Delivering Security Efficiently and at Scale for Tomorrow's Mobile Apps: Total Cost of Ownership in Gi LAN Firewall

Executive Summary

Innovation in applications, devices, and mobile technologies are stimulating dramatic growth in the users and devices and traffic that mobile networks will support in the next five years. Key user groups and applications are expected to increase at compound annual growth rates of 40 percent and higher through 2020. As this occurs, it will not only be necessary for transmission capacities to grow, but also for application delivery infrastructures in Gi LANs to grow and perform well at scale along with them. One key element of the Gi LAN central to the integrity of service as volumes grow is its firewall, which has to scale on multiple dimensions efficiently for services to succeed.

F5 anticipated these developments and incorporated support for cost-effective multi-dimensional scaling into its VIPRION family of carrier-class firewalls, which provide critical services in Gi LANs. F5's approach to achieving the necessary scaling and cost efficiencies concurrently puts it in a unique position to help operators maintain the integrity of their mobile services and aggressively grow the number of users, devices, and applications they are supporting at the same time.

To explore these considerations in detail, F5 asked ACG to analyze the cost and return on investment (RoI) of alternative approaches to performing Gi LAN firewall functions in support of future mobile requirements. ACG compared the total cost of ownership (TCO) and RoI of F5's VIPRION 4800 Carrier Class Firewall to two other prominent suppliers' firewall offerings of similar dimensions in Gi LAN deployments. ACG determined that over five years F5's VIPRION 4800 will incur between 50 and 80 percent lower TCO than alternative firewalls, depending on the size of the operator and, based on savings achieved, delivers an RoI of 118 percent (and higher in larger networks) compared with alternatives.

KEY FINDINGS

- Rapid growth in the number of users, devices and applications being supported by mobile networks is creating a parallel need for Gi LAN firewalls to scale efficiently along a similar trajectory.
- Scaling in firewalls on total number of sessions supported concurrently and on connection setups achievable per second, in addition to scaling on throughput is essential.
- Scaling on these multiple dimensions cost-effectively is needed for service providers to handle the growth they are faced with and doing that at a profit.
- In a Gi LAN modeled on a Tier 1 provider's high traffic volume requirements, F5's VIPRION 4800 firewall incurred up to 80% lower overall TCO than alternative offerings while providing 216% and higher better RoI than alternatives for operators deciding to use the VIPRION platform.

Introduction

Broad-based innovations are continuously driving the mobile network to expand on an end-to-end basis. Advances in endpoint intelligence, capacities of radio technology, diversity in application designs, and power and scale of network infrastructures are in parallel moving constantly forward. Prominent studies point to dramatic growth in subscribers (for example, 20 percent compound annual growth (CAGR) in the number of broadband subscriptions globally by 2020 and 40 percent growth in the number of LTE subscriptions within the same period).[1] In the same time period more than 10 billion intelligent machines will come online in the Internet of Things, and 80 percent of mobile traffic will be generated by smart phones.

These projections create a clear imperative for operators to determine how they will scale many aspects of their infrastructures to meet the demand. From access to transport to core and application delivery, the capabilities of the mobile network infrastructure will increase dramatically. One critical segment of the network is the Gi LAN where mobile operators can tailor services to their subscribers to generate increased revenues.

Scaling the Gi LAN as a Fundamental Component of Scaling Services

It is clear that the logic of how mobile traffic is processed will evolve moving forward, including bringing functions closer to the network edge and creating a more dynamic and elastic infrastructure that is able to leverage the technologies of the cloud to the operator's advantage. Simultaneously, it will be necessary for the capacity of the mobile core to grow as well. It is a crucial supplier of service intelligence to mobile services overall.

A critical factor in increasing the capacity of the core is optimizing performance through visibility and intelligent control applications in the Gi LAN. The challenge is to increase the agility and performance of the Gi LAN at the same time as increasing its efficiency to keep services profitable.

These requirements put a premium on the elements of Gi LAN to be able to meet the scaling demands of the evolving mobile network, enhance their capabilities, and do it in a manner that contributes positively to operators' margins in delivering services.

