



**Optimizing
Business Continuity
and Disaster Recovery Capabilities
for Lotus Notes® / Domino®**

A WHITE PAPER

Abstract: The FalconStor Software® Solution for Lotus Notes/Domino delivers rapid, reliable, quality backup, restore, and recovery associated with routine and unplanned events, minimizing downtime, maximizing availability, streamlining storage administration, and reducing associated costs. The result is improved performance, availability, resource utilization, and management in an enterprise environment.

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Introduction

This white paper highlights the challenges associated with data protection in a Lotus Notes®/Domino® environment¹ as well as illustrates how the FalconStor Software® Solution for Lotus Notes/Domino can improve both business continuity and disaster recovery capabilities in a Lotus Notes/Domino environment.

This paper, as well as the FalconStor Solution for Lotus Notes/Domino itself, focus on the challenges and capabilities associated with Lotus Notes and Domino 6.5 and 6.0 on Microsoft® Windows® and Linux® platforms, as well as 32- and 64-bit agents.

The FalconStor products and features referenced here—including IPStor®, TimeMark®, TimeView®, DiskSafe™, IPStor® Snapshot Agent for Lotus Notes®/Domino®, IPStor® Backup and BareMetal Recovery, IPStor® Remote Replication Software, and IPStor® Active-Active Failover—are part of a comprehensive array of integrated, scalable software options available in the FalconStor Solution for Lotus Notes/Domino. Functionality is the focus of this paper. For additional details, please refer to the FalconStor product datasheets and brochures that are available via the company's website at www.falconstor.com.

Data Protection Challenges in a Lotus Notes/Domino Environment

Enterprise success today hinges on critical application and data availability. Messaging and other collaborative capabilities rest at the absolute center of day-to-day administrative and business communications. In order to perform and flourish, companies must be able to reliably and efficiently send and receive messages; set and change appointments; and transmit, store, retrieve, and recover associated data and records.

Demonstrating their breadth and effectiveness, Lotus Notes/Domino servers are implemented widely for highly available enterprise messaging, calendaring, scheduling, and other integrated collaborative capabilities. Thousands of users within a single organization—across disparate locations—expect and require the application and associated data to be accessible at all times and under all conditions. Application and data unavailability resulting from downtime of any sort, for any reason, even in the event of a disaster, is unacceptable. Operational continuity is paramount. Consequently, data protection schemes must provide for rapid, seamless, non-disruptive backup, restore, and recovery of Lotus Notes/Domino environments.

Lotus Notes/Domino excels in performance and dependability, and boasts low implementation and maintenance costs. However, due to the popularity and use of messaging applications, coupled with the equally explosive growth in associated data volume, companies relying on Lotus Notes/Domino often find themselves with a proliferation of servers, storage, and data—at both local and remote sites—that can be difficult to administer, manage, and protect. This can promote ongoing and broad resource inefficiency, affecting enterprise performance, productivity, and bottom lines. The typical Lotus Notes/Domino-dependent enterprise hosts thousands of active mailboxes, multiple servers, and increasing terabytes of associated email storage capacity. Because enterprises typically grow in a piecemeal manner, the de facto result is often a disconnected, often redundant infrastructure, unnecessarily complex processes, higher overhead,

¹ Inclusive of the Lotus Notes client and the IBM Lotus Domino Server.

wasted assets, and hindered application availability—even in an otherwise-promising enterprise Lotus Notes/Domino scenario.

While Lotus Notes/Domino applications feature some built-in and supplemental data protection capabilities, total enterprise data protection—comprehensive and efficient backup, restore, and disaster recovery—in such a critically important and dense environment can be daunting, let alone ineffective. Ultimately, enterprises choose Lotus Notes/Domino for its availability. As such, they absolutely need to design and implement highly available Lotus Notes/Domino environments. Yet, in the most common scenario, Lotus Notes/Domino availability is restricted not by application server performance or capability but by backup, restore, and recovery windows, which are driven by process- and task-time. The key to the most effective and highly performing enterprise Lotus Notes/Domino system, therefore, is the optimization of data protection capabilities.

In any Lotus Notes/Domino environment, the heightening availability requirements and burgeoning user traffic—impacting the rate of data change and corresponding resource requirements—as well as the associated volume and data growth command constant attention from any IT administrator. Frequent data protection challenges and concerns include:

- Shrinking backup windows but larger backup requirements (making more traditional methods of backup less realistic)
- Hard-to-achieve recovery point and time objectives (putting enterprise data and business continuity at risk in the event of unplanned downtime due to a disaster)
- A constant need to reconfigure disk resources and add storage capacity (a result of growth in data messaging volumes, application servers, and attachments, increasing email storage capacity requirements, as well as increasingly strict regulatory compliance requirements for email record retention, producing new and broader email storage capacity requirements—both inhibited by an inability to dynamically manage storage and storage capacity growth across multiple servers)

Slow and Inadequate Backup, Restore, and Recovery

Most data protection regimes provide for data copying. Even Lotus Notes/Domino servers—through inherent functionality—support automatic backup of message and database files, as well as associated data. However, the speed and quality of enterprise replication varies by implementation, from solution to solution, and is largely affected by the associated storage solution. Where backup capabilities might have sufficed in the past, for many enterprises, they are no longer adequate in the current environment.

Depending on the particular enterprise and the level of associated transactions over a given period, the rate at which data changes—and, therefore, must be re-protected—varies greatly. Many storage and data protection solutions simply force Lotus Notes/Domino administrators to duplicate entire data volumes every time, pushing the boundaries of storage capacity and management by precluding rapid, efficient, incremental data protection.

