Software-based application delivery services are critical to maintaining the adaptable and secure application infrastructure demanded by enterprises undergoing digital transformation. F5 accelerates your transition to the cloud and software-defined architectures with virtual application delivery platforms that provide an agile, flexible, and efficient way to deploy advanced application and security services.

Many enterprises have or are planning to deploy applications across multiple cloud environments—both public and private—making it more difficult to implement advanced, consistent and compliant application services for every app in their portfolio. Furthermore, they are expanding beyond traditional monolithic applications and deploying more modern, dynamic application architectures including containers and microservices that have unique requirements.

Standardizing on F5 app services accelerates migration to, and between clouds, while providing consistent and advanced services for both monolithic and modern applications running in those environments—helping you more easily support and manage your growing multi-cloud application portfolio.

F5® BIG-IP® virtual editions (VEs) are the industry’s most scalable virtual application delivery controllers (vADCs)—facilitating high-performance application traffic processing across all leading hypervisors and cloud platforms—easing your transition from hardware to software. VE’s deliver all the same market-leading application delivery services—including advanced traffic management, application security, application acceleration, DNS, network firewalling and secure access management—that run on F5 purpose-built hardware. This similarity enables service configurations and policies from existing F5 appliances to be reused and replicated on VE’s, simplifying cloud migrations. VE’s can easily be provisioned and configured automatically by network operators and developers alike, allowing them to be integrated within existing CI/CD pipelines and ensuring all applications are deployed with the necessary security, compliance and traffic management capabilities. When used in conjunction with F5 BIG-IQ® Centralized Management, you can rapidly create, provision, and manage application services anywhere while gaining visibility into the health and performance of your multi-cloud apps, all from a centralized point of control.
**KEY BENEFITS**

**Increase multi-cloud agility**
Quickly and easily spin up, spin down, or migrate application delivery services across the data center and public cloud, using instant deployment options as needed.

**Accelerate deployments with automation**
Automate app services insertion with F5’s Automation Toolchain. It enables declarative provisioning and configuration of BIG-IP VE across cloud environments and integration with automation and CI/CD tools including Ansible, Jenkins, and Terraform.

**Optimize application and security services**
Implement robust security and traffic management services to keep your apps available, protected and compliant—regardless of deployment location.

**Use modern application architectures**
Native integration with container orchestration environments lets you implement advanced app services that are as dynamic as your containers.

**Support high-performance requirements in the cloud**
Make the transition from hardware to software without the typical performance degradation issues.

**Gain ultimate deployment and consumption flexibility**
Deploy BIG-IP VE across the broadest array of supported hypervisor and cloud platforms with the freedom to consume through perpetual, utility, subscription, or enterprise licensing agreement (ELA).

**AVAILABLE BIG-IP MODULES:**
- BIG-IP Local Traffic Manager (LTM)
- BIG-IP DNS
- BIG-IP Advanced Firewall Manager (AFM)
- BIG-IP Access Policy Manager (APM)
- Advanced WAF
- SSL Orchestrator
- BIG-IP Carrier Grade NAT (CGNAT)
- BIG-IP Policy Enforcement Manager (PEM)

**PRIMARY CLOUD SCENARIOS**
BIG-IP virtual editions (VEs) can be used to deliver a consistent set of advanced application services in the four primary cloud scenarios described below: private cloud/software-defined data center (SDDC), public cloud, multi/hybrid cloud, and colocation with cloud interconnect.

**PRIVATE CLOUD USING SOFTWARE-DEFINED ARCHITECTURES**
Enterprises are migrating to private cloud/SDDCs to achieve agility, application time to market, and to provide control to application owners and developers via a self-service portal or catalog. A private cloud or SDDC using F5 application services is ideal for speeding application deployments, enabling dynamic changes in the data center, and matching infrastructure services to workloads using a per-app model. F5 products and solutions integrate with the leading private cloud technology platforms, including OpenStack, VMware, Cisco, and Microsoft Azure Stack. F5 provides cloud solution templates and supports open source tools like Heat, Ansible, and open-vm-tools to orchestrate and automate the deployment of app delivery and security services.
Flexibility and high performance in a two-tier hybrid architecture

Some enterprises are moving to a two-tier architecture as part of their SDDC transformation. At the edge of the network is the application tier that provides front-door services including L4 traffic management, DDoS firewall, or SSL offload—for all traffic entering the network, based on overall business and security policies. Services that deal with high-volume traffic require the highest performance and scalability, a case where dedicated, purpose-built hardware can be more cost-efficient than commodity servers. The per-app tier manages the application stack inside the data center, which leverages highly scalable, flexible software to deliver advanced application and security services on a per-application basis. This two-tier hybrid data center model (see Figure 1) offers the best of both worlds: hardware where it’s needed and software agility close to the app.

