## Executive Summary

Mobile broadband traffic growth is driving large cost increases but revenue is failing to keep pace. Service providers, consequently, are seeking solutions that allow cost to scale more efficiently with traffic growth and are implementing monetization strategies to limit cost increases while accelerating revenue growth. Improved capabilities to meet security threats and neutralize attacks also are needed to implement monetization strategies.

F5 offers a unified solution that allows service providers to optimize, secure, and monetize their networks for delivery of mobile broadband services. The solution simplifies the network, yielding efficiency, lower cost and secure service delivery and provides greater subscriber and application visibility and control. The F5 unified solution uses a single management interface for all functions, which simplifies network management and operations.

ACG Research analyzed the total cost of ownership (TCO) of the F5 unified solution versus a point products alternative for two use cases: S/Gi network simplification and intelligent traffic steering for value-added service (VAS). For each use case the traffic and functional requirements for a typical S/Gi network node were defined and then configured using the F5 unified solution and alternative point products solution where best-in-class point products were utilized to provide each network function. The capital expense (CapEx) and operations expense (OpEx) for each solution were calculated and compared. ACG found that the F5 unified solution has 25 percent lower TCO than the alternative point products solution. The VAS solution with intelligent traffic steering has 50 percent to 84 percent lower TCO than a VAS solution with no intelligent traffic steering. The TCO savings increase as the share of total traffic used by each VAS decreases.

### KEY FINDINGS

F5 provides a unified solution for delivery of S/Gi services. An S/Gi network simplification use case compared an alternative point products solution to the F5 unified solution. It shows that the F5 solution has:

- 36% lower TCO

- 50% to 84% lower TCO for value-added service delivery by employing intelligent traffic steering

- CapEx is reduced by eliminating replication of i/o ports and chassis common equipment

- OpEx is reduced by eliminating replication of vendors' service contracts and training

- Complexity is reduced through consolidation of functions within a single management interface

# Introduction

The prolific use of smartphones and tablets is driving dramatic increases in mobile broadband traffic. This is propelling total cost of ownership (TCO) to higher levels as well. Revenue has not kept pace with the TCO increases and, thus, the viability of the mobile broadband business model is being threatened today and will become unfeasible as traffic continues its robust growth.

Challenges and requirements that service providers face to profitably deliver mobile broadband include:

- More scalable and high-capacity network to accommodate traffic growth: Scalability implies that large capacity increases are delivered at very low incremental cost. This is essential to bring TCO increases in line with revenue growth rates as traffic continues its expected high growth rates.

- Content and context awareness: Service providers must have real-time awareness of subscriber, application and network context to deliver value-added services (VAS) and implement monetization strategies. This is needed to exploit changing market conditions and respond to competitors' sales initiatives.

- Better network security: Creation of value-added applications and monetization strategies requires that subscribers trust the network to securely and privately deliver services. This necessitates improvements in mobile broadband network security.

### F5's Value Proposition

F5 offers an S/Gi[1] unified solution that enables mobile operators to optimize, secure and monetize their mobile broadband networks. The F5 unified solution also provides greater subscriber and application visibility and control than a solution utilizing multiple point products. It also delivers the scalability and capacity to accommodate the expected increases in future mobile broadband traffic.

The F5 unified solution uses a common hardware and software framework to deliver multiple services. The addition and removal of these services within this framework is as simple as adjusting the software licensing schema. The unified framework means that there is a common technology to understand and manage.

The F5 unified solution provides the performance and scale necessary to unify all S/Gi functions on a single platform. It features high-availability and capability and includes sophisticated health monitoring, fast system failovers, and comprehensive connection mirroring to ensure service uptime and at-peak performance. This enables simpler configuration and management of network resources without any hardware restrictions.

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[1] Gi is the interface between the Internet and the Evolved Packet Core. In 4G networks it is called the SGi interface. This study uses the term, S/Gi, which includes 3G and 4G networks. This paper analyses the functions applied to the packet flows through this interface.

