

# Aspera Software for Isilon Scale-out NAS

The Aspera and Isilon Solution for High-speed File and Content Delivery over the Wide Area

WHITE PAPER



# Aspera Software for Isilon Scale-out NAS



## The Aspera and Isilon Solution for High-speed File and Content Delivery over the Wide Area

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### HIGHLIGHTS

#### Challenges

Moving large digital assets over long distances using traditional file transfer software like FTP is unreliable and unpredictable, leading to business delays and loss of productivity

#### Use Cases

- Enterprise-wide file movement
- High-volume content ingest
- High-performance content distribution
- FTP/SFTP replacement for high performance transfers

#### Solutions

- Predictable, non-disruptive, high-performance Wide Area Content Ingest and Delivery solution from Aspera and Isilon
- Cluster-aware version of Aspera's FASP high-speed transfer technology optimized for Isilon OneFS operating system
- Aspera software pre-installed and configured on every Isilon OneFS node with a simple license key activation

#### Benefits

- Maximum speed and predictable delivery times for digital assets of any size, over any distance or network conditions
- Massive concurrency and linear transfer performance scaling
- No single point of failure with Isilon SmartConnect
- Single-point transfer management with Aspera Console
- Support for web services and industry-standard APIs

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## The Aspera and Isilon Solution for High-speed File and Content Delivery over the Wide Area

### INTRODUCTION

Businesses across many industries need to rapidly transfer and store large data sets over wide area networks (WANs). These big data transfers – moving packages of large, unstructured files, assets, and media – need to be delivered on time, within a given data transfer window, over varying network conditions and capacities.

Unfortunately, even over the fastest networks, sending large files over long distances is problematic and costly using conventional file transfer and server technologies. Once files travel outside a company's firewall, traditional file transfer software and protocols such as FTP and HTTP become unreliable, unpredictable, and suffer significant performance degradation leading to business delays and significant loss in productivity. And the problems only worsen as the size of the files increases, the distance from source to destination increases, and the quality of the network deteriorates.

Another challenge for moving files is rooted in computer system architectures. The clients and servers sending and receiving the files using FTP are limited to single transfers, using a single computer system. Each computer has finite limits in bus speed, CPU, memory, and disk IO bandwidth. While the fastest server may be able to transfer Gbps on a local area network, throughput will slow down to a fraction of the speed over a long distance WAN. As networks are now capable of Multi-Gbps speeds, individual computers and storage systems struggle and are often unable to keep up with the network capacity.

Historically, there are two ways most companies overcome these limitations for moving large files over long distances:

- (a) Mail or carry the files on physical or optical media, using overnight, express mail, or sneaker net (courier).
- (b) Partition the data across multiple servers, attached to separate storage devices or volumes. Once the data is partitioned, FTP would be used to transfer the data across multiple servers, in parallel.

Both alternatives are impractical at scale. The mail system is a costly, human-intensive process, and not designed for transporting electronic media. Files and assets need to be delivered when businesses need it, on-demand and on time.

The second option, partitioning data across servers and running

FTP in parallel may work for some companies on low bandwidth networks, but adds additional management complexity and does not scale for companies in the business of moving massive amounts of large files and critical assets, rapidly on high bandwidth networks.

### SINGLE SERVER DELIVERY CHALLENGES

There are four key challenges to the server and storage partitioning approach:

- **Insufficient scalability.** Often, companies need to transfer files at speeds faster than a single server running FTP can accomplish. In other cases, inbound and outbound transfers need to occur simultaneously: a single system may not have the CPU, memory, disk, and network resources to process and deliver multiple transfers, or deliver files on time.
- **Management cost and complexity.** Managing more than one server and storage separately may become cost-prohibitive for businesses transferring the same files – or many new files – to multiple locations. If half the files are stored on server 1, and the other half are stored on server 2, only one server at a time can transfer the files (unless redundant copies are created on both). Furthermore, the costs and complexities of integrating servers, operating systems, separate tiers of servers, networking, and storage components often outweigh the benefit.
- **Inadequate reliability and availability.** If a single server or its storage device fails, the data is either lost or needs to be recovered and restored to a standby system. Active-passive failover scenarios are often unreliable and require over-provisioning by 100%. This risks potentially catastrophic business delays.
- **Limited flexibility.** When the business grows or peaks – requiring faster transfers of larger files, or a larger numbers of files – there is often no way to accommodate the growth, since the server systems used to transfer files do not scale up beyond Gbps transfer rate.

Each of these problems has been addressed in an integrated software and hardware solution for Wide Area File and Content Delivery from Aspera and Isilon Systems: Aspera Enterprise Server and Aspera Connect Server for Isilon OneFS.

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### ASPERA ENTERPRISE AND CONNECT SERVER FOR ISILON ONEFS

Aspera and Isilon Systems have partnered to create the first predictable, non-disruptive high performance Wide Area Content Ingest and Delivery solution designed specifically for moving large files or data sets over long distances – at the fastest possible speed. Aspera Enterprise and Connect Server software applications for Isilon OneFS run directly on Isilon scaleout NAS and provide a cluster-aware version of Aspera high-speed file transfer software and technology that is optimized and integrated with the underlying Isilon operating system.

