

Application

Delivery Challenge

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THE CHALLENGE SERIES

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The Critical Role of an ADC in the Data Center and the Internet

By Robin Layland
President
Layland Consulting



The data center is the heart of the corporation's information infrastructure. A well-functioning data center is critical to keeping users, customers, and management happy. Selecting the right solutions for the data center is one of the most important tasks facing network managers. The Application Delivery Controller (ADC) is at the center of any data center architecture and having the right ADC is critical to keeping everyone happy.

The ADC plays a key role in directing traffic, defending and securing the data center, and accelerating applications, while controlling the ever escalating cost of the data center. How do you know which ADC is right? What are the key functions and requirements for an ADC?

The Application Delivery Challenge will help you answer these questions and better understand which vendors can assist in building a high-performance data center. I have asked two of the leading ADC vendors, Foudry Networks and Citrix, to present their own views on the right ADC for an enterprise data center. I have also asked Akamai to explain how ADC technology and functions complete the picture outside the data center and in the Internet cloud. These views will help you understand how to build a world-class network with an ADC at the center.

What is an ADC?

ADCs have been around since 2004, and they are the evolutionary step up from Server Load Balancers (SLB) of the late nineties. Gartner uses the term "Advanced ADC" to allow vendors that just provide the older SLB function to use the ADC name. Let's be clear, what I call an ADC and they call an Advanced ADC are the same thing, and given the small cost difference but big functional difference between them, every network manager should focus on the real ADC - the advanced ADCs. Consequently, all references to an "ADC" in this challenge refer to "Advanced ADCs." ADCs can make your data center and network work better; SLBs belong in the past.

What makes an ADC an ADC? What are its key functions? The truth is that many of the features in an ADC are provided by all the ADC vendors. When shopping for an ADC, you should concentrate on their differences.

The Differences

ADCs retain all the functions of the older SLB. They have the ability to load balance Web servers, but an ADC does not stop at just load balancing servers running Web applications. The list of non-Web applications they can support is long. An ADC can handle the range of Microsoft applications including Exchange, Outlook, OCS and SharePoint. ADCs also support many Oracle applications, including those from BEA, and SAP applications. They also can load balance applications such as RADIS, DNS, firewalls, and FTP.

Many ADCs have gone the extra step and have had their implementation certified by the individual application vendors. Certification provides extra assurance that they have worked with the application vendors and fully understand the ins and outs of the application. The range of applications an ADC can handle varies from vendor to vendor and you should check with each vendor to make sure they can handle all the applications on your list. For example, not every ADC can load balance SIP.

One area where ADCs currently vary is how they support server virtualization. All the vendors can provide the full range of functions to any virtual server and the application running on it, but this is not the issue. The primary

virtualization issue is how they know when a new copy of an application has been spun up on a new virtual server. The ideal answer is that the ADC automatically recognizes it and adds it to its list. This most commonly is done by having an interface into the virtualization manager, and when the virtual server starts up a new copy, the ADC automatically learns about it from the interface. The problem is that not every vendor does this, and, instead, some require manual intervention. You need to ask each vendor both what they can currently do and what their plans are. You also need to ask how they handle all common the virtualization solutions – VMWare, Hyperware or Xen. There is no one general answer, as the ADC vendors must build a solution for each virtualization solution.

Two other issues are also lumped under the “virtualization” banner. The first is whether the ADC has the ability to direct the server virtualization software to bring up additional copies of an application or to take them down, depending on the load. This allows the ADC to become the manager of the servers. While the idea is sound, care should be taken to insure that coordination is worked out with the application/server group before the ADC becomes the overall manager.

The second virtualization issue is role-based management. ADCs support many different applications, and, with the customization available, they can perform useful application-specific functions. This can range from using deep packet inspection, to deciding where to send the message, to redacting credit card numbers. The code or script to perform this function can be written and maintained by the application group and then run in the ADC. Additionally, you may want to give each application group the ability to look inside the ADC to see what is happening with their application, while not giving the different groups the ability to make changes that affect other applications or what is happening with these applications. Role-based management, or virtualization of management, allows you to define what each group can and cannot do. This is a very useful feature that allows network managers to keep different groups happy without giving them too much control.

The next area where there are differences between ADC vendors is the type of security they provide for servers and applications. They all provide DoS and DDoS support, but they can vary on the degree of attacks they can handle. The main security difference between ADC vendors is the amount of application security they provide. Many of the vendors provide Web firewalls, but you should take the time to understand the particulars of what they protect and how they do it. Some vendors also provide Data Loss Prevention (DLP) support that can stop sensitive data such as credit card numbers from leaving the data center. If application security features are important, and they should be, then check to understand exactly what the ADC vendors provide. The good news is that the vendors in the challenge are at the upper end of providing application security.