This solution gives service providers the ability to scale performance on demand, virtualize or horizontally cluster multiple systems, creating an elastic infrastructure that can efficiently adapt as business needs change.

*TCO Analysis*

The TCO of two use cases are analyzed to illustrate the significant cost savings delivered by the F5 unified solution. The use cases are:

1. Gi network simplification
2. Intelligent traffic steering and VAS offloading

## Use Case 1: S/Gi Network Simplification

Use Case 1 compares the TCO of the F5 unified solution versus a typical S/Gi-LAN configuration that employs a separate device for each S/Gi-LAN function (alternative point products solution). The functions are:

- Load balancing
- Network firewall
- Carrier Grade Network Address Translation (CGNAT)
- Traffic detection/Intelligent traffic steering

The TCO analysis simulates the build-out of the equipment required to provide each of the four functions over five years given an annual traffic forecast. The required network capacity for the F5 unified solution and the alternative point products solution is determined by sizing each network element to accommodate a processing load measured as throughput (Gbps) and connections[2] per second (CPS). The amount of required network capacity is determined as the maximum of either the throughput or the CPS requirement.

*F5 Unified Solution*

Figure 1 shows the F5 solution, which is hosted by the BIG-IP VIPRION 4800 chassis that employs NEBS[3] compliant blades.
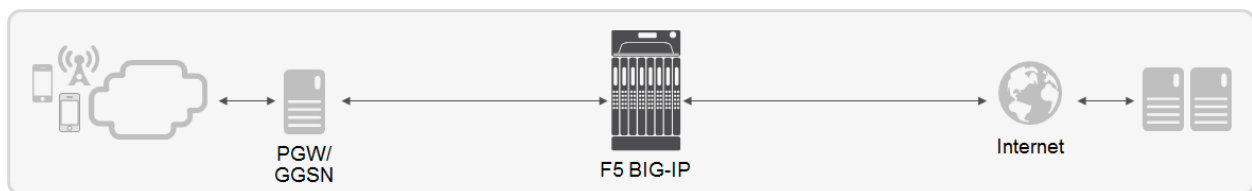


PGW/GGSN    F5 BIG-IP    Internet

**Figure 1 – F5 Unified Solution**

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[2] TCP connection
[3] Network Equipment-Building System, a U.S. standard established by the former Bell telecommunications companies

The F5 software applications that provide comparable functionality are:

- BIG-IP Policy Enforcement Manager, includes intelligent traffic steering
- BIG-IP Advanced Firewall Manager
- BIG-IP Carrier Grade Network Address Translation (CGNAT)

The routers and other IP mobile core network elements shown in the diagram are common to both solutions and, therefore, are excluded from the analysis.

### Alternative Point Products Solution

Figure 2 shows the alternative point products solution where each function is hosted by a separate network element.
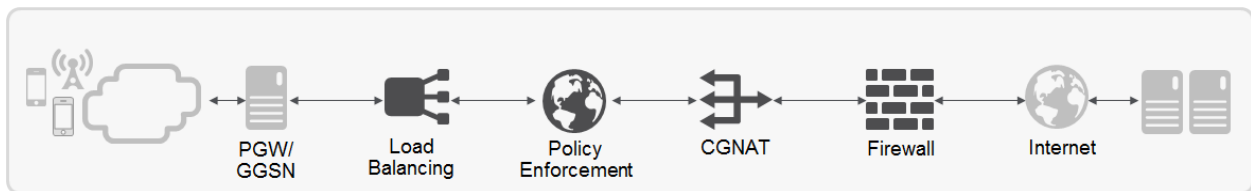


**Figure 2 – Alternative Point Products Solution**

In this solution each function is hosted on a separate appliance. The study incorporates the configuration, performance characteristics and market pricing of each appliance type of a leading vendor.

