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The FX Series Content Reduction Saves Bandwidth & Increases Application Throughput

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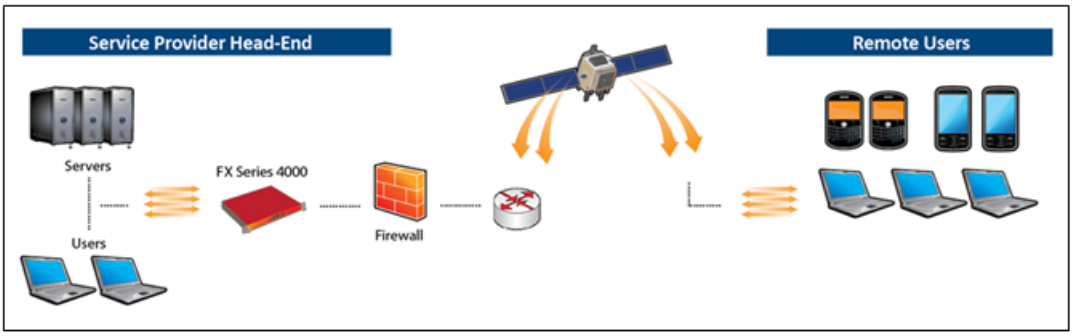
The plethora of new IP-enabled devices is giving rise to many innovative business and consumer applications that are generating greater demands on network bandwidth. With the increasing stress upon satellite links, network administrators are looking to application delivery and WAN optimization solutions to get the most performance out of their available bandwidth. Application Delivery Controllers (ADCs) and WAN optimization Controllers (WOCs) have become key technologies in solving satellite link performance problems, and are quickly being adopted to flexibly scale satellite bandwidth, create faster responses to user requests for applications and content, and to provide a built-in capability for site disaster recovery and business continuity.

Data reduction can dramatically improve satellite link utilization and user response times. By reducing the amount of data sent over satellite links, more applications and users can be supported with existing bandwidth. The FX Series is based on a single platform that supports satellite networks as a single-sided Application Delivery Controller (ADC), or two-sided WAN Optimization Controller (WOC).

ADC Solution Deployment

As a single-sided solution, the FX4000 Series located at the head-end, offers satellite connection management to fully utilize satellite link bandwidth. The FX Series offers many capabilities for reducing data in order to optimize satellite beams, including outbound JPEG image reduction, outbound GZIP compression and data caching. By reducing data from satellite links, the FX Series allows satellite networks to handle greater traffic loads, rather than being burdened with the overhead that would otherwise diminish capacity and slow traffic down. Below are some of the content reduction capabilities that the FX Series provides within a single-sided deployment.



In a single-sided (ADC) deployment, the FX Series resides within the head-end.

Caching – The FX Series utilizes caching to accelerate content requests by maintaining copies of routinely accessed content to eliminate unnecessary requests from going over limited satellite links. By keeping local copies of frequently requested content, the FX Series allows organizations to significantly reduce their upstream bandwidth usage and cost, while improving performance. The FX Series acts as an intermediary from end-users requesting content (such as a file, web page, or other resource) from servers. Some of the key benefits include:

- Reducing bandwidth consumption
- Keeping servers behind the FX Series anonymous for security purposes
- Delivering fast access to content

GZIP Compression - GZIP compression is handled on-the-fly from the servers to the clients. This reduces bandwidth consumption and improves application delivery and client response time. The FX Series uses GZIP compression to reduce the payload size to deliver more data across the satellite link, enabling more applications to be delivered and the ability to support more users. GZIP compression removes non-essential information from data being moved from one location to another, and then reassembles the data to its original form after the transfer is complete.

Squeezing the data reduces network traffic and accelerates the delivery of time-sensitive information. GZIP compression uses standard techniques to compress data sent to browsers. While compression

exists in many forms throughout Web deployments, the FX Series is able to more effectively apply compression resulting in better compression ratios. The most common use of compression in Web environments is accomplished by enabling GZIP functionality at the Web server. This is useful for reducing the text portions of pages, but GZIP is not normally used for attachment compression or for inbound compression from the browser. In addition, GZIP cannot be used to compress HTTP headers or image data.

The FX Series utilizes various compression techniques to reduce the amount of data that must be sent across the network. In a single-sided mode, the FX Series appliance utilizes GZIP to compress information that can be processed by standard browsers. In addition, GZIP cannot be used to compress HTTP headers, cookies or image data.

