



A Software-Defined WAN is a Business Imperative

Introduction: It's time for the WAN to evolve

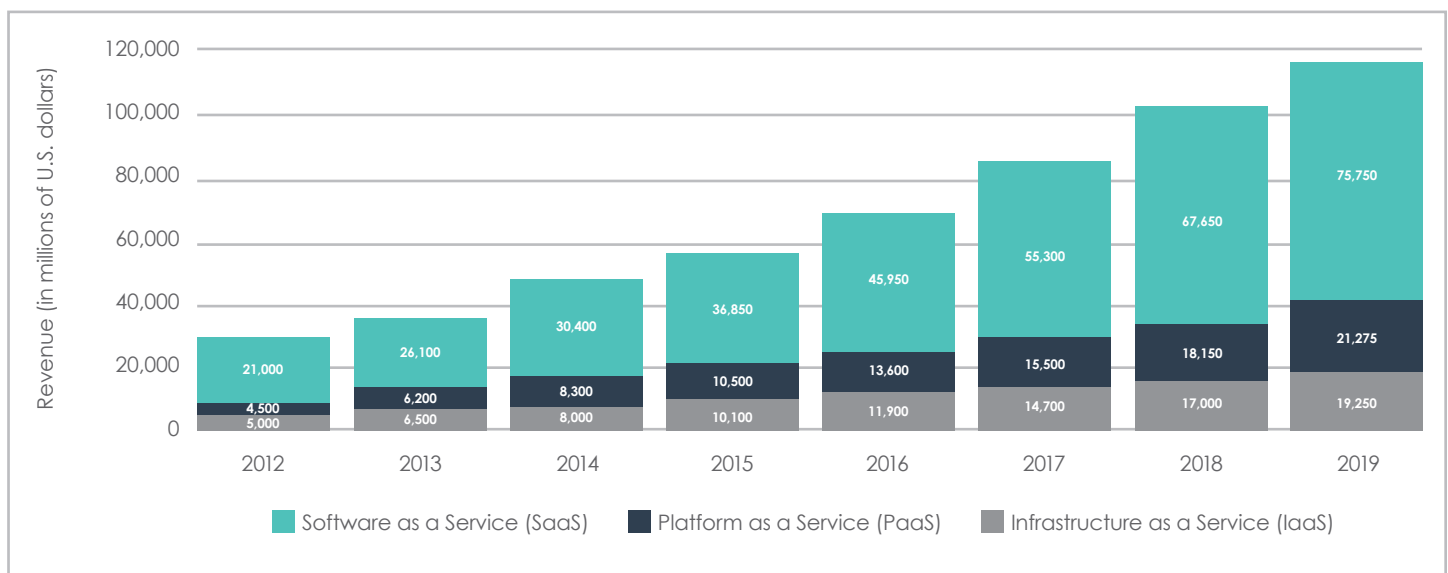
Almost every IT and business leader in Canada today is focused on creating a more agile business. The ability to adapt immediately to business climate changes is now the basis for competitive advantage, and it will determine which Canadian companies will thrive and leapfrog their competitors and which ones will face becoming irrelevant. However, business agility cannot be achieved without having an agile IT infrastructure to enable it. This is one of the reasons why businesses have spent billions of dollars on technology to make IT more agile.

In the data center, virtualization has become the norm and has raised the level of agility at the compute layer. Flash storage is now being used to enable businesses to migrate data at unprecedented speeds. Some organizations have deployed network virtualization as a way to increase the agility of the data center. ZK Research estimates that businesses have spent \$12 billion on infrastructure used to make the data center more agile.