A crucial element in achieving these objectives is the firewall in the Gi LAN, which provides a pervasive first tier of protection to subscribers, operators, and applications in the connection of network domains. The capacity and efficiency of Gi LAN firewalls must expand as the capacity of the network expands.

This puts the focus directly on evaluating the efficiency and scaling power of alternative offerings for firewall services in the Gi LAN. This is the direct inspiration for the analysis described in this report. The purpose of our analysis is to compare the efficiency and capability of three prominent Gi LAN firewall products in meeting the needs of the future mobile network.

[1] Ericsson Mobility Report, June 2015.

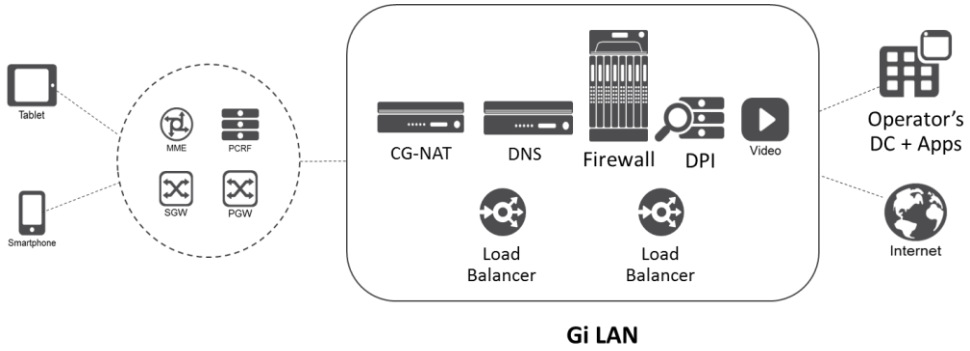

Figure 1. Gi LAN Environment

Scenarios under Analysis

To analyze the total cost of ownership (TCO) and return on investment (RoI) of alternative firewall products in the Gi LAN, ACG Research focused on three scenarios representative of high, medium, and low concurrent subscriber and connection counts and similarly high, medium and low overall traffic volumes in Gi LANs of differing operator sizes, based on experience in dimensioning Gi LANs for a variety of cases. We focused on dimensioning a single Gi LAN site within those operator scenarios, as it is representative of the efficiencies that would be achieved in multiple Gi LAN sites within their broader infrastructures. Tier 1 operators, for example, may have 10, 20, 40 or more Gi LAN deployments within their footprint, depending on geography, implementation model, and organizational structure. The findings we have made in a single Gi LAN case can be generalized in an approximately linear manner across the total number of sites.

The parameters we examined in the operator cases are summarized in Table 1, which describes a high-capacity Tier 1 operator Gi LAN with high density subscriber count and high volume traffic flows. It is illustrative of the kind of traffic profile leading operators will be supporting as the mix of applications users are employing in the coming three to five years increases, and as their frequency of use also rises with the improving penetration and performance of their mobile network platforms.

Variables	Amount (2016)
Total # subscribers or end devices	14,000,000
Average # connections per sub or device	14
Growth rate in connections per sub or device per year	5%
Total # of connections in this network (site)	196,000,000
Number of connections per second at peak time	2,000,000
Average bandwidth per sub or device at peak utilization	13 Kbps
Rate of increase in bandwidth per sub/device per year	10%
Total network (site) traffic	182 Gbps
Percentage of traffic traversing firewall	100%

Table 1. High Volume Gi LAN Deployment

We assume a mix of 3G and 4G subscribers in the beginning of the period in 25 percent and 75 percent penetrations, respectively, and expect the percentage of subscribers in 3G to decrease and in 4G to

increase approaching 2020. We also expect the early stages of 5G penetration to begin in the last two years, 2019–2020. Although the bandwidth use of many subscribers will increase during the period, the increased penetration of machine to machine and the Internet of Things—whose endpoints tend to use lower bandwidths overall—will have a mitigating effect on the amount of bandwidth used on average at peak times by active subscribers. This will have a decidedly accelerating effect on the numbers of concurrent sessions supported by the network over time, because of the scale of their deployment.