Application acceleration for Web applications is another important feature. All the vendors provide some degree of application acceleration such as object caching and GZIP compression. The differences include the type of objects they cache, whether they can they handle dynamic objects, whether the objects are stored in memory or on a disk, and how much storage they have available. It is important to remember that the ultimate test of whether one vendor’s solution is better than another vendor’s is the difference in end-user response time. This evaluation is difficult because it varies from enterprise to enterprise depending on the application mix. The best way to judge acceleration is by doing your own testing and/or looking at the vendors tests.

Key Features of an ADC

- Server Load Balancing**
 - Application supported
 - Application certified
 - Support for server virtualization
 - Role based management
- Server availability**
 - Monitoring server and application health
 - Monitoring application response time
 - Reporting and action
- Application Acceleration**
 - Web object caching
 - Compression
 - HTML protocol optimization
- Server Off-load**
 - SSL processing
 - Connection pool / multiplexing
 - TCP off-load
- Security**
 - DoS and DDoS
 - Web and application firewall
 - Data Loss Prevention
- Engineered for high Performance**
 - Engineered for high availability

ADCs provide server off-load features to save server resources and reduce the cost of the data center. This includes SSL off-load, connection pooling/multiplexing, and TCP processing. The main point is to make sure the vendors you are considering have these features. If they have these features, then there will be little difference in their effect. The key difference is the load each ADC can handle.

All the major ADC vendors, including the vendors in this challenge, support monitoring and alerting if a server or application is slow or not responding. This is an old SLB feature and there is minimal difference between the vendors.

One important area where the vendors differ is how the ADC is engineered. This is primarily seen in how they provide a high-availability solution, the level of throughput, and the form factor.

Whose ADC should you choose? The first step in choosing an ADC should be to determine which applications are important and then make sure they are well-handled by the vendor. Next, determine which acceleration and security functions are important and check whether the vendor has them. Then understand the role of virtualization in your environment and ask the vendors how they plan to support it. Lastly, make sure the design and performance of the ADC meets your requirements both now and in the future. You do not want to get locked in to a solution that doesn't grow with your business.

I encourage you to give serious consideration to the two leading ADC vendors in the challenge. I have talked with their customers, and while both provide excellent solutions, their solutions do differ. I encourage you to take the time and talk with these two vendors as that will give you a good understanding of what is available and help educate you on what is possible.

What about the Internet?

ADCs in the data center are important tools to ensure application performance. As long as the users are within the corporate network, you can control the overall environment to ensure that nothing goes wrong.

The problem comes when your employees, suppliers, partners or customer are reaching you over the Internet. The Internet can introduce uncontrollable problems for application response time and security. Solving the Internet problem can lead to happy customers, suppliers, partners and remote employees. Fortunately there is a way to address the problem by placing the same functions and solutions found on ADCs in the Internet.

What if you could place an ADC at the edge of the internet? An ADC at the Internet edge with its ability to cache objects, pre-fetch data, and mitigate inefficient application protocols would significantly improve user response time. It would also overcome Internet performance problems that don't occur over corporate WAN, such as packet loss and possibly high error rates. An ADC in the Internet also has the advantage of addressing attacks, such as DoS, before they hit your network. The question is how to put ADCs close to your users and customers when they are using the Internet.

That is why I was interested in getting Akamai to participate in the challenge to showcase their service, ADC-like capability within the Internet. By placing ADC functions at strategic locations throughout the global Internet, they have addressed many of the problems caused by using the Internet. Their solution should be viewed as a complement to whichever ADC solution you choose, and I think you will find they have an interesting story.

Conclusion

ADCs are a critical part of any data center and network design. I encourage you to contact the vendors in the Challenge – Foundry, Citrix and Akamai – and learn how they can help you build a better network.

If you have any comments about this Challenge you can contact Robin Layland at Robin@Layland.com.

Foundry ServerIron Application Delivery Controller



By Gary Hemminger
 Director, L 4-7 Product Marketing
 Foundry Networks



Industry Leading Application Delivery and Traffic Management

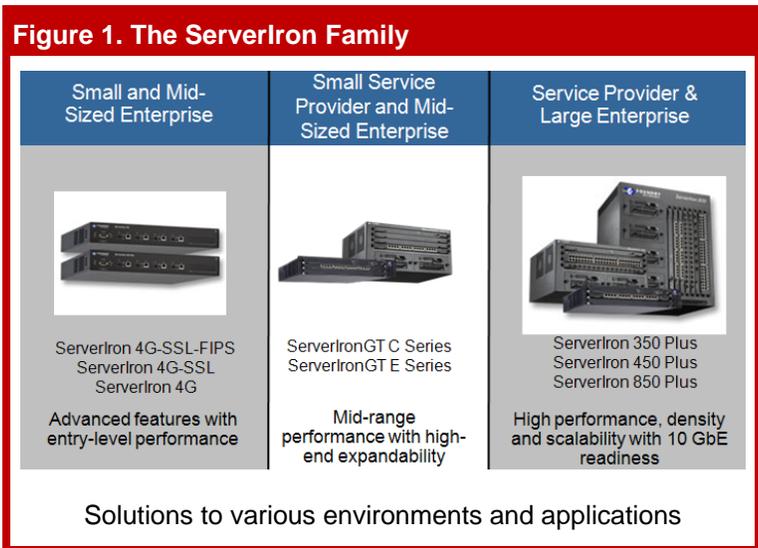
Foundry Networks'® ServerIron® product family has been delivering application traffic management and security solutions for enterprises, service providers, and telecommunications vendors for more than a decade. We first pioneered the load balancer market in the late 90's, and we have continued to build the industry's most scalable, flexible, high-performance application delivery controller (ADC) product family on the market today. Our virtualized, multi-core processing architecture has been proven at more than 4,000 customers in large, medium, and small enterprises and service providers worldwide. The key to our continued success has been both the architecture of our products, the feature sets we provide, our high-speed denial-of-service (DoS) protection, and our L4-7 and ADC expertise and field support. Foundry has a staff of highly skilled field systems engineers that work directly with our customers, regardless if they are direct or through our channel, to ensure the success of our products deployments in a range of applications. This is important in helping customers successfully deploy and operate ADC solutions, which can be quite involved .