### Traffic Model

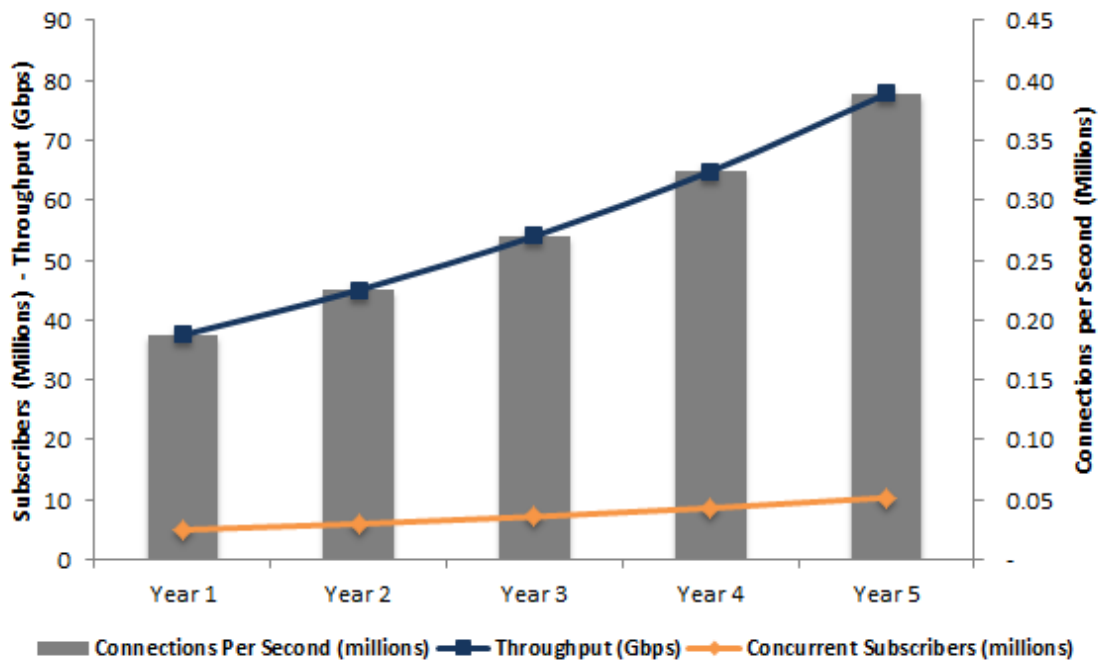Figure 3 shows the traffic projections that are used to model TCO for Use Case 1.



**Figure 3 – Traffic Projections Use Case 1**

The traffic projection is driven by the number of concurrent mobile broadband subscribers for a single IP mobile core node. Throughput grows from nearly 40 Gbps in year one to nearly 80 Gbps by year five. TCP connections per second also grow from nearly 0.2 million to nearly 0.4 million by year five. Throughput and CPS are used to size the network elements employed in each solution.

With these traffic projections as inputs, a TCO model is used to configure and size the network elements used for each solution and to calculate capital expense (CapEx) costs, including chassis, blades, optics, and software, and to calculate operations expense (OpEx).