In parallel we analyzed a medium and lower end scale deployment to compare the efficiency of different Gi LAN implementations in their cases. The parameters related to each of their deployments are summarized in Tables 2 and 3.

Variables	Amount (2016)
Total # subscribers or end devices	10,000,000
Average # connections per sub or device	10
Growth rate in connections per sub or device per year	5%
Total # of connections in this network (site)	100,000,000
Number of connections per second at peak time	1,500,000
Average bandwidth per sub or device at peak utilization	10 Kbps
Rate of increase in bandwidth per sub/device per year	10%
Total network (site) traffic	100 Gbps
Percentage of traffic traversing firewall	100%

Table 2. Medium Volume Gi LAN Deployment

Variables	Amount (2016)
Total # subscribers or end devices	6,000,000
Average # connections per sub or device	6
Growth rate in connections per sub or device per year	3%
Total # of connections in this network (site)	36,000,000
Number of connections per second at peak time	1,000,000
Average bandwidth per sub or device at peak utilization	7 Kbps
Rate of increase in bandwidth per sub/device per year	10%
Total network (site) traffic	42 Gbps
Percentage of traffic traversing firewall	100%

Table 3. Low Volume Gi LAN Deployment

Firewall Alternatives Analyzed

We compared F5's VIPRION 4800 Carrier Class Firewall with two prominent alternative firewall products often considered for use in mobile operators' Gi LANs. We took each supplier's optimal fit configuration for the requirements defined (see tables of assumptions, Tables 1, 2, 3). We used either 40 GbE or 100 GbE interfaces based on their availability from each supplier (biasing toward 100 GbE when available, for their relative efficiency and throughput). Each vendor's I/O and service/application processing architecture was used to determine the configurations that address the traffic requirements of the case.

We assumed 1:1 chassis-level redundancy as it is the most common approach to ensuring availability of firewall services for the Gi LAN.

Approach to the Analysis

Our analysis calculates the TCO and RoI of using firewall products from three different vendors to support Gi LAN security based on the scenarios described. The purpose is to determine which of the platforms provides the best financial performance in meeting the operators' requirements.

Our TCO calculations include both capital (capex) and operating expenses (opex). Capex are costs of the firewalls and include each one's chassis, common equipment (power supplies, fans, internal fabric, and platform control and management) along with each one's input/output cards, firewall processing cards, and external media such as QSFP+ and CFP transceivers for 40 and 100 Gb/s interfaces. Platform operating system and firewall software costs are included in the capital expenses in accordance with each supplier's practice. We also include the cost of management software and network rollout in the capex calculations.

Opex include costs for ongoing environmental support of the platforms (power, cooling, rack space) as well as costs for personnel to manage the deployments. Ongoing personnel costs include people doing configuration and change management, software version updates, monitoring and control, diagnosis and repair, and collection and analysis of events, anomalies, traffic patterns, policy conformance, and capacity forecasting/planning.

Return on investment in this case focuses on savings an operator would achieve using one platform versus another over five years. This means, from a cash flow perspective, if there is lower cash outflow required for one platform versus another, there is a cumulative cash flow advantage for the less costly platform. By spending less money on the platform with the lower TCO, the operator can realize a positive RoI based on the amount not spent on the costlier alternative. This is a TCO based RoI.[2]

Analysis Based on All Dimensions of Gi LAN Firewall Implementation

We know from studies cited previously that mobile services will experience dramatic growth in numbers of subscribers (for example, 4G subscribers to 3.7 billion, growing 40 percent per year through 2020), types of endpoints (10s of billions of new machines and devices coming online in parallel with smart phones, tablets, and computers approaching 2020), and the diversity of applications being used. In addition, as devices evolve from 3G to 4G and 5G, the latency of the traffic will become lower and lower, from 180 milliseconds in 3G to 20 milliseconds in 4G to sub-millisecond levels in 5G, increasing the importance of high session setup rates for large device populations in the core. With this robust evolution, functionality in the Gi LAN will need to grow along with the volume of traffic being forwarded through its platforms. It will also grow an order of magnitude in the number of concurrent connections the firewalls will need to handle, because of the increased penetration of human and machine users