This paper will focus on our virtualized, multiprocessing architecture, the features of our advanced platform ADC, including our hardware-based DoS protections capabilities, and our service and support features.

ServerIron Virtual ADC Architecture

The ServerIron product family is built on a high-speed L2/3 platform with a service blade architecture that allows application switching modules and SSL service blades to perform virtualized application switching, security, and management functions in a highly reliable, scalable fixed and chassis-based set of solutions. The architecture has a number of hardware based optimization components that provide high-speed DoS attack protection, multi-core/multi-processing virtualized application switching, SSL acceleration, and deep packet inspection capabilities.

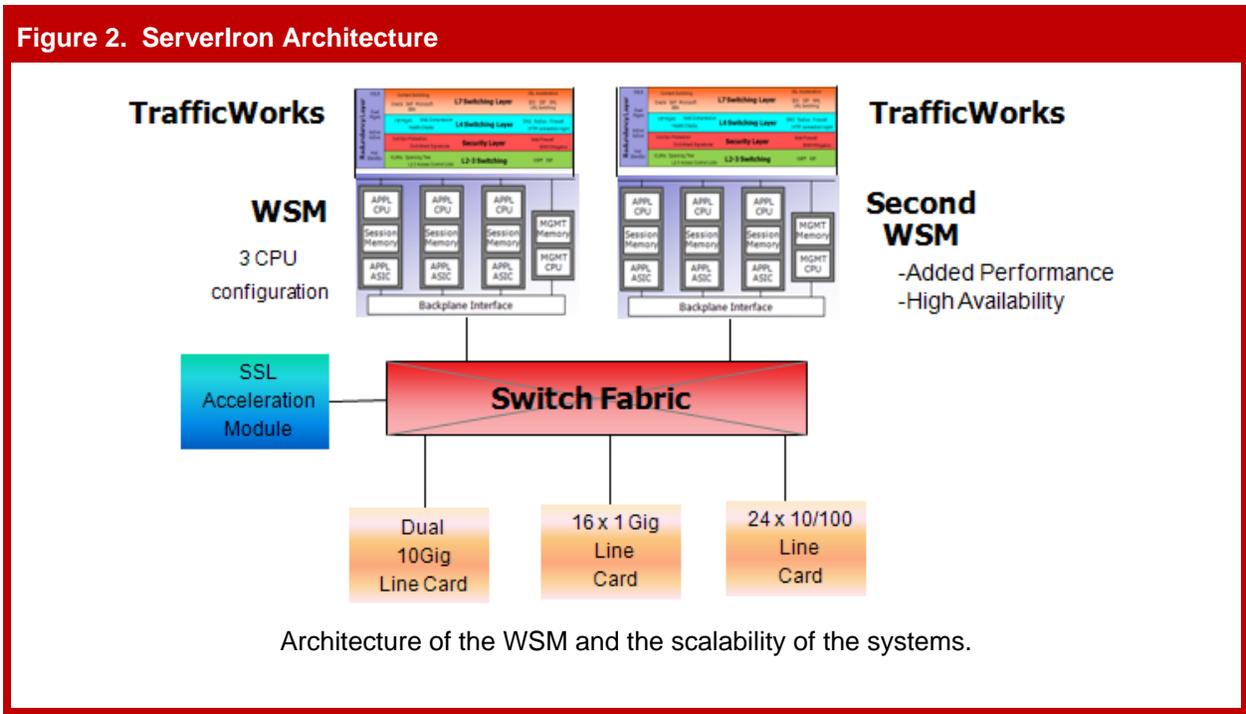
These capabilities are packaged in a family of purpose-built, entry point fixed configuration, as well as mid-range and high-end chassis products to give customers the maximum flexibility in choosing a solution that provides the most cost-effective, scalable solution for their environment and applications.