In a two-sided deployment, the FX Series bi-directional compression provides compression for:

- All HTTP Headers
- Application Cookies
- All Text and Data Objects
- JPEG files with Image Reduction, yielding very acceptable quality
- All attachments and file uploads and downloads

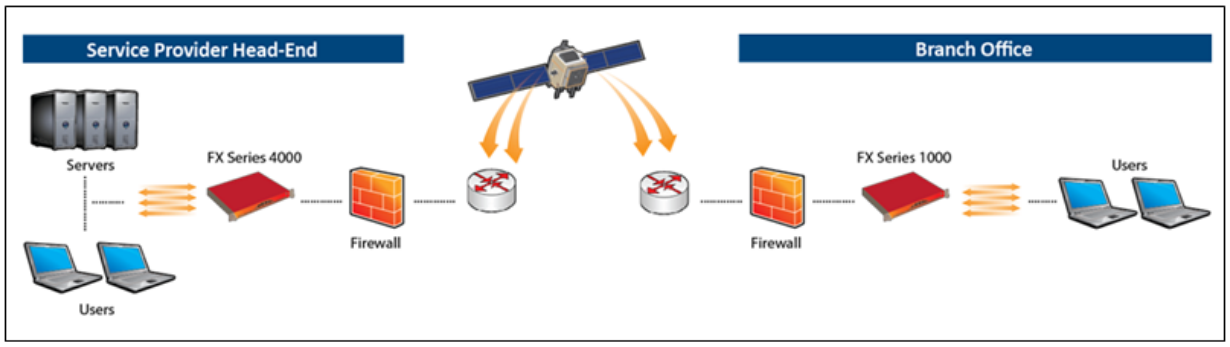
Image Reduction and Smoothing – Image Reduction and Smoothing reduces the amount of data required to represent an image without significantly altering the visual perception of the image. This is accomplished in two ways. Smoothing reduces the high frequency components or the sharpness of an image. A moderate amount of smoothing can significantly reduce the amount of data. The quality factor of a JPEG image relates to the precision of the samples. Sample precision can be reduced without visible detection.

The goal of the JPEG quality and smoothing values is to reduce the amount of data while maintaining a usable image. Depending on the JPEG, the compression is often in the range 9:1. A number between 1 and 100 specifies the tradeoff between size of the jpeg data and quality of the original image. A higher number will retain a higher quality, but will not conserve as much bandwidth. If no value is specified, then the FX Series value is inherited from a higher level policy; a default value of 25 is used if no higher level policy is defined. Images that have been transformed are typically not significantly changed by running through the algorithm again. What this means is that if an image has been compressed with a particular smoothing and quality factor, and if the same factors are used again, the image is not significantly changed.

Dynamic Data Suppression – Dynamic Data Suppression (DDS) is block level de-duplication, which is a technique for recognizing and replacing repetitive streams of payload data with signatures prior to transmission over the satellite links. DDS is not application protocol specific and can be applied to most TCP application traffic. The FX Series intelligently monitors the data stream and is able to distinguish protocol headers which change frequently from payload data which is often static. The FX Series extracts this payload data and segments it into blocks, storing each block into persistent memory known as a "byte cache". Blocks of data are replaced with a signature for that data. This generates significant data reduction.

WOC Solution Deployment

In a two-sided implementation, The FX4000 is located at the head-end, and FX1000 Series appliances are located within the remote sites.



In a two-sided (WOC) deployment, an FX Series resides within the head-end and at the remote site.

In addition to the compression technologies used in a single-sided deployment, the FX Series two-sided solution improves performance with content reduction through:

Static Caching – Caching brings information closer to the end-user by storing recently accessed data in local memory or on hard disk, reducing the time it takes to bring back needed information, making the user experience more positive and action oriented. While today's browsers maintain their own cache, they tend to be overly conservative. This means they will err on the side of requesting a new piece of data or object, usually when it really hasn't been changed. This not only impacts response time to the end-user, but also saturates bandwidth with unnecessary data transmissions.
Some of the key benefits include:

- Reducing bandwidth consumption
- Keeping servers behind the FX Series anonymous for security purposes
- Delivering fast access to content

Cache Differencing – Cache Differencing goes beyond static caching by maintaining identical copies of the browser's cache at the local device and on the FX Series appliance. The FX Series then uses intelligent differencing technology to understand what data has actually changed, and then transfers only the changed data. The local device functions normally, but with less data being transferred, you realize improved utilization of the satellite network, and increased end-user productivity.