Aspera's software provides an innovative and reliable bulk data transfer protocol, designed to meet the speed, predictability, and security requirements for moving business-critical big data over wide area networks. Aspera software installs and runs directly on an Isilon cluster to maximize throughput and efficiency across each "node" in the cluster.

When Aspera's FASP™ technology is combined with Isilon's scalable and reliable storage architecture, businesses can easily add both performance and capacity to send or receive files rapidly and predictably, to or from any-sized wide area network. Isilon provides the underlying scale-out NAS architecture and capability for scaling and adapting transfers from a single pool of storage. If performance beyond a single system is required, simply scale the Aspera transfer out across multiple nodes in the cluster—or add nodes or accelerators to the cluster. When less performance is required, or needs to be used for another project, simply scale back the transfer, and utilize the shared cluster resources for other data transfers.

Because all resources in the cluster are shared, operators can easily adapt transfer speeds as projects demand – drawing from a single, shared pool storage. Isilon's OneFS® operating system software provides a single, unified file system that makes it exceptionally easy to manage data and transfers together, without having to partition or replicate data from server to server.

The Aspera on Isilon solution provides:

- **Highest performance over any distance.** Scale-out transfer performance over campus and wide-area networks. Start small from lower bandwidth rates and scale-out nondisruptively to 10+ Gbps.
- **Predictable performance over any distance.** When performance is required, simply adjust the Aspera transfer speed, scale the transfer across more nodes in the cluster, or add new performance nodes to the cluster. Full predictability ensures files are delivered on time—and transfer times can be calculated with certainty based on data set size and bandwidth rates.
- **Easy Management.** Because all files are stored, served, and transferred from a single logical file system, the solution provides an alternative to managing tiers of servers and legacy storage systems separately. All storage can be made available to Aspera transfers, or a limited set through Isilon's SmartQuotas software application.
- **All-Active High Availability and Load-balancing using SmartConnect.** Aspera FASP clients connected to the cluster through Isilon's SmartConnect software application obtain all-active load balancing and failover. If a failure on a node occurs, or resource threshold is reached, Aspera clients are seamlessly redirected to other active nodes in the Aspera transfer zone, managed through Aspera's patent-pending Virtual Link capability.
- **Proven reliability.** The entire file system, or any sub-directory within the file system, can be configured with N+1 through N+4 data protection, through Isilon's FlexProtect. More important projects can receive the highest levels of data protection – or the data protection level can easily be changed on the fly, once a transfer is complete.

Aspera Enterprise Server is a file transfer server hosted on one or more Isilon cluster nodes, combining high-speed, secure FASP transport with additional transfer management features for enterprise applications. The server application supports common transfer modes, such as upload/download, as well as automated workflows. In the Isilon-integrated solution, the Aspera Enterprise Server is hosted on each node of the Isilon cluster.

The Aspera Connect Server incorporates all the features of the Enterprise Server, and adds a Web based portal for easy upload/download and browsing of files and directories. It also includes support for the Aspera Connect browser plug-in for high-speed transfer of files directly from all the most popular client browsers.

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Aspera Enterprise and Connect server software come pre-installed and configured on OneFS—shipping with every Isilon node. Aspera server software is enabled through a license key purchased from Isilon.

The following diagram shows the Aspera Enterprise and Connect Server hosted on the Isilon scale-out NAS cluster, serving various Aspera clients and standalone server endpoints:



**Figure 1: Aspera Enterprise Server and Connect Server Hosted on the Isilon Cluster**

The Aspera on Isilon solution provides a number of features and benefits:

- **Maximum cluster-to-cluster performance over campus- and wide-area networks.** Aspera scales from lower bandwidth rates linearly up to 10 Gbps cluster to cluster.
- **Massive concurrency.** Supports many clients connected concurrently to a common cluster—and scale-out as needed. Performance scales linearly for individual highbandwidth transfers, as well as many concurrent transfers at broadband speeds.
- **Easy scalability of WAN transfer performance.** Performance scales through a single command initiated cluster-wide. As bandwidth increases to higher speeds, simply add nodes to create additional performance. Performance and capacity can scale independently by adding storage-only nodes, or performance accelerator nodes. These out-of-the-box cluster features lend themselves directly to Aspera software capabilities.

- **No single point of failure.** If one node becomes unavailable, the transfer resumes on the remaining nodes. By using the Isilon SmartConnect application software zones, transfer connections can failover to other nodes and resume transfer from the point of interruption.
- **Single point of management.** With this solution, it is as simple to manage one Aspera Enterprise or Connect Server as it is to manage ten servers since they are all hosted on the same cluster. All Aspera Enterprise and Connect Servers share the same configuration: user authentication, transfer rate control, ports, security, destination name, and other settings.
- **Web Services and Industry-standard API support.** Aspera software supports a fully extensible set of web services and common SOAP APIs to provide easy integration with 3rd-party data management tools and web-based management applications.
- **Network agnostic.** The solution works with any IP network, and can be configured to take advantage of high-speed networks and endpoints that use large packet sizes by increasing the MTU setting.