*TCO Results Use Case 1: S/Gi Network Simplification*
Figure 4 shows the five-year cumulative TCO comparison for the S/Gi network simplification use case.
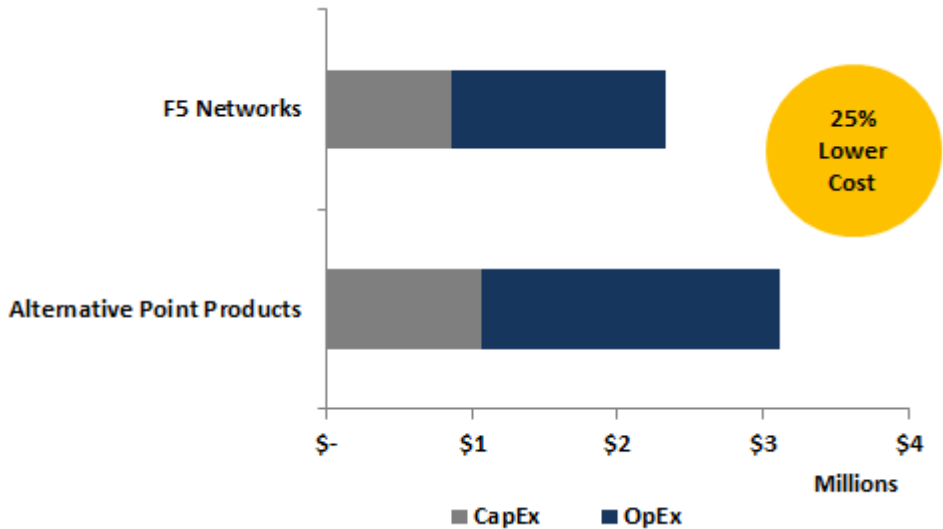


**Figure 4 – TCO Comparison S/Gi Network Simplification Use Case**

The F5 unified solution has 25 percent lower TCO over five years as compared to the alternative point products solution. CapEx is 19 percent lower, and OpEx is 28 percent lower. Unification of all four S/Gi functions in a single solution eliminates replication of i/o ports (back-to-back) and replication of chassis common costs such as power supplies, backplanes, and software operating systems. This is the primary source of the CapEx savings produced by the F5 unified solution.

Vendor service contract expense is a very large portion of total OpEx for this use case. The F5 unified solution has 15 percent lower service contract expense than the alternative point products solution. The use of a single management interface by the F5 unified solution eliminates a great deal of the complexity involved in four different management interfaces for the alternative point products solution. Also, one service contract consolidates much of the administrative and staffing overhead incurred when four separate contracts are required.

Figure 5 provides a comparison of all of the OpEx items (service contracts excluded) for the F5 unified solution and alternative point products solution.
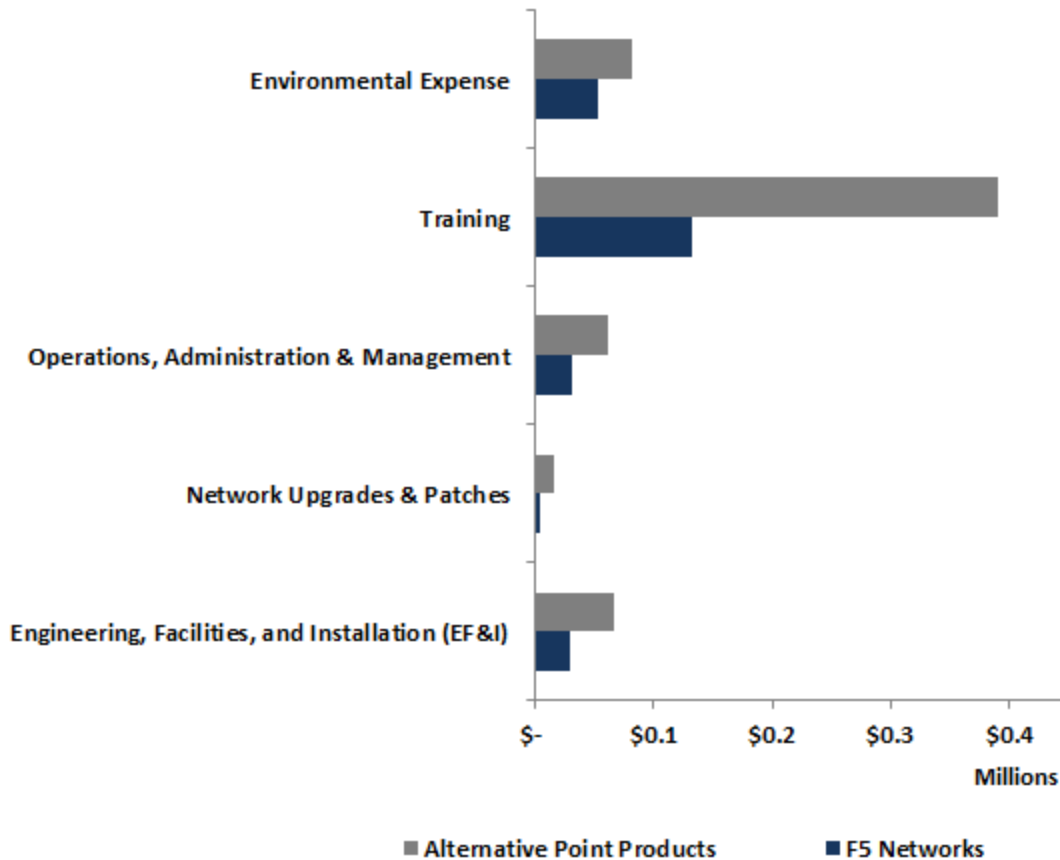
**Figure 5 – OpEx Comparison for S/Gi Simplification Use Case (Service Contracts Excluded)**