All of the products run the same award-winning ADC software that provides a vast array of application delivery features. In the chassis products, a multitude of line cards, application switching modules (known as WSM's), and

service modules can be mixed and matched to provide a range of different configuration options. The mid-range GTC and GTE products provide excellent price-performance and are available in a 2U, 3-slot chassis (GTC) and a 5U 4-slot chassis (GTE) configuration. Our high-end ServerIron 350, 450, and 850 products provide the industry's most scalable, high-performance, high-density ADC solutions in a 2U, 5U, and 8U configuration.

Foundry's products provide an array of interface options, including line cards that support multiple 10 Gigabit interfaces as well as multi-gig copper/fiber and 10/100 interface line card options. These line cards can be co-mingled with two different models of our application switching modules (WSMs); the WSM6 and WSM7.



Note that each WSM provides up to three processing cores, and that a second WSM can be added to the system to double L4-7 throughput, connection & transaction processing rates, and DoS security performance. The WSM's can be combined with a variety of different line card types to provide the most flexible and scalable interface and L4-7 ADC processing on the market. SSL acceleration service modules are available to provide high-speed SSL offload processing services as well. This capability offloads SSL from the server, which can then focus on pure application processing rather than SSL encryption/decryption. The ServerIron WSM also comes with an optional SSL acceleration capability integrated onto the same module, so that a module slot is saved in the chassis. Each processor on the WSM has its own memory and application ASIC. The application ASIC performs DoS security and other L4 functions to assist the processors in delivering the highest speed L4-7 and security processing.

The ServerIron product family has no disks, so the Mean Time between Failures (MTBF) is extremely high for the system, in contrast to appliance based systems which are more vulnerable to system failures. In addition, each WSM also has a dedicated management processor, and with two WSM's in a chassis this provides redundant management in a single chassis.

The ServerIron 4G is the most cost-effective, high-performance fixed configuration ADC in the market. The 4G supports all of the features of the chassis products, and can also be ordered with SSL or FIPS 140 level 2 support. The 4G comes standard with 4 Gig copper/fiber combo interfaces.

ServerIron Application Delivery Features

On top of ServerIron's highly reliable, scalable, and flexible platform, Foundry delivers the award-winning TrafficWorks application delivery software that provides one of the industry's most complete set of advanced platform ADC features. TrafficWorks provides a range of capabilities including:

- Content switching & rewrite for advanced Layer 7 support
- Multiple high-availability modes (Hot-Standby, Active-Active), VRRP, VRRP-E)
- GUI and standard-based Command Line Interface (CLI) support
- Web application firewall application support
- Global Server Load Balancing (GSLB)
- Server TCP multiplexing support to reduce server TCP connection processing
- Hardware-based DoS, DDoS, and packet filtering security protection
- A variety of SSL acceleration options including FIPS 140 level 2 support
- L2/3 high-speed switching and dynamic routing support (for both IPv4 and IPv6)
- Firewall, IDS, and Cache load balancing

All of these features are available on both our fixed configuration and chassis products without the complex licensing that other vendors require. The ServerIron family also supports the industry's most important Enterprise and Service Provider applications. This includes enterprise support for a number of Microsoft, Oracle, and SAP applications. Foundry's products have been certified with applications across each of these vendors products lines, and we have small, medium, and large customers that rely on Foundry ADC products to deliver optimized & secure application delivery solutions for their daily enterprise application operations.

Foundry can also support a number of SP applications, including high-speed secure mail and DNS service, Blackboard, software-as-a-service applications, Web 2.0, peer-to-peer applications, IPTV, and SIP telephony solutions.

Foundry ADC Expertise

Foundry provides both field and headquarters-based personnel that have years of application delivery and L4-7 experience to help our customers design, deploy, and operate their application infrastructure. Our products are architected for reliability, scalability, with advanced platform ADC features, but it is our applications switching and security knowledge that is the key to our success in the market over the past decade. We have a decade of experience working with customers to build optimized and secure application delivery solutions for both enterprise and services providers.

Foundry will continue to build next-generation platforms and services using our virtualized multi-core architecture. These will address the requirements for application reliability, scalability, optimization, and security for the next decade of application delivery.

For more information about the Foundry ServerIron solutions described here, please visit: <http://www.foundrynet.com/solutions/sol-app-switch/> or call Foundry at 888.TURBOLAN (888.887.2652).



Transforming the Data Center into a Dynamic Delivery Center

By John Gudmundson
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Application delivery is becoming increasingly important to modern business operations. Internet-centric and enterprise operations alike are turning to advanced, processing intensive and asynchronous Web 2.0-based models. Such models are highly interactive, content-rich, and provide community enriched web pages that require accelerated delivery, advanced traffic management and application level security.

To compete and succeed, organizations need a comprehensive and highly scalable application delivery solution with complete functional integration and advanced Web acceleration techniques to overcome the latency of global communication links. They need a Web application firewall with an integrated compliance reporting tool to meet Payment Card Industry (PCI) security mandates. They need automated server provisioning, simplified installation, and performance monitoring methods to ensure proper user service levels. With networks moving to 10 gigabit throughput levels, they must exceed these throughputs at wire-speed and support concurrent use of all functions.