Most traditional solutions also mandate either online (“hot”) or offline (“cold”) backup, but rarely are they flexible enough to support both methods. If a solution mandates online backup techniques, it likely reduces primary server and/or production environment availability by precluding effective offline data copying. If a solution mandates offline backup techniques, it likely reduces availability by precluding effective online data access. Either way, an enterprise customer depending on a

traditional Lotus Notes/Domino data protection scheme is left with little choice. The same can be said for local and remote backup capabilities. Without an advanced solution, the ability to centrally replicate all enterprise Lotus Notes/Domino data is inadequate.

Regardless of the process functionality, Lotus Notes/Domino backup tasks can substantially affect critical Lotus Notes/Domino application availability because most traditional data protection regimes and storage infrastructures were not designed to address the replication needs of today's typical 24x7xForever enterprise operating environment. In this context, optimized Lotus Notes/Domino data protection leads to maximum Lotus Notes/Domino application availability.

Data restore and recovery in a Lotus Notes/Domino enterprise environment is equally challenging. Here again, Lotus Notes/Domino servers offer built-in recovery capabilities. However, the ability to quickly resume operations after a version upgrade or after repairing and recovering a corrupt database or retrieving and restoring a single corrupt record—with assured data integrity, limited downtime, and resource efficiency—is not guaranteed.

Most traditional solutions provide slow and undiscerning enterprise data recovery, at best, forcing IT staff to sort through a maze of data volumes and types, while users experience critical application downtime. In a high-growth Lotus Notes/Domino environment, these challenges are exacerbated. In addition, when the time comes to attempt data recovery, those organizations that still rely on tape-only backup regimes experience even higher degrees of data loss and unavailability due to infrequent, unreliable, or inefficient tape backups.

In short, in an enterprise Lotus Notes/Domino environment, administrators often spend too much time trying to meet backup needs; correct resulting problems; restore deleted mails; and perform archive retrievals, emergency restores, or system recoveries. In the end, despite Lotus Notes/Domino capabilities, users do not experience the application uptime envisioned and needed because, due to data protection shortfalls, administrators cannot achieve the system performance required. Once again, backup, restore, and recovery optimization in a Lotus Notes/Domino environment is the key.

Complex and Unreliable Disaster Recovery

While many firms dedicate countless hours to disaster recovery strategies and plans, not many are truly assured of a fully operational recovery—with current data and its integrity intact—following a disaster. In an enterprise Lotus Notes/Domino environment, lost or inaccessible data due to an unplanned event can be catastrophic. The existing data storage infrastructure at some companies portends that the best-case scenario is resumption of business—often days later—under an old or incomplete messaging data volume. Sometimes, the next-best scenario is resumption of business with corrupt data from a sudden or rolling outage.

In addition, many enterprises set up duplicate hardware and software “hot-spare” combinations in an effort to protect themselves from a site failure. Oftentimes, however, if the hot-spare disaster recovery combination is not an exact match—in product type, configuration, and currency—of the primary production server or combination of servers, effectively resuming Lotus Notes/Domino operations during or after a disaster remains elusive.

The bottom line is that many of today's enterprise Lotus Notes/Domino environments are not prepared to handle or recover from a disaster. Even with adherence to Lotus Notes/Domino disaster recovery guidelines, many of these environments are certainly not set up to do so with any sense of simplicity, speed, or reliability. At a minimum, most enterprise Lotus Notes/Domino environments bear a heightened level of data vulnerability, and the companies that rely on them operate at a heightened level of business risk.

Such a result cheats Lotus Notes/Domino application aptitude. With the proper data protection and storage solution, disaster recovery capabilities in an enterprise Lotus Notes/Domino environment can be optimized to reduce data vulnerability and business risk—as well as improve operating efficiencies and overall performance.

Difficult-to-Manage Infrastructure and Processes

In the typical enterprise Lotus Notes/Domino environment, the variety and placement of the infrastructure alone can make storage management difficult. Enterprise-wide, Lotus Notes/Domino systems can depend on a combination of storage types (DAS, NAS, SAN) and operating systems (Windows, Linux, AIX, Solaris, etc.), adding complexity and duplicity to data protection tasks, to say nothing of overall system management. Due to the complexity of the typical enterprise environment, IT administrators often spend a significant amount of time carrying out ongoing management tasks that include provisioning, configuring, and mapping for performance tuning, space management, and system resource tuning.

For example, for each mail database, administrators must manage the database file system and volume manager as well as an endless number of associated files. In addition, the ability to scale Lotus Notes/Domino storage without downtime (and, therefore, without disrupting application availability and messaging capabilities) is not a common aptitude. However, data volumes can grow 20% or more annually, mandating additional storage capacity and management requirements. Also, most email archival schemes were not devised for quick access, at a granular level, to archived messaging data. The inability to rapidly recover a storage group, mail file, or message in minutes means not just additional user productivity downtime, but also the absorption of wasted administrative labor hours as well as any possible regulatory consequences due to lags in response time. In a critical application environment, the inability to meet regulatory email retention and retrieval rules can mean fines, imprisonment, or operational suspension.

These and other difficulties compound the challenges facing today's IT and storage administrators. Some of their management tasks can require dozens of manual activities and take days or weeks under a traditional storage scenario. FalconStor Software understands data storage and the critical nature of Lotus Notes/Domino application needs, especially in an enterprise environment. In response to this, the FalconStor Solution for Lotus Notes/Domino optimizes data protection—for backup, restore, and disaster recovery—in a Lotus Notes/Domino enterprise environment.