Traditionally, pages can be marked as cacheable and will have expiration dates. When they expire they must be retrieved from the original server, resulting in additional traffic and data being transmitted across the satellite network. Within a two-sided environment, the FX Series remote appliance caches all pages returned to the browser (even pages that are marked as non-cacheable) and performs validation when needed to ensure that no stale data is returned to the browser. When the browser asks for a page or an item that has expired or been marked as non-cacheable, the FX Series remote appliance sends a validation request to the FX Series appliance at the head-end. If the FX Series appliance is aware of the last page the client cache contains and can compute differences in the page, it sends just the differences to an expired page or non-cached page. If the differences are too big, or if the FX Series appliance no longer has retained the last version that the client has, then the entire page is returned and subsequently cached for future possible differencing. The client in turn reconstructs the requested page, caches it, and returns it to the browser. Checksums are calculated by the FX Series appliance at the head-end and verified at the FX Series remote appliance so that pages will never be delivered incorrectly. While this technique adds value on expired pages, it is extremely effective for dynamic page generation.

An important aspect of Stampede's Cache Differencing is the ability to perform differencing not only on HTML GET requests but also on POST requests. This is significant because a) responses to posts are always marked non-cacheable, and b) most applications that are based on SOAP and XML (including most AJAX applications) issue SOAP requests via the HTML POST command.

Content Distribution - Pre-Caching – When large amounts of repetitively accessed data are routinely accessed by end-users, the satellite link can become saturated with requests for the same file. In addition, users can be adversely impacted with long response times for critical data. Stampede's Pre-Caching feature helps to eliminate this bottleneck and improve end-user response time.

Administrators can define content that is automatically distributed (Pre-Cached) to specific users at off peak hours. During a predefined window of time, the end-user devices will randomly pre-cache the content, enabling instant access to the information when the user needs it.

Bi-Directional Data Compression – Compression removes non-essential information from data being moved from one location to another, and then reassembles the data to its original form after the transfer is complete. Squeezing the data reduces network traffic and accelerates the delivery of time-sensitive information. Stampede utilizes various compression techniques to reduce the amount of data that must be sent across the network. When Stampede's FX Series is deployed in a two-sided environment, our bi-directional compression provides compression for, all HTTP headers, application cookies, all text and data objects, JPEG files with image reduction (yielding very acceptable quality), and all attachments and file uploads and downloads - all of which are dynamically adaptable based upon network speed and latency.

IE Optimization – For customers that use Microsoft's Internet Explorer browser, the FX Series can reduce round trips during Internet sessions by marking the HTTP objects to allow IE to extend the time that the objects are stored within the browser cache without the content becoming stale.

Optimizing Microsoft Updates – The FX Series intelligently caches Microsoft® Updates on the client side saving significant bandwidth attributed to "Patch Tuesday". The FX Series caching methodology handles the rather complicated procedures employed by Microsoft and other AV vendors to request updates by requesting "partial objects". This reduces the amount of data sent over satellite links to reduce bandwidth consumption and provide faster response times for end-users.

The FX Series Remote can dramatically curb bandwidth consumption by caching software updates published frequently by Microsoft, Symantic, Adobe, Apple and many other leading software vendors.

Most Satellite service providers are aware of the bandwidth impact of "Patch Tuesday" - the day that Windows updates are distributed. The delivery of these updates is performed when software that resides on client devices downloads the new content in the background by requesting "partial content" over HTTP. The complex nature of "partial-content" HTTP requests thwarts the capabilities of most caching devices, however the FX Series Remote appliance caching engine can handle these requests. Once the content is cached by the FX Series Remote, subsequent retrievals by the updating agents that request "partial-content" will be satisfied by the FX Series Remote appliance, eliminating the need to repetitively transfer the same updates over satellite links.

Summary

As the demand for satellite networks continues to grow, the need to optimize bandwidth to control costs, support the greatest amount of traffic and to stay competitive is imperative. The FX Series offers a wide range of content-reducing technologies that allow network administrators to get the most from their available bandwidth with the lowest total cost of ownership. The FX Series is a vital tool to enable satellite Internet service providers to improve their network performance while lowering bandwidth costs. The benefits of content reduction over satellite links are very tangible - data transfer times are improved and bandwidth is more efficiently used.