## COMPARING WIDE AREA FILE SERVICES TECHNOLOGIES

Today, many Isilon partners provide complementary solutions for Wide Area File Services. Each solution was designed to solve a specific problem. Some, such as WAFS caching appliances and embedded network acceleration, may be used in conjunction with the Aspera on Isilon solution.

There are three broad categories of Wide Area File Delivery solutions:

1. End-to-end software. Aspera is an example here, where software runs on all endpoints in the solution.
2. Caching or acceleration appliances deployed over the network, in front of each end-point.
3. Embedded network optimization strategies, such as TCP acceleration.

The Aspera on Isilon solution is designed to move large files over wide areas, through platform-independent software — at

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the highest speeds possible. Categories two and three often represent complementary solutions, often designed to solve a fundamentally different problem.

In general, category two and three appliances and embedded network strategies are designed to:

- **Remove traffic from the network** through intelligent caching and data reduction. Many appliances are deployed on top of an underlying network, in between transfer points, to reduce traffic through any number of means (compression, caching, protocol acceleration, etc.). These techniques are complementary to the Aspera on Isilon solution when much of the data remains static over time, supports compression, or where data is being accessed frequently at remote locations – and caching may benefit.
- **Overcome the latency and lost user productivity** associated with “chatty” or stateful RPC- to TCP-based protocols. Many applications can benefit from caching or embedded acceleration when the file access protocols rely on highly transactional network communication – thus driving up network traffic and latency. Examples include Microsoft Exchange MAPI (used by Outlook clients), CIFS (in its various incarnations) and other chatty file sharing protocols, proprietary RPC protocols, and/or highly transactional databases or middleware-based protocols. Various caching and acceleration techniques may benefit specific applications and/or protocols, fitting the above criteria.
- **Service-oriented bandwidth management.** These solutions were designed to provide quality of service within the network – and may rely on packet tagging, through diffserv or MPLS, as well as packet shaping. These solutions also include techniques to enable control of bandwidth usage based on different policies, allowing critical network-intensive applications to receive variable priorities or Quality of Service (QoS) levels. Often, these solutions are embedded into the underlying network fabric or architecture – through the routing or switch fabric.

The Aspera on Isilon solution was designed to solve the problem of moving big data at highspeed over potentially high-latency, high-loss networks—or conditions common to most any wide area IP network. The solution is designed to enable the largest file transfers across the same networks while scaling to

meet the capacity capabilities of the fastest networks.

The Aspera on Isilon solution is especially well suited to environments that consistently generate new files—and require a need to immediately transfer, or store and rapidly transfer those same files.

At the heart of the Aspera bulk data transfer technology is an embedded, patented high-speed file transfer protocol called FASP. Tightly integrated with Isilon for data transport, FASP eliminates the fundamental bottlenecks of conventional file transfer technologies and provides high-speed, reliable transport over public and private IP networks, independent of network delay and robust to extreme packet loss. As a result, FASP transfers large data sets, at maximum speed regardless of network conditions or distance. With built-in adaptive rate control, FASP achieves extraordinary quality of service, predictable delivery times, and virtually ideal bandwidth efficiency, and combines complete security and data integrity verification to meet the present and future business requirements for global file transfer including ingest, distribution, collaboration, and synchronization.

Aspera’s software solution provides an application and network transparent means of maximizing network efficiency and minimizing transfer times. Specifically, the Aspera FASP software technology is designed for:

- **Speed:** FASP ensures maximum throughput utilization, independent of network latency and packet loss. FASP incurs less than 0.1% bandwidth overhead handling 30%+ packet loss.
  - Isilon cluster to cluster, using Aspera file transfer rates at line speed, regardless of network distance, delivering 10 Mbps to 10 Gbps (without encryption).
  - Isilon cluster to any other non-Isilon Aspera endpoint delivers 10 Mbps – 1 Gbps.
- **Reliability:** Aspera FASP sustains transfer rates through intra-protocol reliability, enabling FASP to withstand network connection failures by transparently restarting from the point of interruption – without requiring manual retries nor reconnects on the client.
- **Predictability:** Provides precise transfer rate control, pre-set

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or automatic (50 kilobits per second to 1 gigabit per second), on-the-fly setting of transfer rate, guaranteed finish time and bandwidth sharing policy, and partial transfer resume and automatic retry of failed transfers.