However, one part of IT that has yet to evolve and lacks flexibility is the enterprise wide-area network (WAN). Evolving the WAN must be at the top of every IT and business leader's priority list because organizations can only be as agile as their least agile IT component—which, today, is the WAN. In addition, several other factors are driving the evolution of the WAN, including the following:

- **The cloud is becoming the norm.** More applications and workloads are moving to the cloud. The cloud is now the fastest-growing segment of enterprise software, and ZK Research predicts that cloud computing services will grow from about \$46 billion in 2014 to more than \$116 billion in 2019 (Exhibit 1). The surge in cloud traffic will drive significantly different traffic patterns over the wide-area network.
- **Unified Communications (UC) is business critical.** Competitive advantage is based on a company's ability to make decisions quickly while involving the right people, regardless of where they are located. The rise in virtual teams and mobile workers has made unified communications a mission-critical application for businesses of all sizes. The ZK Research 2014 Unified Communications Purchase Intention Study indicates that 87% of organizations have at least partially deployed UC in their organizations. The multimedia applications in UC such as voice and video are now driving up bandwidth requirements.
- **Computing has become network-centric.** The cloud, mobile computing, the Internet of Things (IoT) and big data are at the top of almost every business and IT leader's priority list today. These new computer paradigms are all network centric. The success of these initiatives is largely dependent on the quality of the network, particularly the WAN.

Exhibit 1: Bright skies ahead for cloud services



Source: ZK Research 2015 Cloud Forecast.

During the past five years, significant advancements have increased the level of agility and flexibility in the data center through software-defined networking (SDN). However, the benefits of SDN have yet to improve the WAN, and they are also required to support the more agile data centers. For businesses to reach the level of agility required to compete in today's digital world, the WAN must evolve into a software-defined WAN (SD-WAN) now.

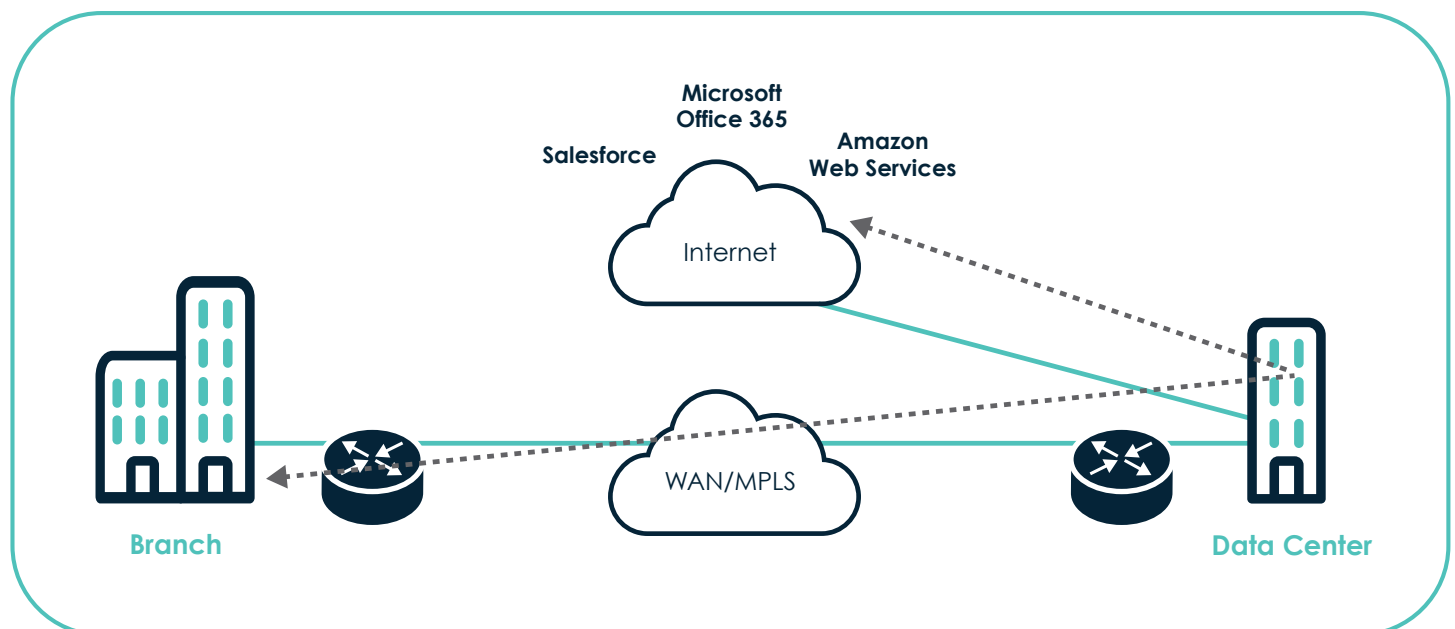
This shift must be made in a way that lowers the complexity of running the network and simplifies the management tasks so the WAN can be run with fewer IT resources.