DEPLOY APPLICATIONS IN AND ACROSS PUBLIC CLOUD ENVIRONMENTS

Deploying applications in the leading public clouds gives you the flexibility and scalability you want, without the investment and capital costs associated with building out additional private data centers. Using F5 application and security services delivered by BIG-IP VEs provides the following benefits:

- **Repeatable architectures across cloud environments**—as you expand and adopt new clouds, reuse the same secure, validated, and compliant architecture to accelerate multi-cloud adoption and simplify operations.

- **Reduced tool sprawl and operational complexity**—standardizing on familiar services that are cloud-agnostic makes deploying and maintaining apps across cloud environments quicker and easier.
• **Consistent levels of availability, performance, and security**—provide your customers with an excellent user experience while protecting both your revenue and reputation.

• **Faster time to market**—rapidly provision advanced application services when launching new applications or migrating existing applications to the public cloud.

• **Deep integration with public cloud providers**—dynamically scale out app services through integration with AWS Auto Scaling, or easily apply advanced application security with an out-of-the-box, pre-configured web application firewall (WAF) solution in the Azure Security Center.

• **Flexible licensing models**—consume with a licensing model supportive of your business requirements, whether that’s as a subscription, enterprise licensing agreement (ELA), pay-as-you-go, or on a perpetual-basis.

**APPLICATION PORTABILITY ACROSS HYBRID AND MULTI-CLOUD ENVIRONMENTS**

Despite the many benefits of public cloud deployments, enterprises often avoid moving all applications or data to the public cloud due to perceived loss of control, risk, regulatory compliance, and lack of support for legacy application design. As a result, many elect to operate within a hybrid cloud or hybrid multi-cloud model whereby part of their operations run in the public cloud(s) while components unable to move to the cloud or that require advanced security and compliance monitoring remain on-premises. In some scenarios, applications operate across environments to increase redundancy or to allow greater scale-out capacity when needed. F5 increases the portability of these apps while reducing management overhead by providing a set of standardized application services that can be reused wherever an app is currently running, or wherever it’s redeployed to. In Figure 3, internet-facing front-end applications are deployed in the public cloud while mission-critical workloads with greater security and compliance requirements run on-premises. A direct connection links the two environments to reduce latency.
Many enterprises operate their application portfolio in a hybrid cloud model similar to that shown in Figure 3. But, for some, there may be an associated latency increase caused by large distances between their data center and cloud edge locations. For these organizations, the best option is to deploy on-premises apps within a colocation facility and use direct connections to connect both ends of their hybrid architecture. F5 BIG-IP VE can also be deployed in these colocation facilities and used to provide application service insertion for both apps deployed in the colocation and those running in the public cloud. As a result, consistent app services can be implemented for apps running in different cloud environments.

Figure 4: Consistent application services across public cloud, private cloud, data center, and colocation facilities.
INTEGRATION WITH SDN FRAMEWORKS

Software-defined networking (SDN) achieves agility, flexibility, and cost-efficiency in terms of overcoming the complexity of networking infrastructure in data centers today. SDN seeks to operationalize the network through virtualization and abstraction, similar to what has occurred for servers and storage. However, while SDN has focused on stateless L2–3 connectivity, there remains the need for stateful and flow-aware L4–7 services. Through its Technology Alliance partnerships, F5 is completing the SDN vision by integrating its intelligent app delivery services with leading SDN architectures (VMware NSX, Cisco ACI) via BIG-IP plug-ins and REST APIs. In addition, BIG-IP platforms can serve as SDN gateways, bridging virtualized networks and traditional network architectures to provide a smooth transition and investment protection.

ACHIEVE HARDWARE-COMPARABLE PERFORMANCE WITH SOFTWARE

A significant inhibitor of cloud adoption among large enterprises and especially service providers, is the reduction in performance typically associated with a transition from hardware to software. This means that, for many, the promise of increased deployment agility and scalability the cloud offers may not be worth sacrificing low latency, highly responsive user experiences their data center delivers.