[2] In some analyses we also consider the increased revenue an operator can earn from using a platform that has greater capacities or functionality that are not present in an alternative platform. We refer to that as a revenue-based RoI analysis, which adds benefits to the operator to consider on top of the TCO based advantages in the TCO based RoI. In this study we have focused on the relative TCO of the alternative products and have thus based the RoI calculations in the analysis on TCO savings.

using the network. And at any one instant, there will be a need to be able to handle a significantly greater number of connection requests per second than has been the case in the past.

Thus achievement on three scaling dimensions concurrently—number of concurrent connections, number of connection requests per second, and total throughput—will determine the effectiveness of a Gi LAN firewall in addressing the needs of mobile operators moving forward. Measuring the cost of deploying a firewall to achieve a specified level of performance on these three dimensions will determine the attractiveness of a firewall in TCO and RoI terms to the operator.

We summarize the results achieved in the high volume Gi LAN deployment we analyzed in Figure 2. In this deployment, the cumulative total cost of operation of F5's VIPRION 4800 over five years, 2016–2020, was $2,902,939; the cumulative TCO of the first alternative we analyzed was $14,170,535; and the cumulative TCO of the second alternative was $7,425,651. This equates to a cumulative cash flow (or RoI) advantage for the F5 approach of 824% versus the first alternative and 216% versus the second alternative in the high volume Gi LAN.

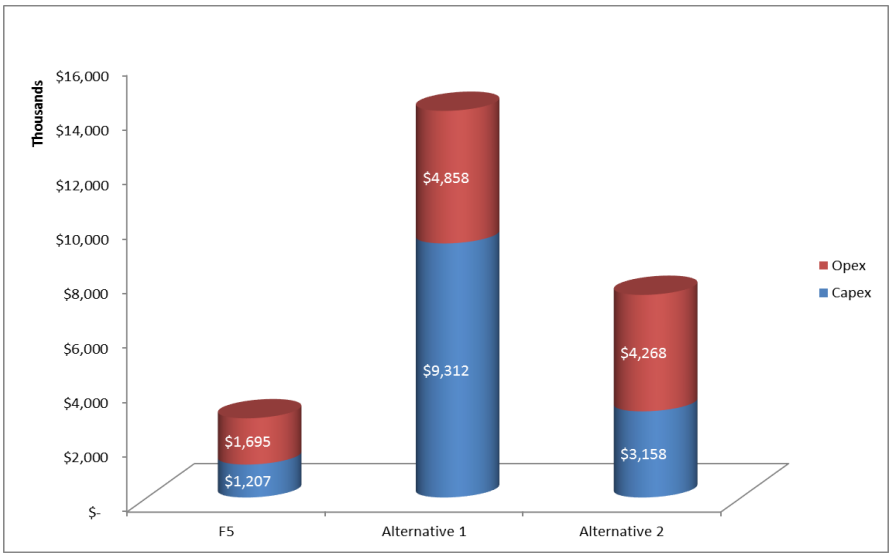

Figure 2. Five-Year TCO for F5 versus Alternatives in High Volume Deployment

In the medium volume Gi LAN, whose results are shown in Figure 3, the cumulative total cost of operation of F5's VIPRION 4800 over five years was $2,107,099; the cumulative TCO of the first alternative we analyzed was $10,747,185; and the cumulative TCO of the second alternative was $4,352,637. This equates to a cumulative cash flow (or RoI) advantage for the F5 approach of 749% versus the first alternative and 118% versus the second alternative in the medium volume Gi LAN.