Training cost savings are the second largest OpEx category after service contract savings. Training cost savings are 66 percent as compared to the alternative point products solution. The savings are produced by eliminating the common costs found in each service contract and by simplifying training under a single solution versus replicating four different training curriculums as required for the alternative point products solution. The F5 unified solution has cost savings for each of the other OpEx elements because less work is required to operate and maintain a single unified system rather than four point product solutions. Also, environmental expenses are lower because one chassis requires less power, cooling and floor space than four chassis. The F5 unified solution also uses a single management interface that reduces the complexity involved in using four different management interfaces.

## Use Case 2: Intelligent Traffic Steering and Value-Added Service Offloading

This use case analyzes the TCO savings produced by using intelligent traffic steering to offload capacity from VAS offerings. Value-added service is used to reduce network costs and to affect monetization initiatives. Four VAS scenarios are analyzed:

- Video optimization: Video content is formatted to meet the display capabilities of individual mobile devices, thus, conserving network capacity (bandwidth).

- Transparent caching: Frequently used content is provided by a caching service. This reduces the costs of sourcing Internet content and reduces the capacity requirements of the network upstream from the cache.

- URL filtering: A URL filtering service is provided for an additional fee. Such services are used by many enterprises to restrict non work-related activities on their networks and to encourage higher productivity.

- Parental controls: Subscribers are offered as a for fee service that restricts the content that can be accessed by their mobile broadband service.

Because of the large scale of mobile broadband services no more than two VASs are implemented on a single router or traffic steering chassis. Therefore, two examples are presented: video optimization and cache; and URL filtering and parental controls. Traffic through the Gi interface is 100 Gbps in the first year and grows at 35 percent CAGR in each of the four subsequent study years. Table 1 shows the percentage of total traffic that is used by each VAS in all years.

| VAS | Percentage of Traffic |
|---|---|
| Video Optimization | 55% |
| Transparent Caching | 30% |
| URL Filtering | 10% |
| Parental Controls | 12% |