The BIG-IP Virtual Edition is the most scalable, high performing virtual ADC available, capable of supporting 100Gbps NICs within a single instance, meaning you don’t have to choose between agility and high performance—you can have both. Below are a few examples of how BIG-IP Virtual Edition has been augmented to provide even greater performance.

- High Performance VEs—these VE instances aren’t limited by a throughput cap, but are instead licensed by the number of vCPU cores that can be allocated. That lets you optimize the underlying host hardware and achieve 85Gbps+ of L4 throughput.

- SR-IOV and Advanced Network Interface Card (NIC) support—BIG-IP VE’s driver is optimized to interact directly with underlying NIC’s using Single Root I/O Virtualization (SR-IOV), significantly improving throughput performance and reducing latency. SR-IOV can be enabled in AWS using AWS ENA, in Azure with Azure Accelerated Networking, and in private cloud environments with select Intel, Mellanox, Broadcom, and Emulex NIC’s.

- Accelerated cryptographic and compression processing—the BIG-IP VE can offload compute-intensive cryptographic functions and compression using Intel’s Quick Assist Technology, freeing up CPU cycles to focus on other important application tasks.

DYNAMIC APP SERVICES FOR CONTAINER ENVIRONMENTS

Organizations are rapidly adopting containerized environments to develop more agile and portable applications, typically using management and orchestration frameworks to coordinate the provisioning and automation of these workloads. But these apps still need services like SSL offload, routing, and web application protection.
F5 Container Ingress Services (CIS) is a container integration solution that helps developers and system’s teams manage front-door ingress control and advanced application delivery and security services for container and Platform as a Service (PaaS) deployments. CIS integrates BIG-IP VE with native container environments and orchestration systems, including Kubernetes and RedHat OpenShift. That integration enables dynamic Ingress HTTP routing, load balancing, and security for containers as they’re spun up.

**AUTOMATION, ORCHESTRATION, AND PROGRAMMABILITY**

F5 offers many ways to program the application services fabric and network, enabling organizations to react in real time to operational and business events, automate deployment and configuration, and easily integrate into home-grown or third-party orchestration systems.

- **F5 Automation Toolchain** Provides a set of open-source automation tools that make it faster and easier to deploy and configure BIG-IP VE via simple, yet powerful declarative interfaces—all of which can be consumed as part of a complete CI/CD pipeline. It includes:
  - **Declarative onboarding** for L1–3 provisioning
  - **Application services extension 3 (AS3)** for L4–7 configuration
  - **Telemetry streaming** for aggregating, normalizing, and forwarding app stats and events to third-party analytics tools
- **F5 Cloud Solution Templates** Enable automatic deployment and bootstrapping of BIG-IP VEs across all leading public and private cloud environments and across a diverse range of architectural topologies, including HA and autoscaling.
• **F5 Cloud Failover Extension (CFE)** An iControl LX extension that provides L3 failover functionality in cloud environments, effectively replacing Gratuitous ARP (GARP).

• **F5 iRules** Scripting that provides granular traffic control and visibility, enabling customization, rapid response to errors in application code and security vulnerabilities, and support for new protocols.

Visit F5’s GitHub repository for additional information on the F5 Automation Toolchain, Cloud Solution Templates, and other open-source extensions and integrations.

### CENTRALIZED MANAGEMENT OF BIG-IP VE

F5® BIG-IQ® Centralized Management provides a unified point of control for your entire F5 portfolio, ensuring your finger remains on the pulse of devices, modules, and licenses—helping you deliver optimal application availability, performance, and security. It provides a single pane of glass to manage and deploy F5 devices, including key BIG-IP modules like BIG-IP Local Traffic Manager (LTM), BIG-IP Application Security Manager (ASM), BIG-IP Advanced Firewall Manager (AFM), BIG-IP Access Policy Manager (APM), and BIG-IP DNS as well as other F5 solutions including SSL Orchestrator, Secure Web Gateway, DDoS Hybrid Defender, WebSafe, and MobileSafe.

Use BIG-IQ Centralized Management to:

- Automatically back-up images and configurations.
- Monitor dashboards, reporting, and alerting.
- Provide role-based access control (RBAC).
- Obtain detailed analytics on a per-app basis.
- Manage BIG-IP VE licenses.
- Ensure consistent security and traffic management policies across your infrastructure.
- Create, provision, and deploy new BIG-IP VE devices and app services.
- Align to modern development practices and CI/CD workflows through Automation Toolchain.
- Assign and manage machine identities and certificates via Venafi integrations.