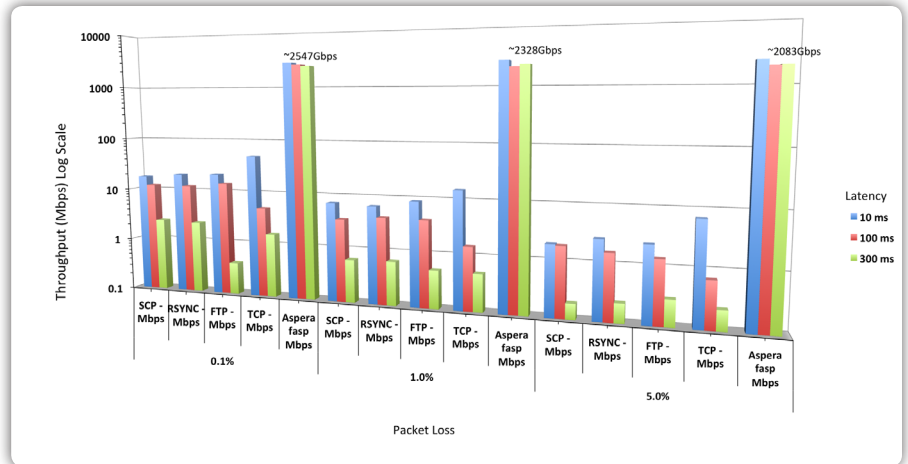
- Quality of service:** Aspera FASP supports a flexible service-oriented architecture where connections can be configured at fixed, variable, or stealth policies – to either consume network bandwidth or honor other TCP traffic on a shared resource. Transfer rates can be controlled and modified on the fly or be set to adaptively “back off” if other network activities are detected. This feature is different than the TCP-based “back off” windows that grow at a much higher rate without control. Transfers can also be set to work in the background only when no other activity is being detected.
- Protocol and data security:** Aspera’s underlying technology delivers secure endpoint authentication, on-the-fly data encryption using block ciphers (AES-128 by default), integrity verification, and extensibility for 3rd-party public key authorization integration. FASP transfers use SSH to form secure sessions for exchanging authentication credentials and establishing the data transfer session. Furthermore, all Aspera file transfer software is FIPS 140-2 compliant.

The above design characteristics make FASP highly robust, flexible, and broadly applicable across a wide number of IP networks and network activity.

### COMPARING ASPERA FASP TO FTP

Conventional protocols like FTP are inherently bound to the reliability and quality of the network. The more network latency and packet loss increases, the more FTP performance degrades.

The Aspera on Isilon solution can achieve transfer times that are up to 1000X faster than standard FTP, depending on network conditions. Unlike TCP-based protocols, the throughput is independent of network delay and robust to extreme packet loss.



**Figure 2: Summary of FASP throughput versus latency and packet loss**

A comparison of FASP, SCP, RSYNC, FTP and TCP in Figure 2 demonstrates that FASP eliminates the TCP bottleneck for the bulk data transmissions and improves the throughput by a factor up to thousands. The tests were performed on an Isilon 3 node cluster, comparing FASP to traditional transmission protocols by calculating the throughput from transferring files of various sizes (mean file size greater than 5MB), under varied WAN conditions. Performance of FASP greatly exceeded all other software and protocols, and perhaps even more important, FASP transfer speeds are relatively constant over network WAN conditions ranging from 0 ms to 300 ms round-trip latency, and 0% packet loss to 5% packet loss! TCP-based protocols drop by a factor of 1000X over the same conditions.

In another set of tests, under the same varying WAN conditions (latency: 10ms, 100ms, and 300ms; Packet Loss: 0.1%, 1%, 5%), results conclusively showed the benefits of running Aspera FASP on Isilon OneFS. Throughput reached 2711.9 Mbps, resulting in a transfer time of under 1 hour, compared to 2.1 days for FTP — a 59X improvement. As latency increased to 300ms, and packet loss increased to 5%, FASP performance remained relatively constant compared to the other tools. FTP performance degraded to .3 Mbps, and a transfer time equivalent to 442.6 days, while FASP transferred at a sustained throughput of 1975.4Mbps and delivered the files in under an hour, a 11944 times improvement.

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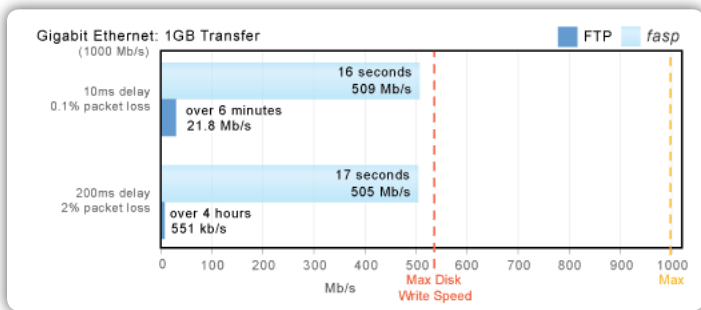
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Band-width (Mbps)	RTT (ms)	PLR (%)	FASP w/ Cluster (Mbps)	Data Size (GB)	SCP (Mbps)	RSYNC (Mbps)	FTP (Mbps)	TCP (Mbps)	1 TB FASP (hours)	1 TB by FTP (days)	Speed Up
10000	10	0.1	2741.9	85871	17.6	20	21	49	0.8 hours	2.1 days	59 X
10000	100	1	2068.8	85871	3.6	4.2	4.1	1.5	0.8 hours	67.9 days	1971 X
10000	300	5	1975.4	85871	0.192	0.224	0.3	0.23	0.9 hours	442.6 days	11944 X

**Table 1: Summary of FASP throughput versus latency and packet loss**

With Aspera, transfers are highly predictable, regardless of network conditions. It is important to note that performance gains are most apparent in the WAN environment. In a LAN, FASP should exhibit similar performance behavior characteristics as traditional file transfer protocols.