The FalconStor Solution for Lotus Notes/Domino

By combining a standard open architecture, advanced storage virtualization features, and intelligent storage management capabilities and services with advanced, application-specific tools, FalconStor ensures that enterprise Lotus Notes/Domino environments are reliably protected, highly available, and easily managed. The consistent results of the FalconStor Solution for Lotus Notes/Domino are:

- Optimized data protection and availability
- Efficient storage provisioning
- Maximized storage utilization
- Lower management costs
- Reduced downtime
- Lower total cost of ownership
- Increased return on investment

The FalconStor Solution for Lotus Notes/Domino enables the utmost in business continuity and disaster recovery by moving storage functionality and management—specific to the application—to the layer between the host and the storage device, into the storage network. The center of the FalconStor solution—FalconStor IPStor Enterprise—delivers an intelligent storage infrastructure across heterogeneous environments.

The software architecture is easy to understand, deploy, and manage. It is simple to integrate into an existing environment since the associated IPStor appliance (a standard, off-the-shelf, Linux- or Solaris-based server running IPStor software) sits between the servers and storage device, and supports any-to-any connectivity. IPStor places no limitations on hardware, software, or storage choices—an important point in today's varied Lotus Notes/Domino environments. It works with any type of storage system that uses Fibre Channel (FC), iSCSI, or direct connections, or any combination of those, from any vendor.

Implementing an IPStor-based storage solution in any environment (including in an existing enterprise Lotus Notes/Domino environment) is easy, and the associated services are readily available via the FalconStor intelligent wizard functionality. One or more IPStor appliances are simply positioned between the relevant Lotus Notes/Domino application servers and the currently associated server storage. IPStor can immediately see and access the storage devices that the servers were originally using. The original associated data is neither moved nor modified (unless desired).

With the FalconStor Solution for Lotus Notes/Domino, data protection is improved without changing the existing storage paradigm (unless desired). The storage devices appear to their respective servers as the same devices that they were using before the solution was implemented. Once the solution has been placed in the "data path" between the host (the application server) and the storage device, advanced data protection for backup, restore, and disaster recovery can be achieved immediately.

The FalconStor Solution for Lotus Notes/Domino offers rapid, simple, and comprehensive backup, restore, and disaster recovery capabilities, including:

- Point-and-click creation of transaction-consistent images of associated data
- Automatic, alternate-location (including offsite) creation of data replica
- Instantly accessible, full-integrity data backups (which can be achieved online or offline) for disaster recovery (for example, in the event of a site loss or sudden or rolling disaster)
- Complete recovery from logical corruption (such as the loss of a group in a mission-critical data set or the loss of a single mailbox or message)
- Administrator-initiated restores

The FalconStor Solution for Lotus Notes/Domino also delivers the improved infrastructure and management efficiencies that come with any IPStor-centered solution. The following sections illustrate how the FalconStor solution optimizes Lotus Notes/Domino performance and availability in backup, restore, and disaster recovery scenarios, as well as how it elevates overall IT asset performance and availability.

Improved Business Continuity Capabilities

The FalconStor Solution for Lotus Notes/Domino offers end-to-end data protection; immediate recovery from hardware, software, and network failures; support for ongoing operations without downtime; and non-stop data availability. Whether it's used to enable "what-if" scenarios or mitigate administrative errors, user errors, or data degradation due to outside events, the FalconStor Solution ensures highly available, highly dependable enterprise Lotus Notes/Domino environments, enabling the highest level of operational continuity.

With FalconStor software (via the IPStor TimeMark option), administrators gain an instant, granular, point-in-time (PiT) rollback capability (via disk-based journaling) to protect data from soft errors such as accidental deletions, corruptions, and viruses. At any given point in time, an administrator can roll back to a mailbox database status of minutes, hours, days, weeks, or months prior. Even individual mail messages, deleted outside of the Lotus Notes/Domino server's inherent retention policies or supplemental data protection features, can be retrieved quickly and fully intact.

The FalconStor Solution for Lotus Notes/Domino permits the creation of continual, consistent PiT images of any managed volume (including of both data and logs) by using copy-on-first-write technology. TimeMark PiT snapshots behave much like physical copies of data, but, unlike a physical mirror, they do not require a significant amount of time or storage capacity to create. Snapshots require mere moments and only a fraction of the disk storage space demanded by the original application. Consequently, a greater volume of associated data can be protected using snapshot technology, and backups and restores can be accomplished without negatively impacting data integrity or availability. The FalconStor solution can be used for both hot and cold backups, as well as for remote replication and PiT disaster recovery.

When a snapshot request comes in, the associated mail database server is put into online backup mode (i.e., a hot backup in archive-log mode, where the table spaces are altered to begin the backup). Normal operations are then resumed (when the table spaces are altered again to end the backup). The Virtual Device Interface (VDI) exposes the backup/restore functionality inherent in the application, permitting the more efficient FalconStor snapshot functionality to supersede. Because this process does not require reading the data from beginning to end, but rather simply capturing

an image of the data on the disk, backup speed is greatly increased, and the backup window is dramatically reduced. Both process time improvements translate to greater application availability.

With the FalconStor Solution for Lotus Notes/Domino, users can create up to 256 TimeMark “copies” per data volume and still use only a small amount of storage—20% of the original capacity, on average. Snapshots can be scheduled to occur by the minute, hour, day, etc., for different intervals, using varying changed-data parameters. In other words, with a FalconStor Solution, customized data protection policies can be set for different data volumes, further extending Lotus Notes/Domino data protection optimization.

Because only changed data is saved, less storage is required. As a result, incremental backups can be stored online, making all backed up data from any of the 256 PIT images immediately and easily retrievable. With this capability, restores require only the time it takes to make a few mouse clicks, not the time it would take to retrieve, load, and scan an actual linear storage medium like tape.