Section II: Challenges with the legacy wide-area network

The existing architecture used to build WANs has been in place for several decades. The traditional "hub and spoke" design was implemented for the efficient delivery of client/server computing and best-effort Internet traffic. In that era, data that moved from the data center to the branches constituted the majority of network traffic. Today, however, cloud, mobile computing, and multimedia traffic are the fastest-growing application types, and they drive significantly different traffic patterns compared to the legacy compute models. The evolving business climate is putting new demands on the WAN that cannot be met because of the following challenges:

- **Inefficient network design.** The concept of moving away from a hub and spoke design to a partially or fully meshed network is certainly not new. However, running a network that is even partially meshed involves a high level of complexity—too high to make it practical for most organizations to migrate away from the hub and spoke design. Also, the redundancy of WAN links is based on an active-passive model, whereby the backup connection only becomes active when the primary link fails. This means businesses are paying for up to twice the amount of bandwidth that they are actually using.
- **Poor use of network bandwidth.** With the hub and spoke architecture, Internet traffic is passed down a WAN link and through the hub before accessing cloud data centers and Software as a Service (SaaS) applications. This "trombone" effect (Exhibit 2) can saturate WAN links and degrade the performance of both the backhauled applications and other applications on the WAN link. The rise of mobile and cloud computing means more and more of an organization's network traffic will be traveling to and from the Internet, which means the performance problems created by the trombone of traffic will be magnified in the future.

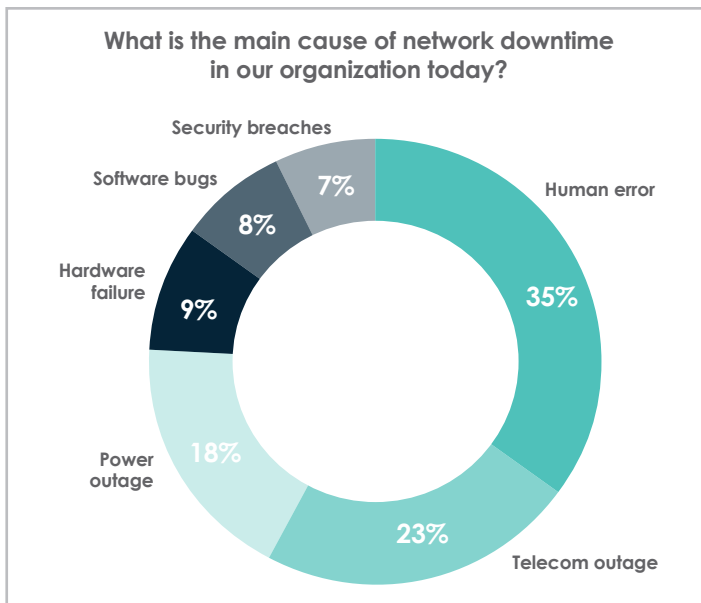
Exhibit 2: The WAN trombone effect inhibits rapid traffic growth to the cloud



Source: ZK Research 2015.

- **High cost of bandwidth.** With legacy networks, the only way to ensure available bandwidth for applications is by using expensive private network services such as MPLS or leased lines. Lower-cost Internet connections do not offer any kind of service level agreement (SLA) or the assurances necessary for bandwidth to be used as business class circuits.
- **Difficulty in optimizing the user experience.** Despite the high cost of private networking services, it is still difficult for most network managers to optimize the quality of the user experience for applications. Consequently, network managers are constantly changing QoS settings, creating alternative paths, or changing other network parameters. The constant tweaking of the network is often done “ad hoc” when users are complaining about problems and, consequently, IT is working under pressure. This is one reason why the largest cause of network outages today is human error (Exhibit 3).