The following figure compares the transfer duration of a 1 GB file using traditional FTP and Aspera Client. Aspera Client transfers are not inhibited by increases in link packet loss and link delay while FTP performance drastically deteriorates:



**Figure 3: Gigabit Ethernet 1 GB transfer**

The FASP protocol is used to transfer data between the following end points:

- **Aspera Client and Aspera Connect Clients:** Rich file transfer applications built on Aspera FASP transport technology providing command line or graphical user interface with remote file browsing, hot folder, and automated queuing and scheduling for transfers with other hosts running Aspera Server or Point-to-Point Client software. Aspera Clients can initiate a transfer with another host (upload or download) but do not themselves accept

transfer requests (like a server). Aspera provides the Client on Windows, Linux, and Mac operating systems, and the Connect web client as a web plugin for IE, Firefox, and Safari web browsers.

- **Aspera Point-to-Point Client, Enterprise Server, and Connect Server:** Client and server applications that can upload and download data with the same capabilities as the Aspera Client, and can also serve remote transfer requests.
  - **Aspera Client for Point-to-Point** acts as a single-user server and supports transfers with other clients or servers under a single user account.
  - **Aspera Enterprise Server** supports an unlimited number of server requests and user accounts. Can be installed on a single host or on a cluster for high availability and capacity scale-out. For management, includes a desktop administration interface, and fully integrates with the optional Aspera Console, allowing both on-server and browser-based remote management of user and group policies including bandwidth, encryption, authorization, and notifications.
  - **Aspera Connect Server** is built upon Aspera Enterprise Server technology and provides the ideal solution when files and directories are exchanged with a large number of users over the WAN. Featuring a web-based directory listing that can be accessed from most standard browsers, the Aspera Connect Server lets authorized users upload and download data using free, auto-installed Aspera Connect web browser plug-in.



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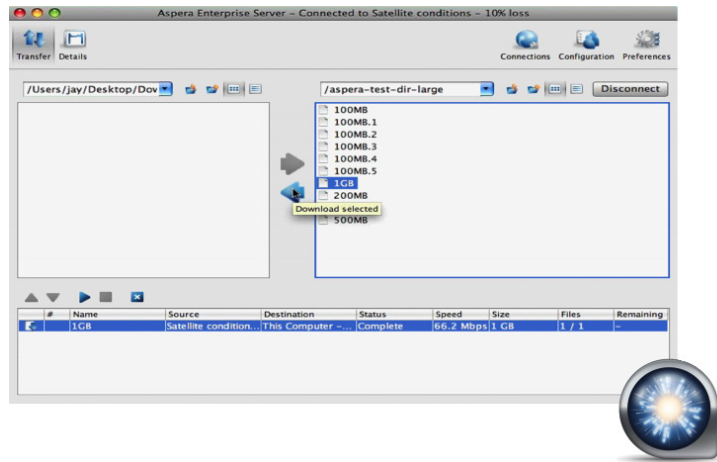


Figure 4: Aspera Enterprise Server file transfer interface

For more information on Aspera software go to: <http://www.asperasoft.com>.

### MANAGING AND MONITORING ASPERA TRANSFERS

In addition to the Aspera Enterprise Server hosted on the Isilon cluster, Aspera provides other software that can be installed outside the Isilon cluster to configure, monitor and automate data transfers.

### ASPERA CONSOLE

Aspera Console provides centralized management for all Aspera transfers — to and from Isilon clusters and other endpoints. The console simplifies the process of deploying Aspera Server and Client nodes and managing Aspera transfers across a wide area network (WAN). Providing users with detailed visibility over all file transfer activity within an Aspera network, Aspera Console offers an advanced web-based interface with comprehensive real-time notification, logging and advanced reporting capabilities, while maintaining a centralized transfer history database for detailed auditing and customized reporting.

Aspera Console's role-based access control allows users to monitor, start transfers, and generate fully customizable reports. From the Aspera Console, users can also automate files

transfers — including multi-site synchronization with Aspera Sync and full business process orchestration with the Aspera Orchestrator — and integrate with third-party applications.

Through Aspera Console, administrators have the ability to centrally configure all managed Aspera nodes, create and manage users and user groups, initiate and automate transfer jobs, and precisely control and monitor all transfer and bandwidth utilization parameters.

### DATABASE LOGGER

The Aspera Enterprise Server supports the logging of all Aspera transactions to a MySQL database. The configuration requires a MySQL database system on a remote machine on the same network. To configure the database, you will need to set up the database schema on the remote machine, and configure the Aspera Enterprise Server on the Isilon cluster to send statistics updates to the remote database.