The FalconStor Solution for Lotus Notes/Domino also permits considerable flexibility in backup methodology. For example, a FalconStor customer can perform hot, online backups as described previously, or traditional cold offline or export backups. In an offline scenario, the associated Lotus Notes/Domino databases are shut down entirely (i.e., during non-business hours), and all data, log, and control files can be backed up rapidly and efficiently via IPStor snapshot capabilities. When the database is restarted, normal operations are resumed. In an export scenario, data table information can also be exported to a separate temporary file outside of the production environment, and the FalconStor software can capture an image of the “logical” definitions and data (as opposed to the “physical” data) in the temporary file or place a copy of the entire file on a backup server. Either way, the backup window time is taken offline.

The FalconStor Solution for Lotus Notes/Domino (via the TimeView extension to the TimeMark option) also permits an administrator to mount any TimeMark snapshot as a virtual disk—or TimeView—and assign it to any server connected to the IPStor-managed storage network. Not only does the server then have full read-write access to the new disk, but TimeView copies can be subsequently backed up or mounted for other uses (such as “what if” scenarios or data mining), while the original data set is in use and unaffected. TimeViews can also be taken from replicated data copies, allowing operations (such as backup, reporting, consistency checking, or retrieval of a lost message, mailbox, or group) on a stable image in a remote location. The same functionality can be used for recovery when system reset is undesired. In addition, FalconStor snapshot capabilities enable data volume modeling without affecting the production data.

FalconStor software excels in supporting high-growth, high-volume data environments that require strict and dependable backup regimes. This is especially true for critical messaging applications like Lotus Notes/Domino because FalconStor solutions are conceived, designed, and fully integrated to be application-specific.

Advanced Backup and Recovery for Lotus Notes/Domino:

- IPStor Snapshot Agent for Lotus Notes/Domino and TimeMark features increase backup frequency with 100% guaranteed data integrity
- IPStor TimeView feature delivers an accelerated, space-efficient message/mailbox recovery process designed to exceed recovery time objectives (RTOs)
- IPStor Backup & BareMetal Recovery feature provides the ability to guard against boot disk failure

Meeting Recovery Time Objectives with Snapshot Agents for Lotus Notes/Domino

FalconStor software solutions can offer rapid and reliable backup and recovery because FalconStor has combined IPStor functionalities (such as TimeMark and TimeView) with an application-aware, client-based snapshot agent—the IPStor Snapshot Agent for Lotus Notes/Domino. This unique combination, the operability of which is certified via the FalconStor-Lotus partnership, minimizes downtime with quick time-to-restore and ensures that active application data is backed up with full transactional integrity and PiT consistency, even if the data is spread across multiple drives and locations.

With the FalconStor solution, when the TimeMark process is activated (either manually or automatically via scheduled policies), the Lotus Notes/Domino snapshot agent communicates with the appropriate server to let it know that a snapshot is about to be taken. The snapshot agent makes calls to the Lotus Notes/Domino APIs to put the server in hot backup mode, momentarily quiescing activity. All transactions are flushed to disk (simultaneously for both the data and transaction log disks) to ensure data integrity. Once the snapshot is taken, the server resumes normal operations. The result is a snapshot that contains a transactionally consistent picture of the data and associated logs. FalconStor IPStor snapshot agents are specifically written and tested for each application, including Lotus Notes/Domino, to ensure that the application is correctly quiesced, resulting in a PiT TimeMark that has guaranteed integrity.

Although multiple Lotus Notes/Domino datasets can reside on the same device, each associated database—particularly mission-critical databases and associated logs and database files—can be placed on separate disks to address both fault tolerance and performance issues. For example, in a single enterprise environment, three databases might be placed on three separate disks to reduce data risk and availability impact. With many data protection solutions, this decision imposes the same scenario on the snapshot agent. The FalconStor Solution for Lotus Notes/Domino, however, delivers more options. With this solution, an administrator can put each database in backup mode individually, one database at a time, or together.

Further extending snapshot technology, the IPStor Snapshot Group feature allows disks to be grouped for snapshot synchronization purposes. Snapshots for all resources in a group are taken at the same time, whenever a snapshot is triggered. This feature, working in conjunction with the IPStor Snapshot Agent for Lotus Notes/Domino, ensures integrity for transaction logs and files that reside on multiple disks.

For groups, mailboxes, or individual messages, snapshot agents make certain that each TimeMark is valid and mountable by the server. While many other data protection solutions fail to ensure that the data has been successfully written to the backup tape or disk, to meet recovery time objectives (RTOs), or to provide high-quality recovery, the FalconStor Solution for Lotus Notes/Domino excels by permitting rapid and complete data recovery. The FalconStor Solution makes it unnecessary to perform time-consuming data validity checks (e.g., using the `chkdsk` command) and recovery procedures in order to successfully mount data.

Lotus Notes/Domino Continuity Challenge: User Deletes Email

The FalconStor Solution for Lotus Notes/Domino automates and expedites single or group mailbox or message recovery, again maximizing application availability and performance. With the FalconStor solution (in this case, via IPStor Message Recovery, which leverages IPStor TimeMark/TimeView functionality to capture, browse, and retrieve lost mailboxes or messages), users can take any TimeMark PiT snapshot of a messaging database and easily mount it on the Message Recovery server. The Message Recovery server resides in a separate domain and assumes the identity of the production server. The Message Recovery wizard provides an

automated recovery process, allowing the snapshot to be mounted as a TimeView on the Message Recovery server.

Only by impersonating the production server can the database provided by the TimeView be mounted to the Message Recovery server. Once the database is mounted on the Message Recovery server, the wizard automatically extracts the requested email, for example, based on user name, and mails it back to either the administrator or the end user for easy re-import.