**Table 1 – Percentage of Traffic for VAS**

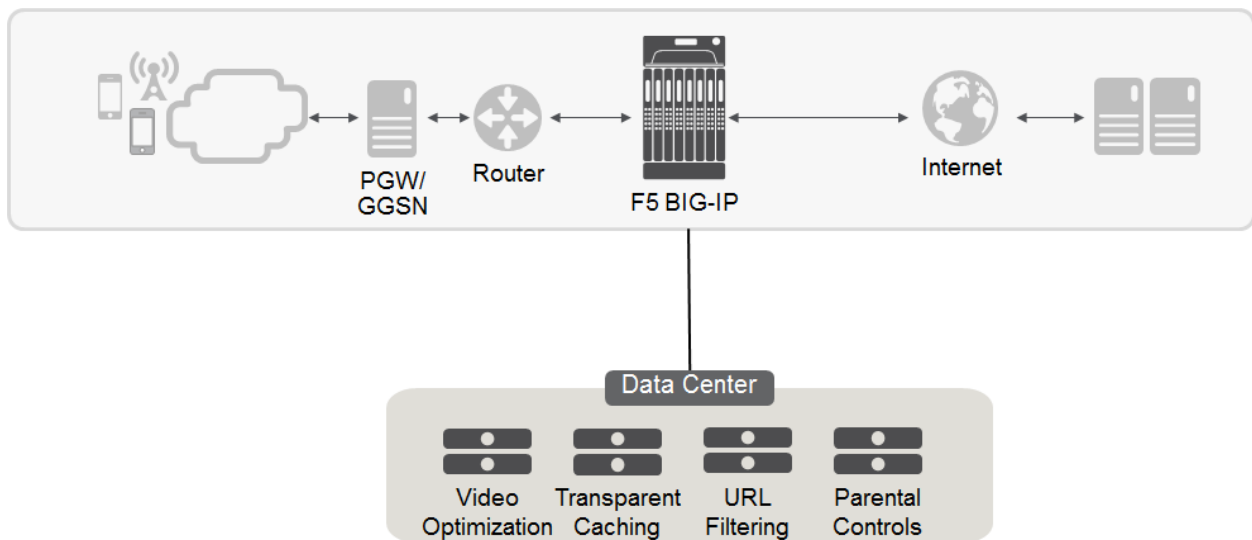*F5 Intelligent Traffic Steering Solution*



Figure 6 shows the network diagram for the F5 intelligent traffic steering solution.
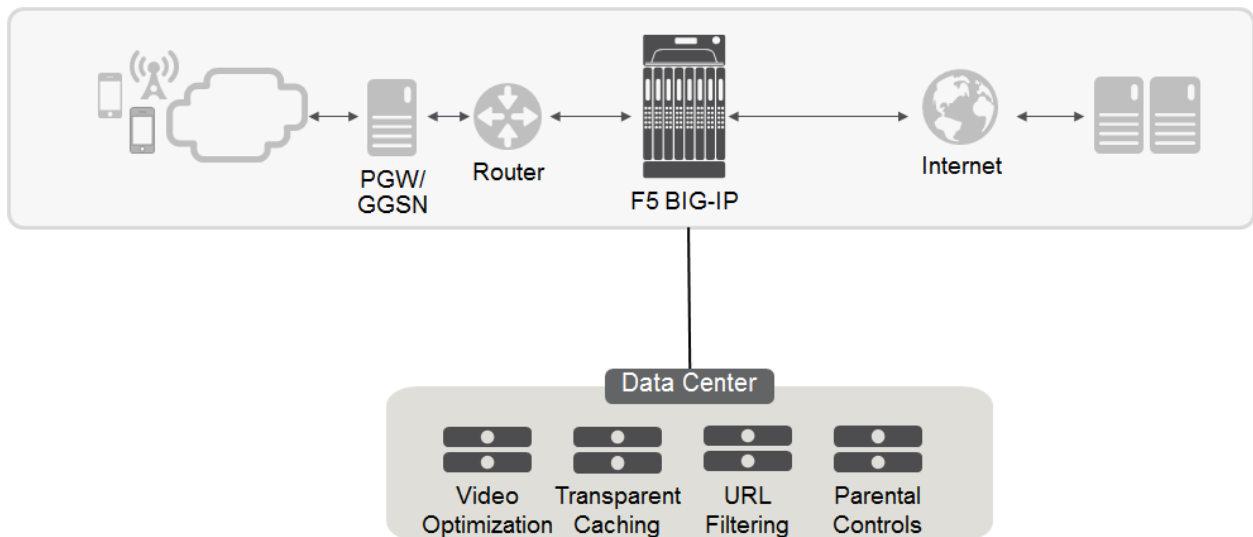
**Figure 6 – F5 Intelligent Traffic Steering for VAS**