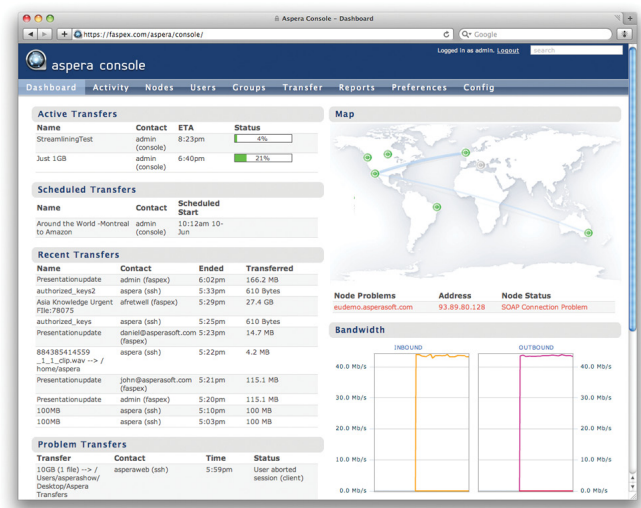


Figure 5: Aspera Console web-based application

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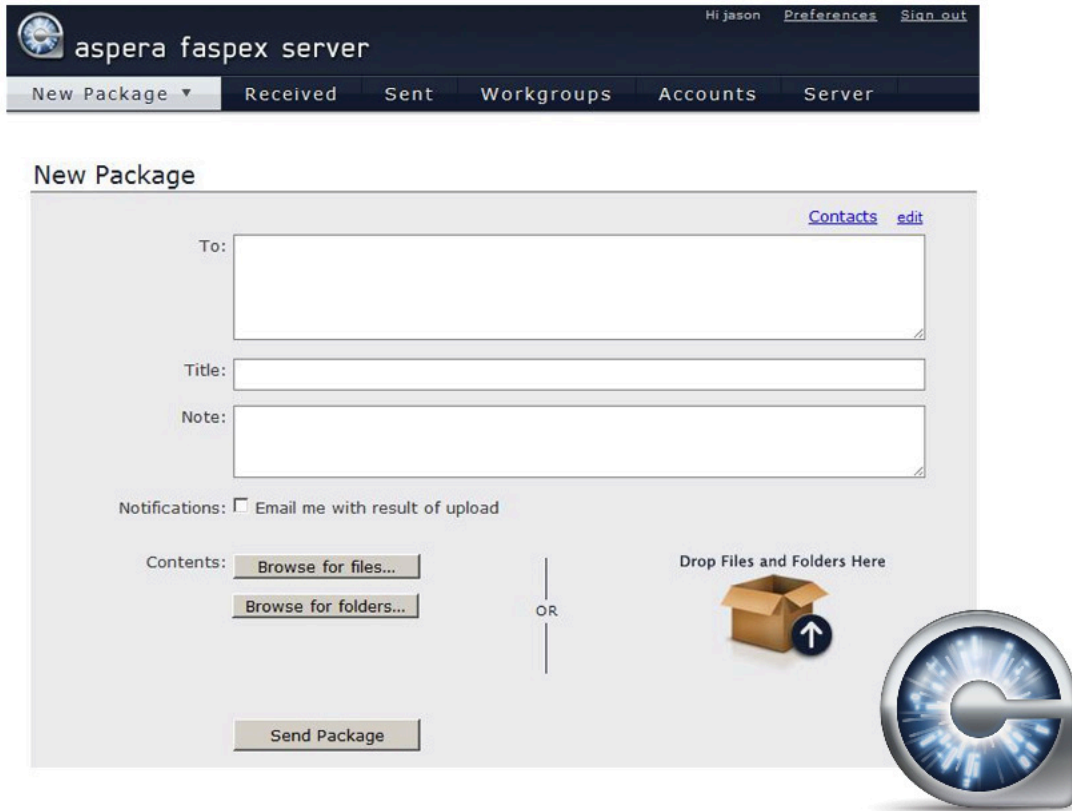


Figure 6: *faspex* Server drag-and-drop file delivery

## GLOBAL PERSON-TO-PERSON FILE DELIVERY

### ASPERA FASPEX SERVER

Aspera *faspex* Server provides an intuitive, efficient way for individuals and groups to collaborate and exchange files and directories of any size, while enjoying Aspera's unrivaled transfer speed. Users create and receive digital deliveries from an easy-to-use web interface or a simple desktop application; recipients are notified via e-mail and Aspera's patented FASP transport technology handles the movement of data to and from the server.

Built for enterprise workflows of any scale, the Aspera *faspex* Server includes comprehensive user and server administration capabilities and can also be remotely monitored and controlled via Aspera Console. A 3-tier application architecture allows the Enterprise Server to be deployed on an Isilon cluster, separate from the *faspex* Server for unlimited scale out of transfer performance and network capacity.

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### SAMPLE USE CASES

This section highlights a few use cases involving Isilon clusters and other remote endpoints for transferring data using Aspera software.

#### TRANSFERRING FILES FROM NON-ISILON CLIENTS TO AN ISILON CLUSTER

This is the basic use case where an Aspera Client connects to an Aspera server, hosted on a remote Isilon cluster, and initiates a transfer. The link can be any IP network link such as a DSL line, satellite link, or another LAN in a remote branch. When a connection is established, the user is authenticated on the Isilon cluster, encryption keys are exchanged, and file data is transferred over a secure session using FASP. By configuring users to be assigned a unique Aspera shell on the Isilon cluster, authenticated users can be restricted (sandboxed) to see only a portion of the file system, or only be able to transfer files but not create/delete files. Once a transfer begins, a status file is created on the target destination per each file being transferred. During the transfer, status is tracked with checksum updates and other progress information. If the connection is dropped, Aspera Client will re-establish the connection and continue the transfer from the point of interruption. Using Isilon SmartConnect Advanced, if for some reason the cluster node, where the transfer took place, is unavailable, the node IP is assigned to another node and the transfer can resume seamlessly on the newly assigned node.

