The Economic Benefits of Session Smart Routing in SD-WAN and Cloud Networks

Executive Summary

128 Technology is delivering an SD-WAN solution that is clearly differentiated from the competition. Where traditional SD-WAN has delivered incremental benefit on legacy infrastructure, 128 has built a disruptive solution that addresses the limitations of the existing infrastructure. The 128 Session Smart SD-WAN solution is inherently service centric, enabling a far-tighter alignment between the network and the applications it supports. Based on research by ACG, when moving to SD-WAN enterprise, customers can expect to save 20% to 40% over their traditional WAN costs by leveraging less expensive connectivity options. The savings are dependent on the level of Internet service purchased, as well as the enterprise's existing contract for MPLS services. With 128 Technology, ACG has found that there are several ways to save additional cost by levering Session Smart Technology.

128 Technology has introduced an innovative software pricing model: project-wide licensing. This provides customers with a success based, pay-as-you grow pricing model that customers only pay for network usage. For SD-WAN ACG has determined that this pricing model can reduce routing software expenses up to 82% over existing solutions.

Perhaps the biggest difference for the Session Smart SD-WAN solution is its ability to create secure SD-WAN networks without creating IPSEC tunnels. On average IPsec tunnels add up to 30% or more overhead to network traffic, increasing expenses for unused network capacity. Specifically, cloud providers such as AWS and Azure charge customers for data transfer expenses. Therefore, customers pay real money for overhead traffic created by tunnels. ACG Research has estimated that for a network connecting 1000 branch offices annual savings of over $1.3 million can be realized with Session Smart routing.

KEY FINDINGS

- Session Smart project-wide licenses reduce network software expenses by 82% compared to other SD-WAN offerings
- Session Smart reduces traffic and public cloud data transfer expenses by at least 30%
- Traditional SD-WAN edge appliances with tunnels have scalability limits; Session Smart routers can save up to $100K annually in each data center for networks with 1000 branch offices
- Simplified management and security reduces network opex by 20% as compared to other SD-WAN offerings

Traditional SD-WAN solutions using IPSEC tunnels have significant endpoint scalability limits. For larger networks, it is not possible to connect branch offices in a full mesh, limiting peer-to-peer voice and video deployments. Furthermore, SD-WAN in data centers has tunnel scalability limits resulting in additional expenses. ACG estimates that for a network with 1000 branch offices with a high availability (HA) architecture Session Smart routing can save over $100K per year.

Session Smart routing also uses an innovative approach to network orchestration by using a word-based network data model defined in terms of services and tenants to create routing and security policies that work together. Tenants can only see or utilize services as policies allow. Easy-to-understand policies are used to configure entire networks such that networks are secure and robust. ACG has estimated operations expense (opex) savings of 20% while providing actual zero-trust security.

The 128 Technology Networking Session Smart Routing solution introduces a session-based, service-centric and security-infused architecture that is fully compatible and interoperable with existing data and control plane architectures. Session Smart Routing replaces and augments complex out-of-band routing protocols, tunnel-based network overlays and cumbersome provisioning systems with centralized control, simple intelligent service routes and in-band signaling. 128 Technology provides a routing solution for SD-WAN that is scalable, cost effective, easy to manage and secure. This paper examines the economic benefits of Session Smart routing for two use cases: SD-WAN and public cloud data center internetworking.

What to Consider When Deploying SD-WAN and Public Cloud

Service providers and enterprises are deploying SD-WAN and moving applications to the public cloud. As technical teams select network and cloud solutions there are some key factors that should be considered.

Total Network-Wide SD-WAN Software Expense Networks

Traditional routers are hardware based and therefore there is a tendency to focus on hardware expenses. However, next-generation routers are virtual, making software as the dominant expense. Many SD-WAN deployments use redundant edge devices for HA designs. Teams evaluating routers must determine the total software costs for the entire network, including software that is running in redundant routers.

Selective Encryption Is Critical

Legacy IPsec tunnels encrypt all traffic regardless of whether it is TLS encrypted at the application level. Because only 10–15% of network traffic needs to be encrypted at the network level, the 128 Technology Session Smart routing selectively encrypts traffic at the right encryption level for each network session. Session Smart uses stateless encryption requiring less CPU and memory resources.

Cost of Network Bandwidth to Public Cloud Data Centers

When enterprises are deploying public cloud applications it is important to consider the cost of data transfer in and out of the cloud. Although public cloud providers such as AWS and Azure have low prices for virtual machines, the price of data transfer is high. For network-intensive applications this can be a significant expense. Quantifying these expenses is an important step in estimating the total cost of running applications in the cloud.