The diagram shows that the F5 BIG-IP solution is used to steer traffic into and out of each VAS. It applies its intelligent traffic steering capability to selectively steer only the traffic that requires a particular VAS into each hosting system. For example, in the use case total Port-80 traffic is 100 Gbps in the first year; however, only 55 percent of this traffic requires video optimization. Therefore, only 55 Gbps is steered to the video optimization system. TCO is analyzed for the F5 BIG-IP system and the VAS resources; the other network elements are common to both solutions and excluded from the study.

*Routed VAS Solution*

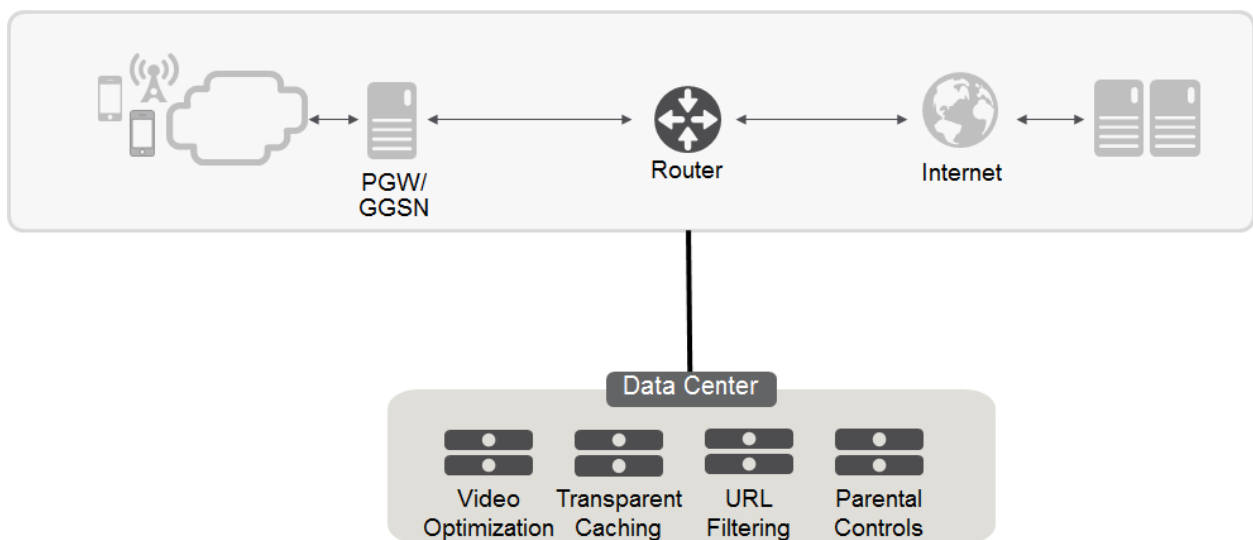Figure 7 shows a VAS solution that uses a router rather than intelligent traffic steering.



**Figure 7 – Routed VAS Solution**

In this solution an L2/L3 router is used to send traffic into and out of each VAS resource. While simple policy- based routing of the S/Gi traffic can be done using the router, 100 percent of the traffic from the router goes to each VAS because no intelligent traffic steering exists for this solution. The F5 intelligent

traffic management solution can steer traffic based upon subscriber classification, traffic classification or a combination of both.