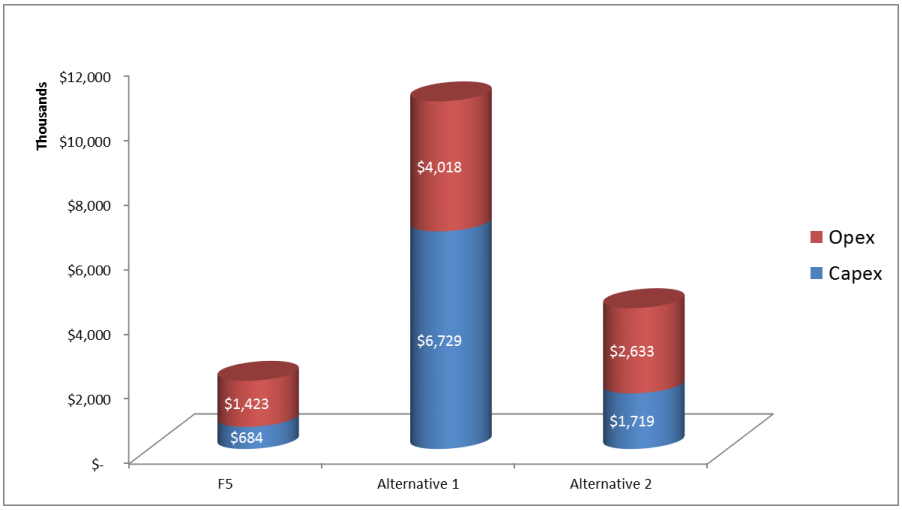

Figure 3. Five-Year TCO for F5 versus Alternatives in Medium Volume Deployment

In the low volume Gi LAN, shown in Figure 4, the cumulative total cost of operation of F5's VIPRION 4800 over five years was $2,047,098; the cumulative TCO of the first alternative we analyzed was $7,629,129; and the cumulative TCO of the second alternative was $2,746,465. This equates to a cumulative cash flow (or RoI) advantage for the F5 approach of 494% versus the first alternative and 33% versus the second alternative in the medium volume Gi LAN.

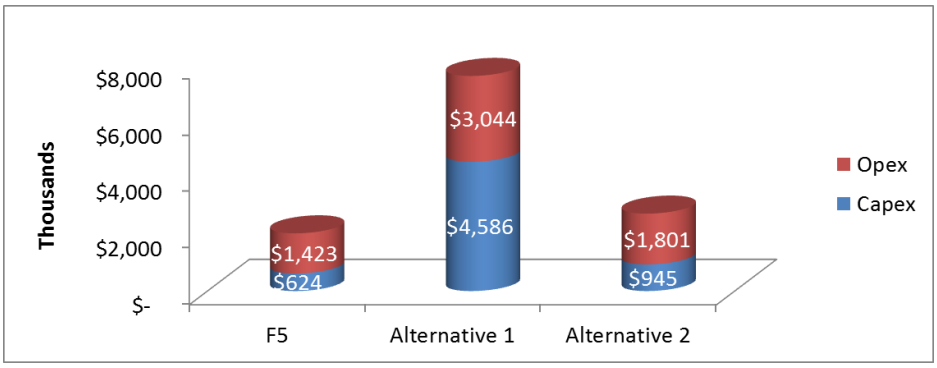

Figure 4. Five-Year TCO for F5 versus Alternatives in Low Volume Deployment

The fundamental reasons for the VIPRION advantage are grounded in its ability to support as many as 1.2 billion concurrent connections, 20 million connections per second, and over 1 tb/s throughput in a single 4800 chassis. Achieving this combination of measurements at its measured TCO (capex and opex) across five years produces its more attractive TCO and RoI compared to the alternatives.

Conclusion

From this analysis, we see that because growth in mobile usage requires scaling on multiple dimensions simultaneously in service-enhancing functions such as the Gi LAN firewall, it is crucial for operators to prioritize on a design that achieves this goal with the most efficient TCO and attractive RoI. F5 has skillfully achieved a balance of capabilities in its firewall implementation that delivers superior performance on each of these important scaling dimensions for the Gi LAN, with a compelling economic return.

As operators expand the capabilities of multiple areas of their networks at the same time as the Gi LAN needs to grow, F5's firewall platform will be in a position to help scale the performance of the core Gi LAN security as the number of users and applications grows.