BIG-IQ’s VE license management lets you automate large-scale virtual ADC deployments, including per-app VEs, in supported clouds with an F5 subscription or ELA licensing. With BIG-IQ Centralized Management, you can spin up and provision individual VE licenses from a single license pool on demand. When resource requirements decrease, you can spin down the VE and return it to the license pool for future use.
SPECIFICATIONS

Available in a range of performance options, F5 virtual editions can be sized and configured to suit the application services required. Maximum performance is based on applicable VE licensed performance ranges and resources (number of CPU cores/memory) allocated.

Minimum resource requirements: 1vCPU, 2 GB RAM, and 10 GB disk.

THROUGHPUT LICENSED VE

<table>
<thead>
<tr>
<th>PERFORMANCE</th>
<th>STARTING</th>
<th>MAXIMUM*</th>
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<tbody>
<tr>
<td>L7 requests per second</td>
<td>3,000</td>
<td>450,000</td>
</tr>
<tr>
<td>L4 connections per second</td>
<td>2,000</td>
<td>135,000</td>
</tr>
<tr>
<td>L4 throughput</td>
<td>25 Mbps</td>
<td>10 Gbps**</td>
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<tr>
<td>Maximum L4 concurrent connections</td>
<td>1 million</td>
<td>10 million</td>
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<table>
<thead>
<tr>
<th>SSL</th>
<th>STARTING</th>
<th>MAXIMUM*</th>
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</thead>
<tbody>
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<td>SSL RSA TPS (2K keys)</td>
<td>900</td>
<td>3,800</td>
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<tr>
<td>SSL throughput (RSA)</td>
<td>23 Mbps</td>
<td>4 Gbps</td>
</tr>
<tr>
<td>SSL ECC TPS</td>
<td>1,200</td>
<td>20,000***</td>
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<tr>
<td>SSL throughput (ECC)</td>
<td>23 Mbps</td>
<td>5.4 Gbps</td>
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<th>SOFTWARE COMPRESSION</th>
<th>STARTING</th>
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<tr>
<td>Compression throughput</td>
<td>20 Mbps</td>
<td>4 Gbps</td>
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<table>
<thead>
<tr>
<th>DNS</th>
<th>STARTING</th>
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<tr>
<td>Query response per second</td>
<td>1,000</td>
<td>250,000</td>
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<table>
<thead>
<tr>
<th>BIG-IP APM/SWG</th>
<th>STARTING</th>
<th>MAXIMUM*</th>
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<tr>
<td>BIG-IP APM access sessions</td>
<td>5,000</td>
<td>20,000</td>
</tr>
<tr>
<td>BIG-IP APM concurrent users</td>
<td>500</td>
<td>5,000</td>
</tr>
<tr>
<td>Secure web gateway sessions</td>
<td>500</td>
<td>10,000</td>
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</table>

* Maximum performance specs are based on ideal lab testing conditions with maximum supported vCPUs and may vary due to customer or cloud provider environmental conditions, type of hypervisor used, and capacity of host server hardware. Please refer to SOL14810 on askF5.com for specific license and performance details that may impact your performance.

** 10 Gbps throughput requires use of NICs that support SR-IOV.

*** Based on ECDHE_ECDSA_AES256_GCM_SHA384 cipher string, running BIG-IP TMOS v12.1.

Figure 6: BIG-IP performance with Dell PowerEdge R620 with Intel Xeon CPU E5-2670 0 @ 2.6GHz and Intel 82599EB 10-Gigabit SFP+ NIC—configured for PCI pass-through with support for SR-IOV.
Figure 7: BIG-IP LTM VE performance on SuperMicro 2U server with dual Intel® Xeon® Scalable Processors @ 28cores (2.7GHz) and Intel XL710 40G NIC—configured for SR-IOV using VMware ESXi 6.5 hypervisor. High performance VE licensed for 24 vCPUs, running BIG-IP TMOS v15.x and later required.