Citrix® NetScaler® is unique in the application delivery market as it is the only solution that provides all these capabilities and many more to application delivery. NetScaler built-for-purpose appliances combine full application awareness with an integral knowledge of the underlying network. Over 7000 deployments have utilized NetScaler to accelerate traffic flows, secure communication sessions and data center infrastructures, reduce capital and operational expenses, and ensure server availability.

Standardized Internet Acceleration Methods

Citrix NetScaler incorporates proven networking and application techniques to accelerate application performance up to five times; network optimization, compression and caching are just some of these methods.

NetScaler provides client-side protocol optimizations that improve application performance to offset TCP/IP limits.

- *TCP Windows Scaling* enables the TCP window size to be set at greater than 65KB
- *Selective Acknowledgement and retransmit* more intelligently manages ACKs and retransmits of dropped packets, reducing congestion on the wire
- *TCP Fast Ramp* overcomes TCP's standard slow-start algorithm by initially setting the transmission rate equal to what the client can receive, leading to more efficient use of bandwidth and faster response times
- *Client Keep Alive* intelligently determines when a client connection can be kept open and when it must be closed. Maintaining client connections reduces network congestion and improves application response time, especially across high latency network connections.

NetScaler further accelerates data delivery through compression. When data is compressed, traffic is reduced, packet loss drops and the number of data acknowledgements is minimized. Data transfer efficiency and application performance are improved. NetScaler offloads this processing-intensive task at up to six gigabits per second. Utilizing browser supported GZIP algorithms, NetScaler compresses data by three to five times, thereby also reducing bandwidth needs.

NetScaler further reduces user response times through content caching. In-memory caching provides an immediate response that further improves the user experience. NetScaler does not just cache static content; it caches *dynamic* content as well, as select content is considered static "*long enough*" to be cached. Yet, proprietary NetScaler techniques ensure fresh content and cache coherency.

Application Security and Data Leakage Protection

Hackers are moving beyond network intrusions and virus attacks to the applications and data. The PCI has responded with mandates for code reviews and application firewalls. Citrix NetScaler appliances integrate a Web application firewall utilizing a positive security model and behavioral methods to automatically identify application deficiencies and prevent attacks. *Basic* attacks such as buffer overflows, cross-site scripting and SQL injection are blocked using a one-direction inspection method. *Advanced* attacks demanding bi-directional request and response inspection for cookie and form-field tampering are similarly prevented.

NetScaler ensures PCI compliance mandates through an integrated PCI compliance reporting tool in the application firewall. The reporting tool provides details on what rules apply, configurations to meet for a security audit, and corrective configuration steps if compliance is not being met. The tool is fully integrated into the NetScaler user interface for ease of use. All companies may suddenly face an audit; with Citrix’s ADC they are prepared.

NetScaler goes further and prevents data leakage. By creating a series of *data objects* for such information as credit card or Social Security numbers, NetScaler can strip, mask out or drop responses to requests for any confidential information. There is no need for a stand-alone *extrusion prevention system*. Standard ADCs, network firewalls and intrusion prevention systems do not even detect—let alone stop—these application attacks and confidential information theft.

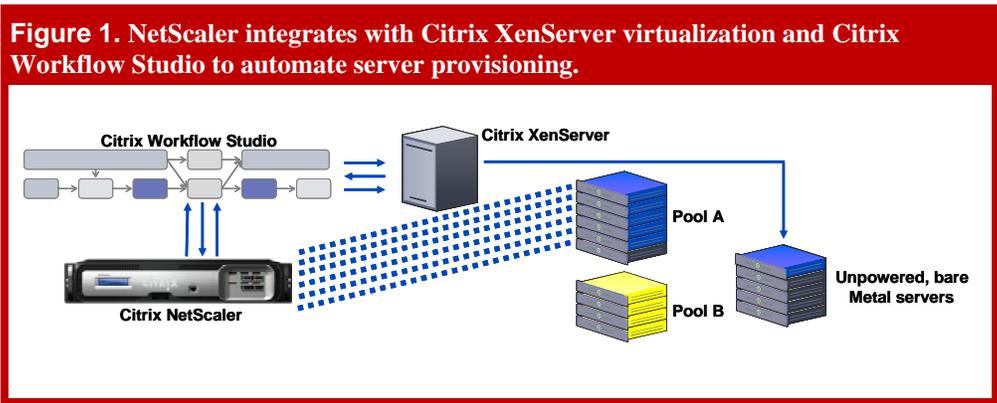
Automated Server Provisioning

Application delivery solutions must be part of a larger dynamic data center deployment. With increasing server demands, rising power charges and IT management resource constraints, organizations need to shift back-end resources *on the fly*. When facing changes in requested service levels, IT needs the ability to automatically provision and de-provision servers. NetScaler integrates seamlessly with Citrix XenServer™ server virtualization and WorkFlow Studio solutions for auto provisioning of servers (see figure 1). NetScaler provides a comprehensive array of server monitoring and health checks; methods to ensure the back-end applications and data are available, not just network layer checks.