Exhibit 3: Human error is the largest cause of network downtime



Source: ZK Research 2014 Network Purchase Intention Study.

- **Security and performance are overlay technologies.** Securing a legacy network is typically accomplished by layering on additional physical or virtual appliances to add the new functionality required. The overlay approach, which is built on multiple appliances, can further increase the complexity of the WAN.
- **Long lead times for new network services.** The ZK Research 2014 Network Purchase Intention Study revealed that the average time taken to start implementing new network services is four months.

The long lead time is due to the fact that changing network settings requires a highly skilled engineer, so only a handful of engineers in organizations can implement these changes. Also, most configuration changes need to be done on a box-by-box or even port-by-port basis, meaning modifications to large networks can often take months to complete.

Network agility is no longer something companies can simply aspire to have in the future—it is business-critical today. Organizations must shed their legacy thinking regarding network design and deploy a network that offers the same level of agility as exists at the compute and application tiers. To accomplish this, a new, agile WAN architecture is required. It's time for the SD-WAN.

Section III: Introducing the Software-Defined WAN

SD-WAN is a WAN that is defined by business and IT policies through software. Traditional network operations have no visibility into the business, but SD-WAN is tightly coupled to the business through policies. The policies are then used to automate the configuration changes, move traffic flows, or enact other changes to ensure the network is continually meeting the needs of the organization.

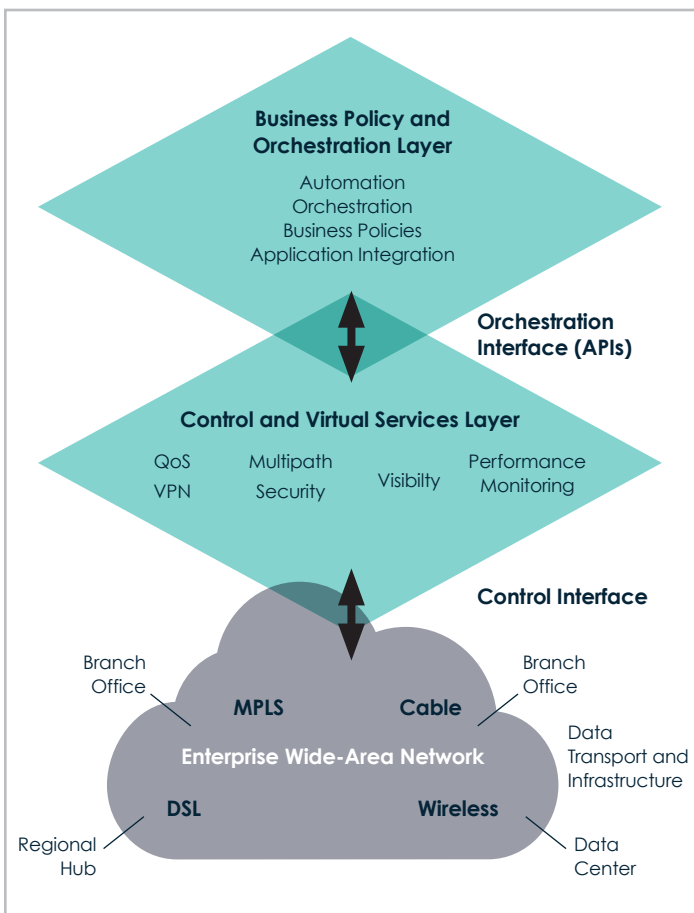
The term “software defined” is used to mean different things in the various parts of IT and can be confusing to business and technology executives. The following characteristics can be used to define SD-WAN and better explain why this technology shift is of the utmost importance to businesses of all sizes:

