecture is, for sure, not able to provide a solution that can solve our needs and still be affordable. The time has come to explore the capabilities of the SDWAN solution. According to Gartner (2015), SD-WAN is an emerging technology that offers several benefits compared with traditional, router-based WANs. Network Architects can achieve cost savings, increased agility, and simplification with SD-WAN [3].

7.8 Documentation Deliverables

(1) Non-Disclosure Agreements (NDA) with various SDWAN providers for technology review

- (2) Master Service Agreement (MSA) with SDWAN partner
- (3) Statement of Works (SOW) with SDWAN partner
- (4) Project Plan
- (5) Network Architecture showing SDWAN in the production network
- (6) Application integration document
- (7) SDWAN Hardware Installation Guide
- (8) Organization’s Network Topology including SDWAN
- (9) SDWAN Network Administration Guide
- (10) SDWAN Business Support Guide

7.9 Hardware and Software Deliverables

- (1) SDWAN hardware installation in all retail locations
- (2) Dual Direct Internet Access circuit installation at all locations
- (3) Network Policy Configuration for SDWAN software
- (4) Security Policy configuration for SDWAN software

7.10 Final Assessment Criteria

The overall success of the project will be evaluated based on the below criteria.

- (1) Improvement in network performance after the implementation of the project.
- (2) Ease of implementation of the new technology at the new sites.
- (3) Ease of Network administration
- (4) Reduction in network incidents after the final roll-out
- (5) Overall operational and process improvements
- (6) Vulnerability reports on the hardware and software.

We will use below Metrics to measure the proposed and actual outcomes of the project.

Table 9. Measure the proposed and actual outcomes of the project

| Evaluations Area | Proposed % | Actual % | Business Feed-back |
|------------------------------|------------|----------|--------------------|
| Internet Bandwidth Upgrade | | | |
| Network Reliability | | | |
| Hardware Reliability | | | |
| Ease of Installation | | | |
| Ease of Access | | | |
| Network Management | | | |
| Security Policies Management | | | |
| Vendor Support | | | |

The network performance will be measured using a tool that is an industry leader in performing a speed test provided by OOKLA. In order to measure the overall network performance and compare the pre and post-installation results, we will be using a renowned industry tool Solarwinds NPM (Network Performance Monitor). To measure incident ticket count and ease of administration using the incident resolution time matrix, we will be using the ServiceNow tool that is one of the most popular Cloud-based ticketing systems in the industry today. The organization should only select an SDWAN partner once he provides the supportive documentation that their product has passed the necessary security and health safety tests. The organization should plan to perform a vulnerability test once the product is installed in the first business location to ensure there are no new vulnerabilities discovered in the network.

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