Many enterprises rely on the inherent mailbox and mail message retention policy settings of Lotus Notes/Domino servers to protect against loss of an individual mailbox or message. If an item is deleted within the set retention parameters, it can be recovered and restored within a few steps. However, if the item is deleted outside of the set retention parameters (for example, if items are set to be retained for 30 days and the item was deleted 45 days prior) and it must be retrieved from backup, an administrator could take hours or days to recover the item. In some cases, an entire database must be recovered and then the desired mailbox or message found. These traditional backup methods make data recovery complex and time-consuming.

With the FalconStor solution, the entire message recovery process takes minutes instead of hours or days (as can be the case with tape). Since it's possible to store up to 256 TimeMark snapshots, a mailbox or message can be recovered rapidly and restored to a state from minutes, hours, days, or months prior to being deleted. The granularity offered by the scheduled snapshot policy provides flexibility for all enterprise Lotus Notes/Domino environments. In addition, all of this can be done without performing a separate backup for recovery purposes. Most importantly, the mailbox recovery is completed while production servers are 100% operational—without any downtime.

Lotus Notes/Domino Continuity Challenge: Non-Disaster Hardware Failure

The FalconStor Solution for Lotus Notes/Domino protects against “soft” errors (i.e., when hardware operations are maintained, but non-hardware-associated errors affect continuity) as well as against “hard” errors (i.e., when software operations are maintained, but hardware-associated failures affect continuity). This solution limits downtime and optimizes application and data availability in either scenario.

For example, many competing backup and recovery solutions for Lotus Notes/Domino protect against data loss but not against boot disk failure, forcing unnecessary downtime for hardware replacement or repair in order to restore the server to working order. If a Lotus Notes/Domino server cannot be rebooted, even the most fault-tolerant data protection scheme is useless.

The FalconStor Solution for Lotus Notes/Domino (in conjunction with DiskSafe) expedites data recovery even after boot disk failure by capturing the system's boot disk image and saving it to a separate, online disk. Return-to-service time is reduced to minutes rather than hours or days because the targeted system can be rapidly rebooted from the remote disk over standard protocols (iSCSI or FC), and normal operations can continue. Once the local boot disk is repaired or replaced, the boot information and data can be restored to the local disk via simple point-and-click functionality. The FalconStor solution makes certain that both the Domino server and the associated data are protected and highly available.

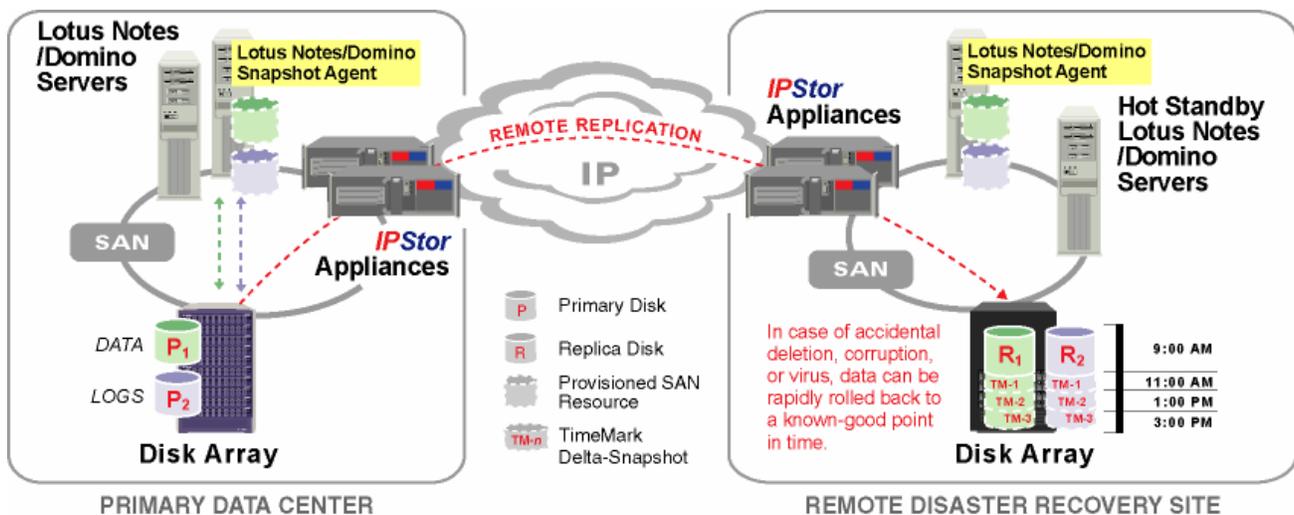
Improved Disaster Recovery Capabilities

The ultimate business continuity challenge is disaster recovery. End-to-end, enterprise business continuity—especially for mission-critical messaging applications—is mandatory, even in the event of a disaster. Many solutions are available to maintain Lotus Notes/Domino high availability.

However, the FalconStor Solution for Lotus Notes/Domino ensures enterprise application business continuity in the event of all kinds of disasters—including sudden outages, rolling outages, and site loss—for all kinds of facilities, from the headquarter to remote data centers and offices.

No matter what the cause, the FalconStor Solution for Lotus Notes/Domino secures business continuity before, during, and after a disaster strikes, without the expense or effort to integrate new, specialized storage arrays. With the FalconStor solution, disaster recovery-associated Lotus Notes/Domino data protection can be assumed the minute FalconStor software is installed. In the event of any kind of disaster, Lotus Notes/Domino operations can be resumed rapidly with minimal data or production time loss.

Utility power failures, local or widespread fires or floods, high-level hacker attacks, and national emergencies all can cause unplanned outages that leave a company's IT systems vulnerable and, quite often, inoperable. In a mission-critical enterprise Lotus Notes/Domino environment, IT administrators must devise a strategy—as well as build an infrastructure—that permits quick and effective disaster recovery. The FalconStor Solution for Lotus Notes/Domino can enable just that.