In addition, the transfer rate can be monitored by the Client and modified on-the-fly by adjusting the minimum and maximum rate control bar. Different transfers can then be run using different transfer rates or rate control modes, based on priority and quality of service requirements. Data transfers can also be configured to adjust the transfer rate automatically if other network activity is detected on the network with maximum and minimum limits applied.

#### WEB-BASED FILE TRANSFERS

When using the Aspera Connect Server on the Isilon cluster, the server directory listings can be exposed via a simple, customizable web portal. Once web transfers are enabled on the cluster, remote users simply point their browsers to the

Isilon cluster and transfer files over the web with the Aspera Connect high-performance browser plug-in. The small footprint plug-in is compatible with most standard browsers, installs on demand, and powers high-speed uploads and downloads with the Aspera Connect Server. The Aspera Connect Server web application can be customized to provide specific workflows and a custom look and feel.

#### DATA TRANSFER FROM REMOTE FILERS TO AN ISILON CLUSTER

Most filers (file servers) cannot host Aspera applications. This includes all NAS appliances other than Isilon clusters. To facilitate a FASP transfer between non-Isilon filers, a client machine can be connected to a local filer using any standard file sharing protocol such as a CIFS share, or an NFS mount, and separately connect to a remote Isilon cluster using Aspera Client. Using this scheme, a transfer can be initiated from the local filer to the remote Isilon cluster through the Aspera Client. In other cases, file servers such as Windows Storage Server or Mac Xserver can host the Aspera Client, in which case transfers can take place directly from the file server to the Isilon cluster. To scale performance, multiple client machines with Aspera Client can create similar transfer connections working concurrently to transfer different sub-directories of the filer. All clients can use the same Isilon cluster SmartConnect zone. The SmartConnect software module on the Isilon cluster will balance the Client connections across all Isilon cluster nodes in that zone, each connection contributing linearly to the overall transfer throughput. For example, on a DS3 WAN between Los Angeles, CA and London, UK, with bandwidth of 45 Mbps, 10 clients connected to 10 Isilon cluster nodes can produce an aggregate transfer rate of  $10 \times 44 \text{ Mbps} = 440 \text{ Mbps}$ .

#### PARALLELIZED DATA TRANSFERS BETWEEN TWO REMOTE ISILON CLUSTERS

When data is transferred between two Isilon clusters, further parallelization can be achieved. By using special Aspera Client command line options, identical transfer streams can be launched from each node on the source cluster working together on the same dataset. In this case, the dataset on the source cluster does not need to be manually carved out between the transfer streams. Individual large files are broken off into smaller chunks and sent across multiple streams. This

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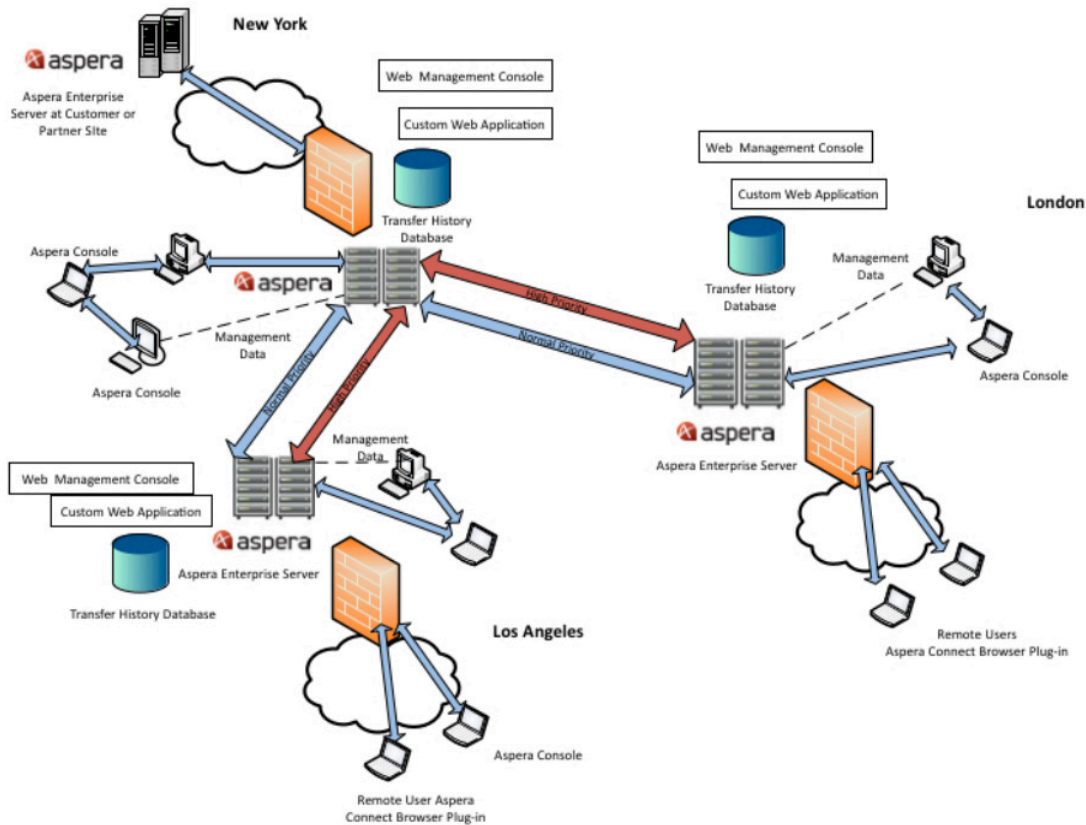