### HIGH PERFORMANCE VE

<table>
<thead>
<tr>
<th><strong>PERFORMANCE</strong></th>
<th><strong>MAXIMUM</strong>*</th>
</tr>
</thead>
<tbody>
<tr>
<td>L7 requests per second</td>
<td>4.6 million</td>
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<tr>
<td>L4 connections per second</td>
<td>1.4 million</td>
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<tr>
<td>L4 throughput</td>
<td>85 Gbps**</td>
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**SSL**

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<tr>
<th><strong>SSL</strong></th>
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<tr>
<td>SSL RSA TPS (2K keys)</td>
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<td>SSL throughput (RSA)</td>
<td>32 Gbps</td>
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<tr>
<td>SSL ECC TPS</td>
<td>100K</td>
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<td>SSL Throughput (ECC)</td>
<td>37 Gbps</td>
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**SSL WITH INTEL QAT**

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<th><strong>SSL WITH INTEL QAT</strong></th>
<th><strong>MAXIMUM</strong>*</th>
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</thead>
<tbody>
<tr>
<td>SSL RSA TPS (2K keys)</td>
<td>95K</td>
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<td>SSL throughput (RSA)</td>
<td>60 Gbps</td>
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<tr>
<td>SSL ECC TPS</td>
<td>59K</td>
</tr>
<tr>
<td>SSL Throughput (ECC)</td>
<td>46 Gbps</td>
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</tbody>
</table>

BIG-IP DNS—Query responses per second | 1.8 million |
BIG-IP APM—Access Sessions | 40,000 |
BIG-IP APM concurrent users | 10,000 |

**SUPPORTED HYPERVERSORS AND LINUX DISTRIBUTIONS**

F5 offers the most flexible deployment options in the industry, with support across all major virtualization platforms.

<table>
<thead>
<tr>
<th><strong>LAB</strong></th>
<th><strong>25 MBPS</strong></th>
<th><strong>200 MBPS</strong></th>
<th><strong>1 GBPS</strong></th>
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<td>Microsoft Hyper-V</td>
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* Maximum performance specs are based on ideal lab testing conditions, optimized host and guest settings, maximum supported vCPUs, SR-IOV capable NICs, and may vary due to customer or cloud provider environmental conditions, type of hypervisor used, and capacity of host server hardware and NICs. Please refer to SOL14810 on askF5.com for specific license and performance details that may impact your performance.

** 85 Gbps throughput achieved using Mellanox CX-5 100G NIC configured for SR-IOV using KVM CentOS 7.5.
### SUPPORTED PUBLIC CLOUD IaaS PROVIDERS

F5 offers support for leading public cloud providers including Amazon Web Services, Microsoft Azure, Google Cloud Platform, and IBM Cloud.

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* 10Gbps & HPVE throughput limit applies to non-Internet facing IP traffic only—due to cloud platform ingress throughput limitations.

** Includes VMware on AWS.

*** Achievable using AWS ENA NIC with Gen5 EC2 instances (multi-NIC interfaces and v141.x and higher)

**** Achievable using Azure Accelerated Networking (multi-NIC interfaces and v15.0 and higher)

† BYOL only

†† Utility (PAYG) billing only

Please refer to this support matrix on askf5.com to learn more about support for BIG-IP VE in the cloud. You can also leverage the **BIG-IP Image Generator Tool** to create custom VE images for specific TMOS releases or hot-fixes that may not be available in cloud marketplaces.
F5 BIG-IP VIRTUAL EDITIONS: SIMPLIFIED LICENSING AND CHOICES

F5 virtual editions are available for all BIG-IP modules and can be purchased based on throughput tier from the 10M non-production lab license to the 25 Mbps, 200 Mbps, 1 Gbps, 3 Gbps, 5 Gbps, and 10 Gbps production licenses. As performance requirements increase, F5 offers pay-as-you-grow upgrade licenses. In addition, F5 offers High-Performance VE licenses with no throughput limits and allows you to increase the number of vCPUs to increase performance—up to a maximum of 24 vCPUs.

BIG-IP Virtual Editions are available in a range of licensing models to suit your individual business and budgeting requirements, including:

- **Perpetual (Bring-your-own-license)**—One-time CapEx purchase, supporting 3 major software releases.
- **Subscription**—1- to a 3-year subscription with unlimited version upgrades and premium support included.
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Using BIG-IP Per-App Virtual Editions (VEs) in tandem with BIG-IQ Centralized Management provides app owners, SecOps, and NetOps teams with industry-leading F5 services including traffic management, advanced WAF, role-based control, health monitoring, actionable analytics, and autoscaling. These services are dedicated to individual apps, which means more agility, lower TCO, shorter maintenance windows, and reduced ticket times. It’s the first solution that aligns the priorities of app owners, NetOps, and SecOps.
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DEVCENTRAL

The F5 DevCentral user community of more than 200,000 members is your source for additional technical documentation, discussion forums, blogs, media, and more related to BIG-IP virtual editions, application services in virtualized data centers, and cloud deployments.
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