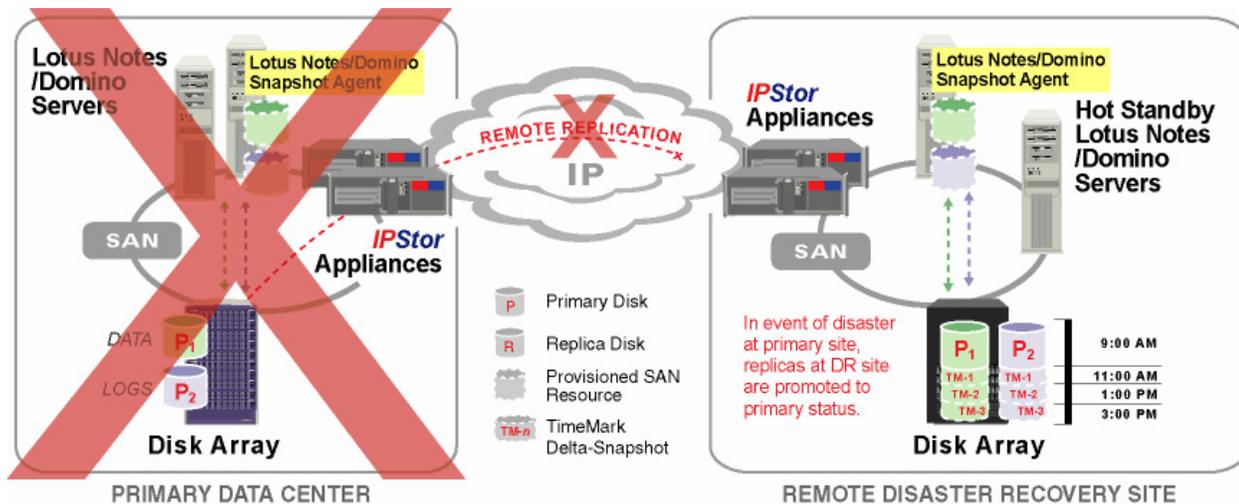
Optimized Delta-Based Replication

The FalconStor Solution for Lotus Notes/Domino epitomizes the optimal enterprise Lotus Notes/Domino disaster recovery architecture in terms of both speed and flexibility. The FalconStor solution (via IPStor functionality) facilitates simple yet comprehensive protection of mission-critical Lotus Notes/Domino data between data centers, or between remote offices and data centers, via innovative remote replication over IP (using a process similar to a hot export backup to create a second instance of Domino server data).

Replication over IP is reliable, secure, and efficient:

- Reliability is achieved through automatic retry and resume in case of disrupted replication sessions.
- Encryption ensures the security of the data in transit.
- Data compression combined with a high-resolution microscan (identifying sector-level changes) enables optimal use of WAN links.

Using delta-based replication over IP, the FalconStor application-aware, transaction-based, remote replication capability (via IPStor Remote Replication Software) enables sites to replicate changed Lotus Notes/Domino server data across any distance to similar or dissimilar hardware for continuous application operation in case of a disaster. The remote replication capability integrates seamlessly with the IPStor Snapshot Agent for Lotus Notes/Domino, maintaining consistent PiT copies of Lotus Notes/Domino data replicas for quick data recovery. And, with the FalconStor solution, the performance of the Domino production servers at the primary site is never affected.



After a quick, initial synchronization, the FalconStor solution easily protects even very large primary disk stores associated with Lotus Notes/Domino. Data compression and encryption are used to maximize network bandwidth and provide data security. FalconStor software allows bulk transfer of the replica via either mirror-and-ship or by image backup/restore via tape, so that the data replica is always in sync, outside of changes that occurred during the shipping or backup process. The FalconStor Solution can then scan the replica for departures from the initial map and sync up any differences (only changed blocks are applied). Once this is complete, the primary and replicated data are identical and concurrent.

Unlike traditional methods that demand more and more data volume duplication, driving up storage capacity and administrative requirements, the FalconStor solution optimizes Lotus Notes/Domino data protection and availability.

Lotus Notes/Domino Disaster Challenge: Site Loss

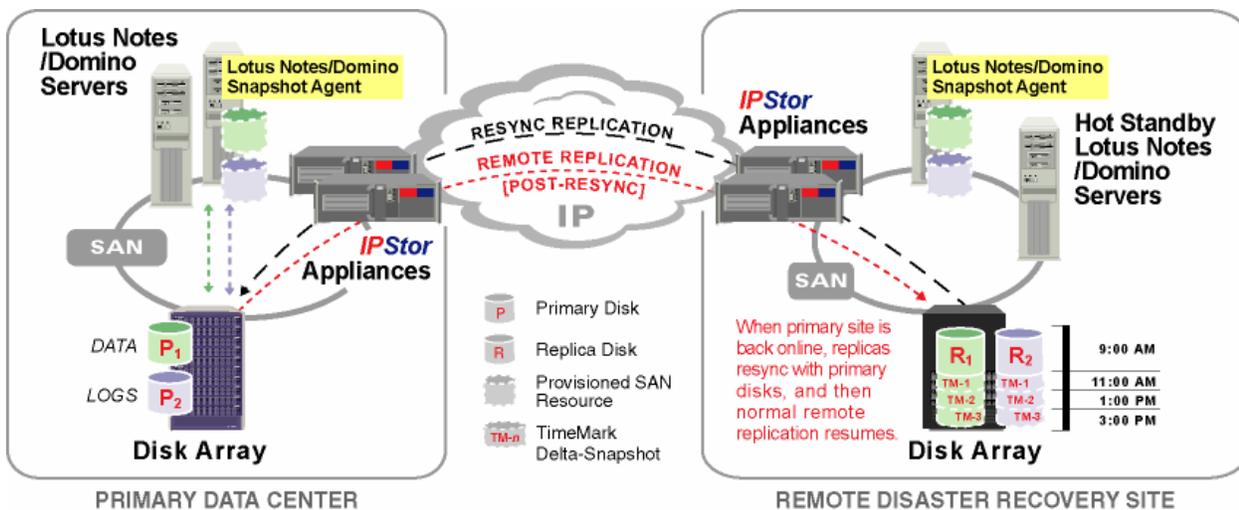
Specifically designed to help organizations cope with site loss, the FalconStor Solution for Lotus Notes/Domino provides automated, offsite data protection. This solution allows a replica disk to be pre-assigned to hot standby servers at the disaster recovery site. In the event of a disaster, the replica is promoted to primary status, and LUN assignment operates automatically. (LUN pre-assignment prevents the confusion that typically occurs in the midst of a disaster.) IT administrators have one less process to manage during their crisis.