XenServer works to allocate virtual server resources over the actual physical servers present and can either provision more hardware or reduce resources as needed. Workflow Studio acts as the *intelligent* interface between NetScaler and XenServer by obtaining server status from NetScaler, such as CPU load or requests per second. Based on pre-defined user settings, Workflow Studio automatically instructs XenServer to expand or contract actual physical hardware support. The result is an automated infrastructure, lower capital and IT administrator expenses, and less power for green computing. No changes to applications are needed nor are services disrupted. Citrix is the only ADC vendor providing this complete workload virtualization solution.

Scalable Multi-Gigabit Rated Appliances

With application delivery solutions addressing needs within the largest Internet-centric and enterprise operations the performance levels must match the demands and be scalable for future growth. Citrix NetScaler is the only provider of fully integrated



stand-alone ADC solutions that exceed 15 gigabit per second of traffic at both Layer 4 *and* Layer 7. The NetScaler MPX-series is the latest platform from NetScaler that provides not only this industry-leading throughput but provides multi-gigabit rates of compression, SSL security and Web application firewall support. This performance is maintained when multiple functional modules are running concurrently.

Ease of Installation and Configuration

Often overlooked is the user friendliness of infrastructure components. An application delivery solution would be of reduced practicality if set-up time is extensive and mandates writing lines of TCL code. NetScaler comes with a straightforward GUI tool, AppExpert Visual Policy Builder, which is a drop-down menu driven configuration interface. Complex compound policy expressions can be developed in minutes. Wizards are provided for local and global load balancing of Citrix's XenApp virtualization solutions and templates are available for standard Web-based applications from software vendors.

User Performance Monitoring

Operation centers need a way to anticipate unacceptable service levels and take proactive action. With Citrix EdgeSight™ for NetScaler, the administrator has that ability. EdgeSight uniquely measures the user experience across a spectrum of Web application performance metrics with page-level visibility. Response time measurements are combined with page download and other measures to provide a highly granular visibility into how the applications are behaving from the users' perspective.

Unlike competing methods, EdgeSight neither diminishes appliance performance nor impacts the measurement itself as EdgeSight transparently injects Java code into HTML pages. The result is a true measure of the user experience. If application performance drops below predetermined thresholds, IT is notified in advance and the administrator can implement infrastructure modifications to return to acceptable service levels.

Citrix NetScaler Leverages Application Delivery Services

Citrix NetScaler solutions are fully interoperable with and maximize the efficiency of all networking protocols and application delivery service providers. There is no need for proprietary protocol extensions or client agents. For instance, compression algorithms are based on GZIP and are supported natively by all modern browsers. NetScaler also integrates tightly with such service offerings as the Akamai® Web Application Accelerator. NetScaler's client-side TCP and HTTP protocol optimization and caching features can be further enhanced when delivering content from NetScaler utilizing Akamai's worldwide array of servers. Content policies can be shared to extend the offloading of the origin infrastructure by moving cached content to the edge of the network. The result is the most comprehensive and fully standardized end-to-end data delivery solution available.

Conclusion

Citrix NetScaler appliances are the most complete application delivery solution available. They are tightly integrated with both the underlying network infrastructure and applications themselves. The value of Web-based applications are dramatically enhanced when their performance behaves as if the user is local, secure from attacks, and available at all times with automated provisioning.

For more information about Citrix Systems solutions described here, please visit:
<http://www.Citrix.com/netscaler> or call Citrix at 1-800-393-1888 toll free or 1-954-267-3000 main.

Managed Services to Complement Application Delivery Controllers



By Andy Rubinson
Sr. Product Marketing Mgr.
Akamai Technologies



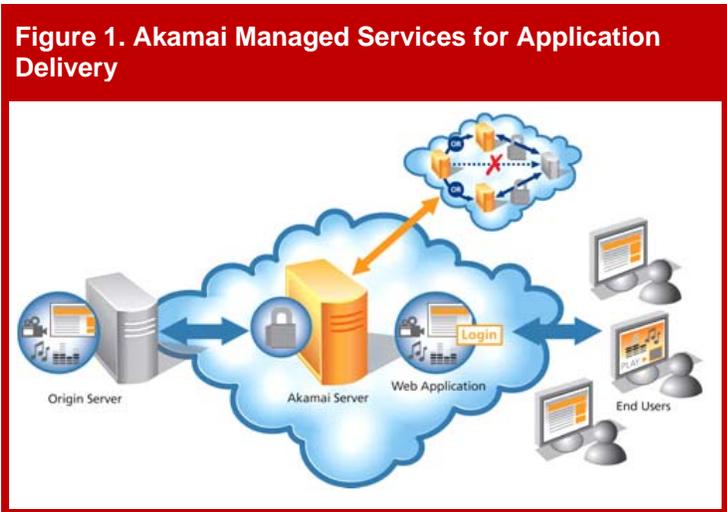
Application Delivery Controllers (ADCs) serve an important role in improving the delivery of Web applications by addressing bottlenecks within the data-center. As applications traverse the Web, a new set of bottlenecks thwart effective delivery to employees, business partners and suppliers across the globe. While you may be already leveraging or considering implementing an ADC in your data-center, taking this approach by-itself is insufficient, leaving out a large part of the equation. Akamai makes your applications Internet ready, by providing an end-to-end Web acceleration solution that fills the gap left by not addressing the Internet cloud with an ADC. Akamai provides the only solution to transform the Internet into a business ready application delivery platform, while also addressing application delivery bottlenecks in the "cloud" with a unique globally distributed platform requiring no hardware or client-side technology. The result is a fully transparent and optimized architecture for addressing critical Web application delivery bottlenecks related to:

- Poor application performance caused by centralized infrastructure
- Inefficient server and bandwidth utilization
- Excess latency and packet loss introduced by Internet routing
- Availability issues associated with the Internet itself
- Security concerns from denial of service and other malicious attacks
- Limited visibility into network conditions and end user impacts

How Akamai's Web Application Delivery Service Works

Akamai's Web Application Accelerator takes a unique approach to solving the Web application delivery challenge by filling the gap between the data-center and end-users while requiring no additional hardware by the customer. Our application delivery services incorporate tens of thousands of managed servers deployed across the globe, providing servers at the edge of the Internet, within one network hop of the origin server and 90%+ of the world's Internet users. By applying a sophisticated set of techniques to accelerate dynamic content, Akamai goes well beyond static caching to optimize application delivery bottlenecks for fully dynamic, enterprise applications.

1. Akamai's dynamic mapping system directs user requests for secure application content to an optimal Akamai server.
2. Route optimization technology identifies the fastest and most reliable path back to the origin infrastructure to retrieve dynamic application content.
3. A high-performance transport protocol transparently optimizes communications between the Akamai server and the origin, improving performance and reliability.
4. The Akamai server retrieves the requested application content and returns it to the user over secure optimized connections.



Solution Benefits

Performance - Unlike ADC's, Akamai's footprint for improving application delivery is not constrained to within the data-center. With servers in close proximity to both the origin and the Internet's edge, it's like having your own specialized application acceleration hardware right next to anywhere a user has access to a Web browser. It is this dual-ended, symmetric architecture that provides Akamai's fundamental architecture advantage for improving end user response times.

With real-time intelligence of Internet conditions across a symmetric pair of servers, Akamai's proprietary SureRoute technology dynamically optimizes round trip time between each end user and the application server instead of next-hop routing decisions made by BGP. Without SureRoute, users are subject to sub-optimal latency and packet loss for each request. Real-time routing decisions become increasingly important as Web applications become more real-time sensitive and interactive, with new technologies such as AJAX while leveraging functionality such as live-chat and VoIP.

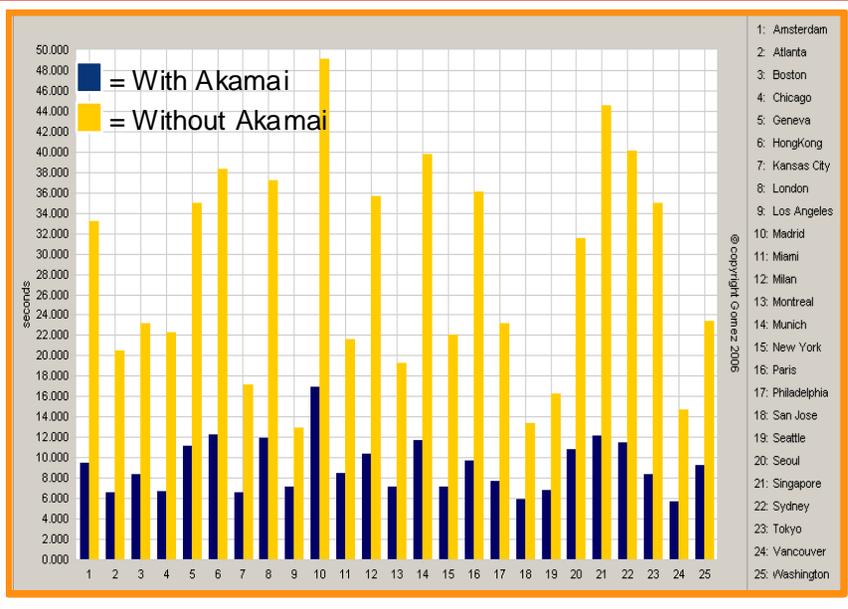
By controlling both ends of the connection with symmetric servers, Akamai can also significantly reduce application chattiness and fortify against packet loss and other network anomalies by applying intelligent transport and application optimizations. The Akamai Protocol eliminates TCP's three way handshake for connection and teardown, slow start and applies guaranteed pipelining and intelligent retransmission. HTTP inefficiencies are eliminated thru compression, caching at the edge and intelligent pre-fetching. Pre-fetching recursively parses HTML pages within Akamai edge servers to bring dynamically generated content to the edge, and are delivered just-in-time to end-users as though they were only a few milliseconds away.