- **Hybrid network architecture.** As stated previously, traditional WANs were built primarily on expensive, private IP network services. If Internet connections were used, they were deployed exclusively as backup connections. SD-WAN is composed of a hybrid of network services including but not limited to MPLS, private line, broadband Internet or even 3G/4G wireless. With SD-WAN, a hybrid configuration becomes the norm.
- **Internet connections for critical business applications.** In a traditional WAN configuration, the Internet would never be used for applications such as VoIP, video, big data, or other business-critical applications. However, in a software-defined configuration, the virtual services layer can quickly switch among multiple Internet connections, ensuring the fastest and highest-quality path is always being used. No single Internet connection can match the performance characteristics of an MPLS network. However, with SD-WAN, when the best path is always chosen dynamically from multiple Internet connections, the

network can have equivalent or better performance than MPLS at a fraction of the price. ZK Research estimates that this can equate to anywhere from a 10x to 100x savings, depending on link length and bandwidth capacity.

- **Multiple active paths become the norm.** The previous section highlighted how legacy WANs use active-passive connections where the backup (passive) connection only becomes active when the primary one fails. This is highly inefficient, as every connection must be sized to handle all corporate traffic. This is akin to building a highway system where all cars must take the same route, and alternative routes can be used only in the event the main road is unavailable. Each road would have to be built large enough to accommodate all traffic. Although this may seem ridiculous to a civil engineer, it has been the norm with network engineers. With SD-WAN, multipath networks (active-active) are the norm, where automated and dynamic path selection is used to optimize application performance and security.

Exhibit 4: The Software-Defined Wide-Area Network



Source: ZK Research 2015.

- **Dynamic meshing.** Meshing has always been challenging for network managers. A mesh network is much more efficient than a hub and spoke design, as it allows traffic to go from location to location over a single hop. However, the higher the degree of meshing, the more complicated managing the network becomes due to the exponential growth in network links. SD-WAN can dynamically mesh connections—in other words, a connection would be created between two locations only when needed and when business policy dictates. Then the connection just as easily can be dynamically turned down. This gives all of the benefits of a fully meshed network without the associated management overhead.
- **Optimized for cloud computing.** Legacy WANs are ineffective for cloud because all Internet traffic goes through a single choke point and then is distributed over the WAN to the remote location. SD-WAN offers secure and high-performance direct Internet access so cloud and mobile applications can be optimized and the entire network can be used more efficiently.
- **Automation of configuration processes.** The business policy layer can be used to fully automate configuration changes. For example, if a video session is being initiated between two points, the application can direct the network to create a path between the two locations using dynamic QoS. Once the call has ended, the application can automatically remove the dedicated path. The automation of processes ensures the best possible performance and can eliminate unplanned downtime caused by human error.
- **Virtual service delivery.** In a legacy network, services are delivered to locations such as branch offices by deploying physical appliances in each location. This makes deploying new services very slow and costly, and even the simplest changes can take months to complete. With SD-WAN, services can be delivered virtually to any location on an on-demand basis.
- **Cloud presence.** In this era of cloud computing, the business WAN must extend past the traditional boundaries and out to the cloud. SD-WAN is inclusive of the cloud.

The rise of software-defined WANs is being enabled by Moore's Law. Software solutions running as virtual 3to significantly more expensive dedicated hardware solutions. The shift to software is a key to greater network agility, but now this agility can be achieved with no loss of performance. The shift to software also allows data paths to be defined by application flows instead of packet flows.

Businesses that adopt SD-WAN will realize greater network

agility, which will enable greater business agility—a key to competing in the digital business era. Also, based on ongoing research, ZK Research estimates that businesses can cut their network operation costs by as much as 50% by running SD-WAN. Highly paid network engineers will have more time to dedicate to strategic initiatives instead of spending the majority of their time just maintaining the status quo.

Section IV: What to look for in a SD-WAN solution provider

Making the shift to SD-WAN is an imperative for enterprise IT leaders, as the network has become the basis of competitive advantage. Enterprises should seek out an SD-WAN provider that can offer all of the benefits without adding any complexity.