Figure 7: Example of a globally deployed Aspera / Isilon solution

enables sending in parallel multi-gigabyte and multi-terabyte files as well as large datasets of small files.

### AUTOMATED TRANSFERS USING CLIENT 'HOT FOLDERS'

Whether pushing content from a central location to remote locations, or pulling fresh content from the central location, Aspera Client provides a mechanism to automate transfers using the 'hot folders' feature. This feature allows a user to designate certain folders to be monitored for changes. Any new or changed file data in these folders is automatically transferred to the predefined remote location. This feature can be used for pushing content from local folders or pulling content from remote folders.

### SUMMARY

Aspera and Isilon Systems have partnered to create a predictable, non-disruptive high performance Wide Area File and Content Delivery solution designed specifically for moving large data sets over long distances, at the fastest possible speed. Aspera's cluster-aware high-speed transfer software coupled with Isilon OneFS operating system and Isilon scale out NAS is uniquely enabled to transfer and store file assets of any size, with maximum speed, over any IP network, with complete bandwidth control and security. This cost-effective and breakthrough performance solution eliminates the bottlenecks of conventional transport protocols and server technologies, and delivers performance and reliability of scale-out NAS across unreliable, high latency and low bandwidth networks. Transfers

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## The Aspera and Isilon Solution for High-speed File and Content Delivery over the Wide Area

occur with maximum bandwidth efficiency from source to storage, and are stable, robust and predictable, even for the largest files, most challenging networks and distances, and highly concurrent and highly loaded transfer patterns.

Other WAN technologies that focus on caching static content near user endpoints, or compressing data before transfer, can be added to complement Aspera but cannot replace it when dynamic incompressible content needs to be transferred across the WAN. IT and storage administrators must evaluate the nature of their data to determine which mix best suits their business needs.

### ABOUT ASPERA

Aspera is the creator of next-generation transport technologies that move the world's digital assets at maximum speed regardless of file size, transfer distance and network conditions. Based on its patented FASP™ protocol, Aspera software fully utilizes existing infrastructures to deliver the fastest, most predictable file transfer experience. Aspera's core technology delivers unprecedented control over bandwidth, complete security and uncompromising reliability.

#### Aspera, Inc.

5900 Hollis Street Suite E

Emeryville, CA 94608

Phone: +1 (510) 849-2386

Fax: +1 (510) 868-8392

Email: sales@asperasoft.com

### ABOUT ISILON SYSTEMS

Isilon Systems is the worldwide leader in scale-out NAS systems and software for digital content and unstructured data, enabling enterprises to transform data into information — and information into breakthroughs. Isilon's award-winning family of IQ scale-out NAS systems combines Isilon's OneFS® operating system software with the latest advances in industry-standard hardware to deliver modular, pay-as-you-grow, enterprise-class storage systems. Isilon's scale-out NAS solutions speed access to critical business information while dramatically reducing the

cost and complexity of storing it. Information about Isilon can be found at <http://www.isilon.com> or contact Isilon Systems at:

#### Isilon Systems, Inc.

3101 Western Avenue

Seattle, WA 98121

Toll-Free: 877-2-ISILON

Phone: 206-315-7602

Fax: 206-315-7501

Email: sales@isilon.com

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### APPENDIX A: PERFORMANCE CONSIDERATIONS

Aspera FASP transport has no theoretical throughput limit. The protocol throughput scales from 50 kbps to Multi-Gigabit speeds independent of network latency and will remain efficient through packet loss rates of 50% or more. On most networks, maximum transfer speeds are limited by the end-to-end network capacity. However, on high-speed networks (100 Mbps or more), the transfer speed may be limited not by network capacity but by the resources of the endpoint computers. In this case the maximum file transfer rate is determined by one of the following factors:

- **Hard disk performance:** The I/O throughput, and the disk bus architecture, (e.g. IDE, SCSI, ATA, and Fibre Channel).
- **Network I/O performance:** The interface card and the internal bus of the computer. Since the FASP protocol is based on SSH for establishing a secure connection and UDP transport for data transfer, the following network configuration settings should be considered:
  - **Firewall:** TCP port 22 and UDP ports 33001 should be open to allow FASP transport.
  - **Routing:** Certain QoS configurations have different priorities for UDP and TCP traffic. Since FASP is based on proper UDP, QoS policies should be enabled.