***TCO Results Use Case 2: Intelligent Traffic Steering for VAS***
Table 2 shows the TCO comparisons for the video optimization and cache combination, and Table 3 provides the five-year cumulative TCO comparison for the URL filtering and parental controls combination.

| Item | $ Millions | | Percentage Savings |
| --- | --- | --- | --- |
| | Intelligent Traffic Steering | Router Only | |
| ITS/Router TCO | $6.4 | $5.3 | -20% |
| Video Optimization | $36.5 | $66.4 | 45% |
| Transparent Caching | $10.0 | $33.2 | 70% |
| **Total** | **$52.9** | **$104.9** | **50%** |

**Table 2 – Five-Year TCO Comparison Video Optimization and Cache**

| Item | $ Millions | | Percentage Savings |
| --- | --- | --- | --- |
| | Intelligent Traffic Steering | Router Only | |
| ITS/Router TCO | $4.3 | $5.3 | 18% |
| URL Filtering | $2.5 | $24.9 | 90% |
| Parental Controls | $4.8 | $39.9 | 88% |
| **Total** | **$11.6** | **$70.1** | **84%** |

**Table 3 – Five-Year TCO Comparison URL Filtering and Parental Controls**

The intelligent traffic steering solution produces total savings of 50 percent to 84 percent over five years as compared to the routed solution. The savings is primarily produced by the ability of intelligent traffic steering to selectively steer traffic to each VAS resource as needed thereby reducing the required capacity of each VAS service. The savings produced by intelligent traffic steering varies inversely with the percentage of total traffic actually requiring VAS processing. URL filtering, for example, is needed for only 10 percent of total traffic; video optimization is needed for 55 percent of total traffic. Traffic steering, therefore, produces a greater savings for URL filtering than video optimization does.

## Conclusion

The rapid adoption of mobile broadband and proliferation of media-rich applications is driving high traffic growth. The traffic growth is, in turn, causing costs to rise faster than revenue, because OTT providers are capturing high value-added service revenue, and widespread flat-rate pricing models are retarding revenue growth. Service providers are seeking solutions that allow costs to scale more efficiently with traffic growth and are implementing monetization strategies to limit cost increases while

accelerating revenue growth. Effective monetization strategies also require an increase in subscribers' trust of the network. Improved capabilities to meet security threats and neutralize security attacks are needed to earn that trust.

F5 provides an S/Gi solution that delivers significant cost savings and meets service providers' challenges and needs by:

- Offering solutions that optimize, secure, and monetize mobile broadband networks

- Providing a unified platform that simplifies the network, yielding improved efficiency, lower cost, and secure service delivery

- Providing greater subscriber and application visibility and control

The two use cases compare the TCO of the F5 solution to a point products alternative with comparison against actual industry leading point solutions. The TCO savings are summarized in Table 4.

| Use Case | Percentage TCO Savings |
|---|---|
| Gi Network Simplification | 36% |
| ITS: Video Optimization and Cache | 50% |
| ITS: URL Filtering and Parental Controls | 84% |

**Table 4 – TCO Savings Summary**

The primary sources of these savings are:

- Unification of S/Gi functions in a single hardware solution and uniform software operating environment
  - Eliminates replication of i/o ports and chassis common equipment
  - Reduces management and operational complexity
  - Eliminates multiple vendors' service contracts and training programs

- Traffic steering limits VAS resource requirements

Another advantage of the F5 unified solution is that it is more easily extensible. For example, additional TCO savings can be realized by adding F5 DNS software to the unified S/Gi environment to allow service providers to augment or replace existing DNS infrastructure and provide much higher performance, scalability and consolidated DNS security functions. Additional TCO savings can be realized by:

- Utilizing the F5 high-performing transparent caching combined with its built-in ICSA firewall to protect back-end DNS infrastructure and to reduce traffic to DNS servers by 80 percent or more

- Leveraging the F5 high-performing DNS resolver capabilities to allow for a full consolidation of DNS functions, DNS firewall plus DNS resolver with DNSSEC validation

- Implementing the F5 authoritative DNS capabilities to allow further consolidation by providing high-performing and secure DNS functions for DNS and authoritative DNSSEC

- Adding the F5 intelligent traffic steering functionality to DNS responses that allow service providers to lower OpEx by enabling selective packet core node selection