Scalability of Endpoint Connections

Tunnel-free IP routers can connect to an unlimited number of endpoints, which have allowed the Internet to scale to a massive size. However, most SD-WAN devices use IPSEC, GRE and/or VXLAN tunnels to create a private overlay network on top of the underlying IP transport network. One of the downsides of tunnels is scalability. Specifically, many SD-WAN devices have limits to the number of tunnel terminations. A typical limit is 500 tunnels per device and many connections require two tunnels per connection. This means that network topologies and scalability are limited. For example, in a network with 1000 branch offices and two tunnels per branch office, 2000 tunnels would need to be terminated in a data center, which would require at least four SD-WAN head-end devices. Also, full-mesh connectivity requires n*(n-1) connections that translates to 3,998,000 connections to fully interconnect 1000 branch offices. This means that voice and video conference traffic cannot be routed directly between branch offices but instead must use a hub and spoke architecture to reduce the explosion of connections.

Operational Expenses in Running SD-WAN Network

Network opex is a significant expense and includes service fulfilment activities (truck rolls, configuration, and provisioning), engineering and planning, and service assurance (help desk, fault management, performance management and security management). There are complex management tasks associated with managing SD-WAN ACLs and tunnels. These expenses are an important consideration when planning an SD-WAN deployment.

Network Reliability and Availability

When designing and building any network reliability and availability are key considerations. Different products and architectures should be compared in the context of network service availability.

Security

Network security is a key consideration for any SD-WAN and public cloud network. The strengths and weaknesses of each vendor and network design should be carefully considered when planning an SD-WAN deployment.

Total Network-Wide SD-WAN Software Expenses

Most SD-WAN software licenses are based on peak router capacity. These software licenses replicate the cost model of hardware routers. With this traditional pricing model customers pay for peak bandwidth regardless of their data usage. In contrast to this, customers are increasingly asking vendors for a pay-as-you-grow model such that customers buy bandwidth using a consumption model that is like the consumption pricing used for cloud services.

128 Technology gives customers the option to use the traditional capacity licensing model or to use an innovative project-wide licensing that provides cloud-based consumption pricing in the network. Project-wide licenses are based on total average network utilization. This means that customers only

pay for network capacity that they use, not for peak capacity at sites with low levels of average utilization.

SD-WAN networks typically interconnect many branch offices with public or private cloud data centers. Traffic at the edge of the network is highly bursty because there is very little aggregation of traffic. For example, an average branch office with 50 users has a network volume of 2000 Gbytes/month that translates to a data rate of 6 Mbps. However, most of the traffic comes in bursts during the eight-hour work day. This means that the connection at such an office is typically 100 to 500 Mbps to support traffic bursts and provide a high level of performance. Therefore, the average monthly network utilization is quite low, typically 5% or less.

Project-wide licensing means that customers only pay for network bandwidth that is used. The benefits of this approach are:

- Pay-as-you-grow model
- Pay only for utilization: All bandwidth entitlements are based on peak utilization vs capacity.
- No additional cost for router redundancy that uses HA architectures
- Fully elastic: Project-wide bandwidth is licensed as a pool that is instantly available across many devices. The network might include multiple time zones where some users are working while others are home; customers only pay for capacity that is consumed
- Efficient: No node locked capacity means customers never pay for capacity they cannot use

To compare project-wide licensing to traditional capacity licensing we have modeled a network using the following assumptions:

- 5000 SD-WAN sites
- Asymmetric network traffics
- Competing SD-WAN expenses are calculated using ACG industry averages for SD-WAN software licenses

A typical SD-WAN consists of many sites with different bandwidth requirements. We assume the following distribution of bandwidth in our model:

Site Data Rate (Mbps)	Site Distribution	Total Number of Sites
10	20%	1000
100	50%	2500
500	20%	1000
1,000	9%	450
10,000	1%	50
Total	**100%**	**5000**

Table 1. Bandwidth for SD-WAN

Additionally, we consider networks with HA and non HA architectures. A network with an HA architecture uses dual routers at each site. Each router needs the peak bandwidth for the site in case of a router failure. A non HA network uses a single router at each site.

The financial benefits of project-wide licensing are depicted in Figure 1. In this graph, the horizontal axis represents to project-wide network utilization, and the vertical axis represents the percentage savings of the 128 Technology project-wide licenses over peak capacity licenses. At lower levels of network utilization, the savings are significant. For HA architectures project-wide licenses have no additional expenses; peak capacity licenses double the expenses.