After promotion and assignment, each standby Domino server is ready to be powered up. With the FalconStor solution, when the TimeMark PiT imaging option is enabled at the replica, each individual change is recorded. In the event of a disaster that causes associated Lotus

Notes/Domino data corruption, for example, any of the previous 256 snapshots can be used in a rollback (both current and previous versions can be mounted for read/write access over IP). And, because replica changes are stored in a separate area and not written to the stored replica until the full data set is confirmed received and intact, the FalconStor Solution for Lotus Notes/Domino guards against replica corruption and interruption.

Unlike other solutions, in a disaster recovery scenario, the FalconStor Solution for Lotus Notes/Domino guarantees that both the data and the boot disk are safe. Applying the same functionality used in any type of unplanned downtime, the FalconStor solution provides expedited recovery of data—even after boot disk failure—and does not require server takedown. Rapid disaster recovery is achieved with a remote boot, especially in the case of a total site loss, because the boot can be conducted from anywhere (with equivalent hardware), without productivity loss.

After the disaster recovery site has been promoted to production status, the remote standby Domino servers can service the entire enterprise.



Lotus Notes/Domino Disaster Challenge: Post-Disaster Restoration

Unlike most disaster recovery solutions, which do not address the methodology to quickly recover the primary site, the FalconStor Solution for Lotus Notes/Domino has been designed specifically to provide rapid, post-disaster restoration.

Following a disaster, to revive or restart the primary site after the problem or failure is rectified, reverse synchronization can be achieved by moving the Lotus Notes/Domino data from the disaster recovery site back to the primary site. The FalconStor Solution for Lotus Notes/Domino facilitates this “role reversal” by scanning for differences, minimizing the time and capacity necessary to re-establish the primary site.

Eliminating Potential Points of Failure for Lotus Notes/Domino Environments

FalconStor software facilitates high availability for Lotus Notes/Domino environments. To accomplish this, the FalconStor Solution for Lotus Notes/Domino (via the IPStor Active-Active Failover option) empowers one IPStor appliance to take over the processing tasks of a second IPStor appliance in the event of a system failure, protecting the enterprise Lotus Notes/Domino environment from any single point of failure.

In the FalconStor high availability scheme, the primary and secondary IPStor servers are independent appliances. Each might have assigned clients that are being serviced (active-active mode), or one might not be serving any clients while it awaits a failover (active-passive mode).

The FalconStor Solution for Lotus Notes/Domino can also make use of multipathing software to heighten business continuity. The solution leverages multipathing software at the application server to create parallel active storage paths that transparently reroute traffic to a redundant storage path without interruption.

For continuous operation during a planned or unplanned outage, the FalconStor Solution for Lotus Notes/Domino delivers a highly redundant storage solution offering 24x7xForever availability. Whether the outage is due to hardware failure or planned maintenance/upgrades, this solution ensures non-stop data availability.

Improved Overall Storage and Management Capabilities

The FalconStor Solution for Lotus Notes/Domino unifies the overall storage infrastructure and streamlines processes, improving data protection as well as data storage and management capabilities. In an enterprise Lotus Notes/Domino environment, this translates to the highest availability and the best possible performance.

First, the FalconStor solution is very flexible. It integrates into existing enterprise Lotus Notes/Domino server, storage, and data protection environments without changes to the existing hardware infrastructure or paradigm. With IPStor and other IPStor software options, storage can be immediately virtualized, and storage services can be instantly enabled. Simple wizards direct all management functionality. Lotus Notes/Domino server performance and availability are optimized via advanced data protection capabilities. Like all FalconStor solutions, the FalconStor Solution for Lotus Notes/Domino fits a customer's preferred method of doing business; FalconStor customers do not have to change their operations to fit FalconStor's approach.

Advanced Business Continuity and Disaster Recovery for Lotus Notes/Domino:

- Pre-disaster
 - Remote replication of LUNs via multiple TimeMarks and transactional integrity via snapshot agents
 - Pre-assignment of replica LUNs to standby Domino servers
- During disaster
 - Sudden disaster—RTO achieved through rapid promotion of replicas to the disaster recovery site
 - Rolling disaster—Immediate roll reversal, leveraging TimeMarks of primary and disaster recovery sites for business continuity
- Post-disaster
 - Reverse synchronization, scanning only for data that has changed, minimizes the time and capacity needed to re-establish the primary site

Second, FalconStor facilitates heterogeneous storage consolidation. IPStor maximizes capacity utilization through consolidation of application servers and disk resources across many different types of operating systems, cabinets, connections, and interfaces, regardless of the vendor. Storage managed by IPStor can be of any type (DAS, SAN, NAS, disk array, RAID, SSD), support any operating system (Windows, Linux, AIX, Solaris, HP-UX, NetWare, etc.), and reside at any location (local, remote). With FalconStor solutions, separate, disparate SAN islands can be unified over IP. Existing storage resources can be combined with new resources to create both SAN (block-level) and NAS (file-level) resources. As a result, in an

enterprise Lotus Notes/Domino environment, IPStor capabilities can be extended across architectural and geographical boundaries to provide the utmost in data protection, while still maintaining infrastructure performance, reliability, and integrity.