With so many choices available today, the best provider may not be obvious. Enterprises looking to transition to SD-WAN should look for the following in a solution provider:

- **Ability to enable a transport-independent overlay for a hybrid network consisting of private, wired broadband and wireless circuits.** Ideally, with dynamic steering and optimization techniques, even single or multiple broadband circuits can deliver business-grade performance.
- **Choice of infrastructure.** The SD-WAN provider should offer flexibility with respect to infrastructure by offering either physical or virtual appliances within the branch offices. Data centers, particularly cloud data centers and SaaS, can be connected without any hardware or software, while data center appliances are available especially to connect legacy data centers to hybrid networks.
- **Delivered as a cloud network.** The ability to provision SD-WAN from the cloud ensures that all the complexity involved in integrating the various technologies is masked from the deploying organization. Ideally, the solution includes the ability to deliver data plane services using multi-tenant, cloud gateways. A cloud-delivered SD-WAN service enables businesses to migrate to SD-WAN as aggressively or as conservatively as is comfortable without any of the associated risk of deploying new hardware or software in data center locations that could disrupt the business.
- **Zero-touch, thin provisioning.** The provisioning of new locations should be done easily without any requirement to have a local IT person. The local infrastructure should be thin in nature and have the ability to immediately communicate with the cloud service. Additionally, all updates, policy changes, and network configuration information should be automatically pushed to each location.
- **Scalable, pay-as-you-grow pricing model.** A cloud-centric business requires a network where the architecture is optimized for cloud services. Additionally, the pricing model of SD-WAN needs to be aligned with the cloud as well. Utilizing a “pay-as-you-grow” model instead of lengthy contracts means organizations can pay for what they need today and increase their investment in the network when the business requires it—not before.
- **Low upfront capital costs and incremental migration.** One goal of the SD-WAN is to lower the total cost of running the network. This cannot be done if the upfront capital costs are so high that it takes years to realize a payback. The solution should have a minimal upfront cost and then offer incremental migration costs as the deployment scales.
- **Ability to connect to infrastructure and SaaS providers.** The SD-WAN service should connect to all of the major Infrastructure as a Service (IaaS) and SaaS providers to ensure optimized performance of cloud services.
- **Rich portal for administration.** The portal is the “control panel” for SD-WAN implementation. The provider’s portal should offer rich functionality to enable organizations to have a complete view of the network and performance of the applications. Additionally, the portal should provide an end view of the network so network managers can better plan and maintain the network over time.
- **Automated application classification and prioritization.** The SD-WAN solution needs the ability to automatically recognize applications, classify them, and prioritize the traffic for optimized performance.

Section V: Conclusion and recommendations

Cloud computing, enterprise mobility, and bandwidth-intensive applications have reshaped the computing landscape, and they are making the transformation of the enterprise WAN not only inevitable but also urgent. IT and business leaders must focus on shifting the WAN to an architecture that's more flexible, dynamic, and secure in order to become an agile business.

The organizations that lead this change will be able to better align their network strategies with their business strategies and help transition IT from a cost center to a business partner. Because the transition to a software-defined WAN is of the utmost importance today, ZK Research makes the following recommendations to IT and business leaders:

- **Make the implementation of SD-WAN an immediate priority.** Some organizations have transitioned to a hybrid WAN, but this is not enough. A software-defined WAN includes software-defined policies, a software-defined branch and a hybrid WAN.
- **Focus on delivering the best user experience.** In this era of the mobilized, cloud-driven enterprise, the user experience has become a key differentiator. Organizations that provide a superior user experience will deliver better customer service, have more productive employees, and leapfrog their competitors.
- **Automate network configuration processes.** The transition to SD-WAN requires new technologies and infrastructure as well as process automation. Automating configuration tasks allows the entire network to be reconfigured immediately, which enables businesses to capture new market opportunities faster.

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