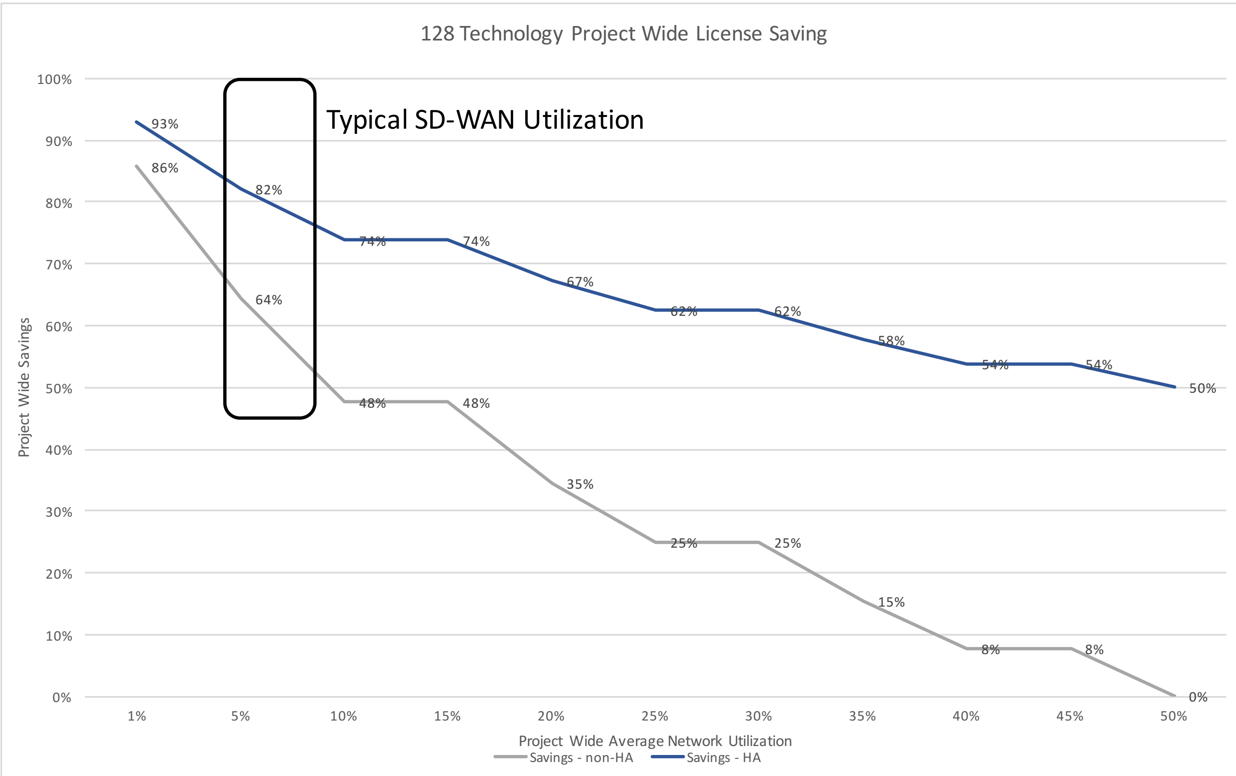

Figure 1. Licensing Savings

Cost of Network Bandwidth in Public Cloud Data Centers

Many enterprises are migrating applications to the public cloud, and most small and medium size companies exclusively use public cloud computing. An important expense to consider is the data transfer expense in and out of the cloud data center. Amazon, Azure and others charge customers for the volume of data transferred.

A key benefit of 128 Technology Session Smart routing is that tunnels are not needed for SD-WAN implementations. This is because encryption and security are an intrinsic part of the Session Smart router. Furthermore, Session Smart uses selective encryption that only encrypts data that is not already encrypted by HTTPS. Today, only about 15% of network traffic is unencrypted. SD-WAN tunnels encrypt all traffic without regard to encryption at the application layer. Tunnels add on average 30% overhead to network traffic. Because public cloud data centers charge for data volume transferred in a month, this overhead has a hard dollar cost associated with it.

As an example, consider an SD-WAN network that connects to AWS with:

- 1000 branch offices
- 5% average network utilization

- AWS cost per Gbyte of $0.065

Furthermore, assume that site bandwidth is distributed as depicted in Table 2:

Site Data Rate (Mbps)	Site Distribution	Total Number of Sites
10	20%	200
100	50%	500
500	20%	200
1,000	9%	90
10,000	1%	10
Total	**100%**	**1000**

Table 2. Site Bandwidth Distribution

For this scenario, the costs for 128 Technology Session Smart Routers and SD-WAN tunnel routers are presented in Table 3. The elimination of tunnels and the associated overhead results in a hard dollar cost annual savings of $1.3 million.