Third, for companies that need to improve operations, performance, and availability while leveraging existing storage investments, the FalconStor solution allows for complete use of legacy tools, including tape libraries and other backup tools. In fact, for even greater protection and for critical archival purposes, backup to tape can be completed via TimeView from a replica with no impact on the production environment, application, or data availability. In addition, the FalconStor Solution for Lotus Notes/Domino leverages existing third-party backup software. FalconStor software solutions (such as HyperTrac™ Backup Accelerator and ZeroImpact™ Backup) accelerate third-party backups while offloading the backup process from the production server, centralizing management, improving overall application availability, and further strengthening business continuity.

Fourth, FalconStor delivers centralized, simplified storage management. In an enterprise Lotus Notes/Domino environment, this translates into improved management of both single and multiple groups. IPStor software merges storage and storage services management at the IPStor console, a single, unified, easy-to-use, go-anywhere, Java-based interface. Fast and easy point-and-click and wizard functionality can be used for storage provisioning, management, and administration tasks. Lotus Notes/Domino-associated data management is simplified and costs are lowered by consolidating storage via the IPStor appliances and the console.

Fifth, downtime and performance degradation due to routine and non-routine tasks are significantly reduced with the FalconStor Solution for Lotus Notes/Domino, freeing up IT staff for more proactive and strategic assignments and limiting overall IT-associated risk. Downtime and task performance time are greatly reduced or eliminated during disk upgrade or replacement, data migration from old to new storage, and data replication. Downtime and task performance time associated with recovery are slashed to minutes.

Management Benefits for Lotus Notes/Domino:

- Maximum resource utilization of storage, tools, and personnel
- Enhanced performance of storage, tools, and personnel
- Greater availability of applications, data, storage, infrastructure, and personnel
- Efficient management of applications, data, storage, tools, and overall infrastructure

Finally, with the FalconStor solution, in enterprises using file system storage solutions (e.g., NAS), administrators gain the ability to add associated storage capacity (via the IPStor Capacity-On-Demand™, or COD function) without downtime of disrupting application functionality. The COD enables administrators to set policies that control automatic storage capacity expansion of specified volumes at specified thresholds. This capability is critical in enterprise Lotus Notes/Domino environments—where data volumes grow exponentially each year—and delivers more dependable functionality than the built in “petition” capacity allocation feature inherent in Lotus Notes/Domino. Projecting disk capacity requirements or space allocations 12 to 18 months in the future can be very difficult. With the COD feature, the worry, uncertainty, and cost inefficiencies associated with capacity planning are eliminated. The FalconStor Solution for Lotus Notes/Domino guarantees that storage capacity will always be available. Plus, IPStor can be used to serve other storage, further extending the COD benefits into the enterprise.

Conclusion

Successful business operations hinge on a company’s ability to maintain a high level of enterprise data availability. Critical messaging applications such as Lotus Notes demand advanced data storage management. In an enterprise Lotus Notes/Domino environment, the FalconStor solution optimizes application and data availability as well as storage management capabilities, delivering an enhanced backup, restore, and recovery regime that protects against soft and hard errors.

The result is not just greater business continuity, but also improved physical and human resource utilization, improved application and infrastructure performance, and easier and more efficient application and storage management. Most organizations cannot afford to lose precious operational uptime or valuable enterprise data. Most enterprises using Lotus Notes/Domino cannot function without these applications. Simple and dependable, the FalconStor Solution for Lotus Notes/Domino optimizes Lotus Notes/Domino data protection.

In summary, the key benefits of the FalconStor Solution for Lotus Notes/Domino include:

- Creating transaction-consistent images of data files, logs, and associated databases
- Improving replication frequency and integrity while minimizing storage capacity requirements
- Conducting automatic, alternate-location (including offsite), instantly accessible, full-integrity data replication
- Rapidly recovering from a disaster, including a complete site loss or sudden or rolling disaster due to Lotus Notes/Domino-associated hardware or other infrastructure failure
- Rapidly recovering from logical corruption, including the loss of a data volume, database, or individual message
- Eliminating downtime from boot disk failure
- Improving resource utilization, availability, and performance
- Better managing data storage and data protection

About FalconStor Software

FalconStor Software, Inc. (NASDAQ: FALC) is a leading developer of network storage software designed to optimize the storage, protection, and availability of enterprise data. FalconStor's flagship product, IPStor, enables corporate IT to deploy a hardware-agnostic, network-centric foundation to maximize operating efficiency and business continuity, and to meet the availability requirements of mission-critical applications. IPStor-powered network storage solutions are available and supported by major OEMs, as well as system integrators and resellers worldwide.

Founded in 2000, FalconStor is headquartered in Melville, NY, with offices throughout Europe and the Asia Pacific regions, including in Paris, Tokyo, and Taiwan. FalconStor is an active member of the Technical Support Alliance Network (TSANet), Storage Networking Industry Association (SNIA), and Fibre Channel Industry Association (FCIA). For more information, please visit www.falconstor.com or call 1-631.777.5188.

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