The result is a dramatic reduction in effective round trips taken over the Internet – further improved by an optimized route whenever a trip to the origin must be taken. Global users experience local response times, regardless of their distance from application infrastructure thereby improving application adoption, utilization and enabling data-center consolidation. Independent tests have shown end-user response time improvements of up to 5X across geographies as a result of using Web Application Accelerator.

Scale - It may seem counterintuitive at first, but Akamai also greatly improves server scale within the data-center, by addressing bottlenecks outside of the data-center. Static content can be offloaded out of the data-center thru caching and persistent, replicated in-cloud storage facilities. And by offloading content and storage in the cloud, we reduce the bandwidth needed to support your application. When combined with Akamai Protocol, the result is a dramatic reduction in server hits, freeing up precious server resources while optimizing power and rack-space within the data-center.

Security - With a growing number of threats, Akamai allows you to eliminate the public entry points to corporate infrastructure by taking the initial hit at the Akamai edge, outside of your data-center. Akamai provides protection at the edge, at Levels 3-7, by locking down a security perimeter and keeping malicious attacks outside of your data-center. Akamai achieves this with multiple technologies such as DNS security, IP Layer DDoS protection, IP layer access

Figure 2. Example - Global Performance With and Without Akamai



control by IP or geographic location and HTTP/S origin cloaking. As hackers have become more sophisticated, Akamai is enhancing its edge protection at the application layer - providing web application firewall capabilities where Akamai edge servers can be configured to check the request at Layer 7 and ensure only valid requests are passed through to the origin.

Availability - Application availability is only as good as the weakest link. Akamai improves the availability of the Internet itself, providing a key ingredient to an overall business continuity and disaster recovery strategy. Akamai's SureRoute technology addresses availability issues associated with the Internet itself. Whether caused by earthquakes, cable cuts, outages, peering issues or simply congestion, SureRoute can identify a path that avoids the issue, making it transparent to the end user.

Visibility - Akamai offers unique network level visibility within the portal, providing insight into performance, users, traffic intelligence & real-time SLA monitoring, providing analysis and alerts. Akamai also provides geographic intelligence based on IP, allowing designers to serve dynamic content customizable on a per user basis.

Quick Time-to-Value - Akamai offers out-of-the-box integration packages for most common business applications, including SAP®, Oracle®, Microsoft® SharePoint® and extranet portal software such as IBM® Websphere®. Akamai accelerates all facets of Website and enterprise business processes such as ERP, PLM, SCM, CRM, SaaS and Web services for machine-to-machine communication. Fine-grained customization of any application is possible by way of a rich, flexible metadata scripting language with intuitive GUI. Speedy deployments can be facilitated by our Professional Services team, eliminating the need to invest in resources to learn custom programming code.

ROI – Independent interviews of Akamai customers using Web Application Accelerator showed an average annual business benefit of over \$7 million for each application accelerated with Akamai. Based on the IT cost savings alone, the average ROI was nearly 600%, with a payback period of less than 2-months.

Akamai Complements Your ADC

While Akamai works with any ADC, Citrix® and Akamai have recognized the advantage of an integrated solution combining optimization from NetScaler® "in the data-center" and Web Application Accelerator "in the cloud," offering a best of breed solution for infrastructure and network, from industry leaders in each respective area. The two companies offer a tightly integrated Web delivery solution, delivering quickest time-to-value, along with better performance, scale, availability, security and visibility than either solution provides on its own. It is truly an industry first – solving the Web application delivery challenge from an end-user perspective with an end-to-end solution addressing application delivery bottlenecks all the way from the data-center to the end-user.

About Akamai & APS

Akamai provides market-leading managed services for powering rich media, dynamic transactions, and enterprise applications online. Having pioneered the content delivery market one decade ago, Akamai's services have been adopted by the world's most recognized brands across diverse industries. The alternative to centralized Web infrastructure, Akamai's global network of tens of thousands of distributed servers provides the scale, reliability, insight and performance for businesses to succeed online. An S&P 500 and NASDAQ 100 company, Akamai has transformed the Internet into a more viable place to inform, entertain, interact, and collaborate. To experience The Akamai Difference, visit www.akamai.com.

Akamai has recently broadened its offering of Application Performance Solutions with IP Application Accelerator. With this new service, Akamai moves well beyond the delivery of Web-based applications such that any IP-enabled application such as virtualized, client/server and conferencing applications can benefit from delivery with Akamai.

For more information about Akamai's solutions described here, please visit:

<http://www.akamai.com/waa> and <http://www.akamai.com/ipa>
or call Akamai at 877-425-2624.