Router Type	Gbytes/Month	Monthly Expense
Session Smart Router	3,974,850	$258,365
SD-WAN with Tunnels	5,678,357	$369,093

Table 3. Monthly Expenses

Scalability of Endpoint Connections

Most SD-WAN head-end devices use tunnels to provide secure connections over IP transport networks. On average, such routers cannot terminate more than 500 tunnels. In networks with large numbers of branch offices multiple routers are needed in data centers because of these scalability limits. To analyze the expenses associated with endpoint scalability a model was developed using the following assumptions:

- 500 tunnels per router
- 2 tunnels per branch office
- HA network architecture requires two redundant routers

The costs of data center head-end devices include capital expense depreciation, hardware maintenance, and software licenses. In Figure 2 the annual expenses in a single data center of SD-WAN head-end devices using tunnels are compared with 128 Technology routers. The vertical axis displays annual expense; the horizontal axis presents the number branch offices. This example is for a non HA network where a single router is used at each branch office. As the number of branch offices grows the tunnel solution requires additional routers in the data center, which adds additional cost to the network. Figure 3 is a similar example; however, in this case HA architecture is used with dual routers at each branch office. This increases the number of tunnels, which makes the problem worse. In both cases Session Smart routers from 128 Technology have significant savings.

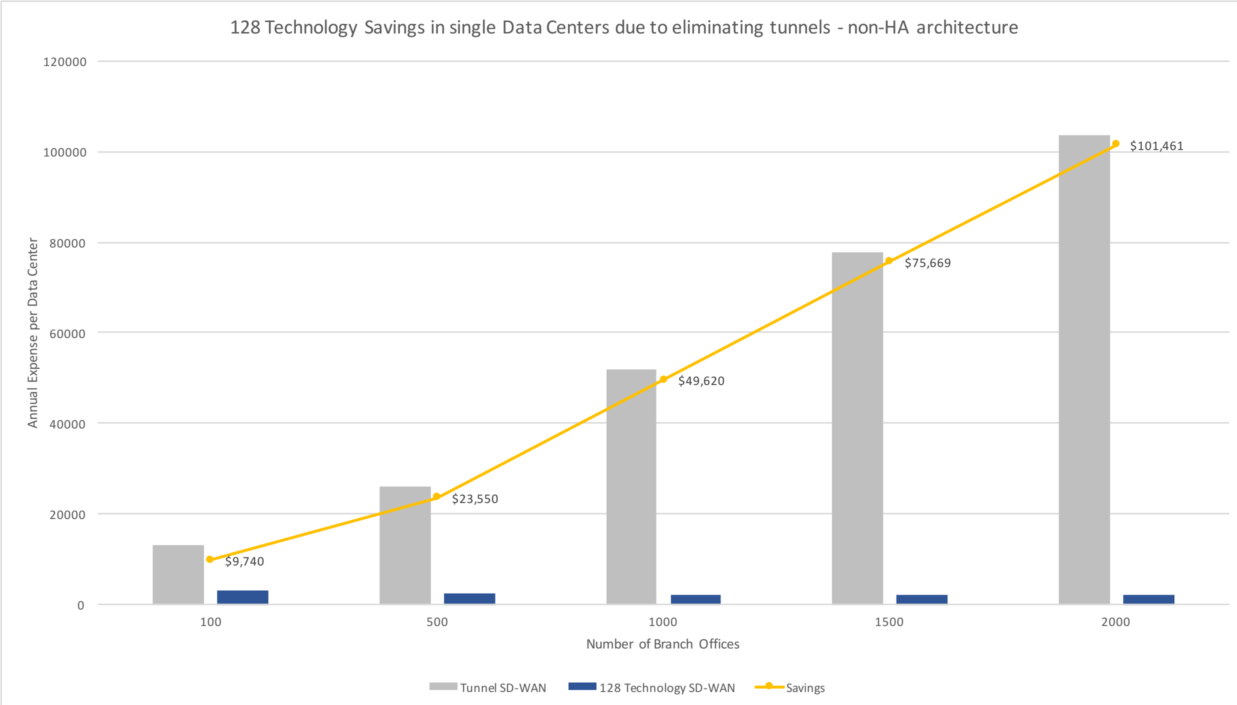

Figure 2. Savings in Single Data Center, Non HA Architecture

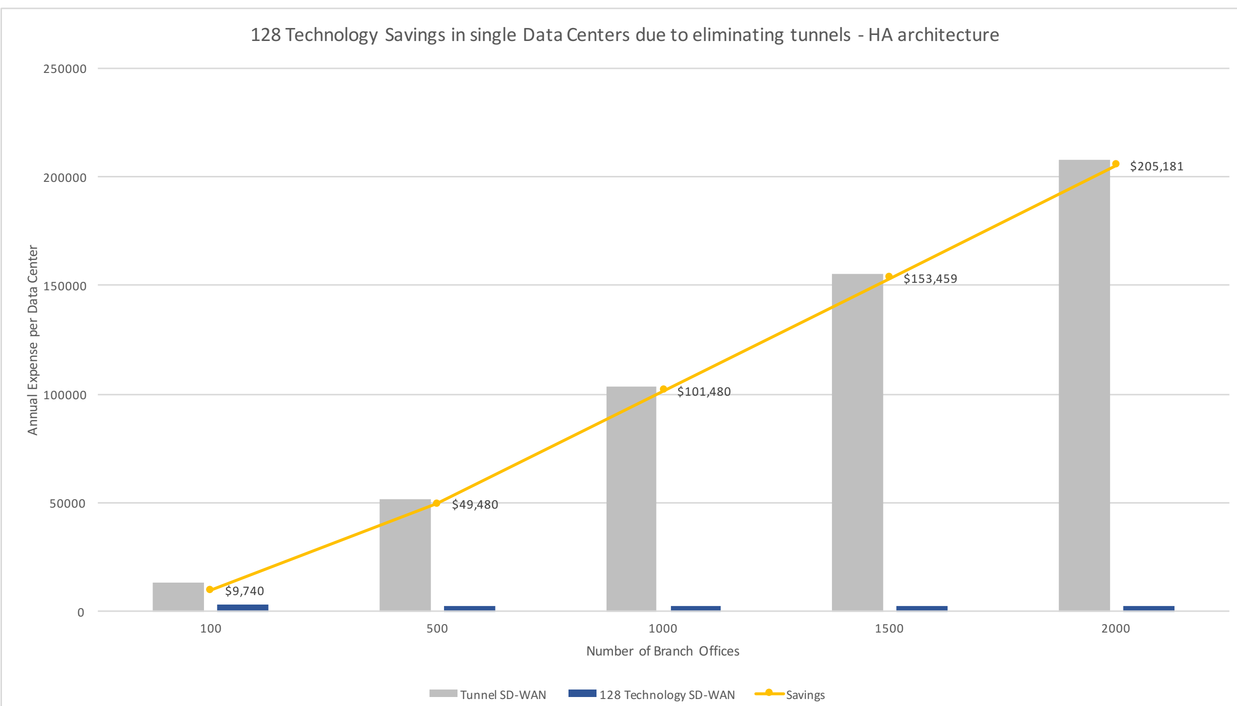

Figure 3. Savings in Single Data Center, HA Architecture

Operation Expenses in Running SD-WAN Network

128 Technology Session Smart routing simplifies network operations with an innovative and unique approach to network configuration. Traditional routers use ACLs to control traffic. This can result in additional complexity with thousands of ACLs managed across many different routers and firewalls using

IP addresses and TCP/UDP port numbers to define policies that are hard to understand and difficult to manage. Session Smart simplifies management by using a new kind of network data model defined in terms of services, tenants and policies. Tenants can only see or utilize services as policies allow. Access, quality of service and security-related policies are defined for tenants and services with policies and permissions propagated automatically throughout the network.

The financial benefits of Session Smart are analyzed using an ACG research opex model that considers service assurance (monthly recurring expense), service fulfilment (nonrecurring expense), and engineering and planning (nonrecurring expense). We use ACG financial benchmarks for average expenses in these categories. These benchmarks are presented in Table 4. The Session Smart annual operation expenses and savings are illustrated in Figure 4. ACG estimates a 20% opex savings with Session Smart routers.

Opex Category	SD-WAN Router	Session Smart Router
Service Assurance MRC	$43	$34
Service Fulfilment NRC	$83	$66
Engineering & Planning NRC	$77	$62

Table 4. Benchmarks

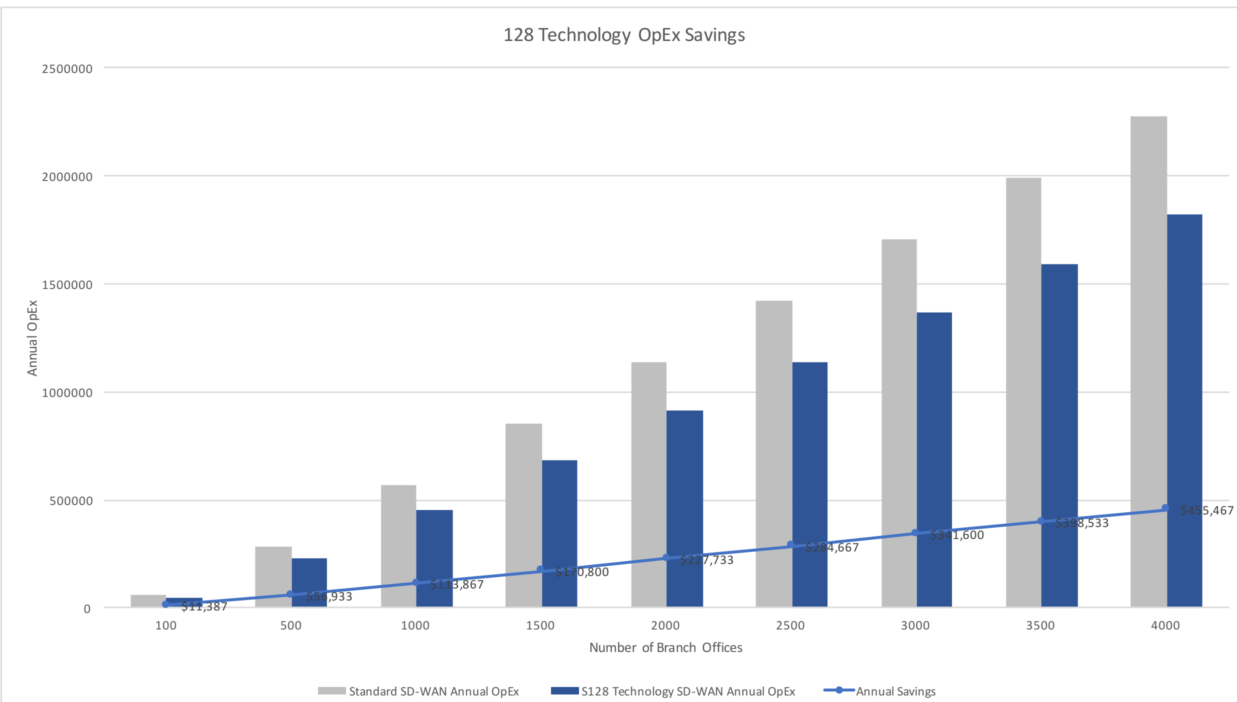

Figure 4. Opex Savings

Network Reliability and Availability

A key requirement for all networks is high reliability and availability. Specifically, users should be concerned with service availability. In networks with IPSEC tunnels a network failure requires a new connection, which can take between 5–10 seconds. This means that voice, video and any real-time sessions will be dropped and need to reconnect. 128 Technology Session Smart routers have subsecond failover capabilities that preserve all real-time sessions. Some of the features that contribute to this capability are:

- Seamless fabric
- Load balancing with enhanced BFD

The average cost of network downtime is $5,600 per minute so service availability has significant economic impact.

Security

The average cost of a data breach is $3.62 million. Many breaches occur in the network, so it is imperative that the network is secure. Some of the problems with IPSEC security are:

- IPsec just secures the network connectivity between two points and lacks any additional controls and intelligence
- Security is applied only at both ends of the tunnel, not in the middle
- Security is only for network connectivity and there is no security at the service level

Session Smart routing uses Zero Trust Security with a deny by default architecture. Connectivity is only provided to endpoints and services specified in the QSN that specifies all global routing and security policies using words based on tenants and services that are easily understood by humans and applications. All IP packets are encrypted using selective encryption to only encrypt those packets that are not encrypted at the application layer. Session Smart also secures services, not just network connectivity. Zero Trust Security provides a robust network security architecture that is easily manageable, reducing the probability of configuration errors that also can lead to security breaches.

Conclusion

This paper examined some of the economic benefits of deploying 128 Technology Session Smart routers in SD-WAN and cloud networks. The key benefits are:

- Reduced software expenses
- Reduced public cloud data transfer expenses
- Increased endpoint scalability and reduced data center router expenses
- Reduced network opex
- Increased network availability and security