Mission-Critical Fault Tolerance for Financial Transaction Processing

CERTIFIED FOR Windows Server® 2008 R2

Windows-based payments solutions from ACI and Stratus deliver mainframe-class uptime assurance

Uptime. **All the time.**

Stratus® Technologies

Abstract

The highest level of uptime assurance is a prerequisite for IT infrastructure that supports financial transaction processing. Historically, these applications were deployed on mainframes or proprietary UNIX® systems. In today's financial institutions, an evolution is taking place. Intel®-architecture servers running Microsoft® Windows® are now being used to support more applications than any other platform. First used for business operations like email and collaboration or print, file and web services, these systems are now playing a critical role in the modernization of legacy banking solutions. Despite widespread use, significant cost savings and recognized administrative advantages, Windows-based servers continue to be misunderstood by many financial firms as lacking the mission-critical qualities required for transaction processing.

This paper confronts the issues surrounding this misconception. The facts demonstrate that Stratus® fault-tolerant servers running Microsoft Windows Server® 2008 and industry-leading ACI Corporation's payments solutions deliver reliability, availability and functionality that usually match or exceed traditional mainframe and UNIX solutions − often at a much lower total cost of ownership.

ACI payments solutions: flexible, reliable software

ACI payments solutions[1] were initially developed and optimized for the Microsoft Windows platform close to 15 years ago. The ACI payments architecture includes a payments platform and SQL Server data store along with application modules that address a full range of payments functions including ATM driving, card management, merchant acquiring and retail payments. For disaster recovery, ACI offers an active/active payments deployment that allows two ftServer systems − ideally located at geographically-separated sites − to operate simultaneously, providing highest application operation in the face of unforeseen site failures.

ACI payments customers are located in more than 50 countries and collectively process over 10 billion transactions annually from over 100,000 ATMs and 750,000 POS terminals. There are more than 350 installations of ACI payment solutions with a significant number running on Stratus fault-tolerant, Windows-based ftServer® systems.

Windows Server 2008: a mission-critical operating system

From Windows NT 4.0 Server in 1996 to its Windows 2008 R2 release, Microsoft has continuously upgraded the reliability, performance, security, and manageability of Windows Server operating systems. Along with the incorporation of a host of new features, the latest 2008 and 2008 R2 releases, have earned Windows Server true, mission-critical status. Important advancements in the 2008 R2 release include:

[1] ACI payments solutions support Windows 2008, SQL 2008 or later versions. For specific release information, please contact: http://www. ACI.com/About ACI /contact.aspx

- Fully optimized 64-bit operation with support for up to 256 processor cores
- Enhanced performance with increased system resources per workload and optimized storage IO
- Improved storage reliability with multi-path failover, recovery from configuration errors and CHKDSK performance optimization

Microsoft targeted reliability, availability and serviceability (RAS) in its development of Windows Server 2008.
These new RAS features offer important advantages that are highlighted below:

- Transactional file system and registry helps to ensure file system and registry integrity
- The new Windows Hardware Error Architecture provides consistent error source discovery, recording and handling
- Service hardening allows restricted privileges for system services helping reduce security risks
- Kernel mode signing allows only authorized code to run in the OS kernel
- Self-healing NTFS provides improved real time detection and correction of corruption to NTFS
  meta data
- Reliability and performance monitoring helps improve the identification and troubleshooting of configuration and performance problems
- Windows Eventing 6.0 allows for easier isolation of problems and better identification of root causes
- Hot patching provides the ability to apply many OS patches without the need for rebooting (it is estimated that 30% to 50% of Windows 2003 would have been hot patchable)
- Hot add and replace of CPU, memory, I/O cards and I/O buses

Microsoft Windows Server continues to maintain its traditional advantages over other operating systems:

- Compatibility with the broadest range of servers, storage and other hardware components along with thousands of software products, giving users more choices and possibly lower costs
- The ability to leverage existing Windows infrastructure along with the skills and experience of existing IT staff and the wide choice of Windows services available in the market
- Superior Windows development and management tools from Microsoft and major third parties

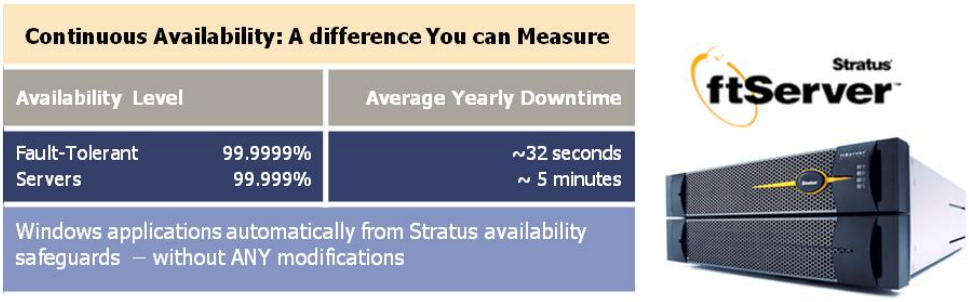
Stratus ftServer systems: industry-leading uptime that exceeds 99.999%

For more than 30 years, financial services providers – including 8 of the top 10 banks – have relied on fault-tolerant Stratus servers to run some of their most critical transaction processing applications. From ATM/POS networks to electronic funds transfer to multi-channel services delivery, you'll often find Stratus servers at work where application outages and data loss are unacceptable.

Mainframe reliability: field-proven and time-tested

Stratus is the only vendor that actually reports the availability of its worldwide installed base of servers. The Uptime Meter[SM], a six-month availability aggregate, is refreshed daily on the Stratus website. Both hardware- and software-related incidents – including those affecting the operating system – are part of the measurement. Since their introduction in 2001, Stratus Windows-based ftServer systems have surpassed five nines of availability. Today, that number consistently approaches six nines, the equivalent of less than 32 seconds of downtime per year on average.

Figure 1: Mainframe-class uptime assurance



By integrating around-the-clock monitoring services with resilient technologies, Stratus delivers "uptime assurance" that approaches six nines

Stratus' fault-tolerant ftServer systems are Intel processor-based servers that run Microsoft Windows Server operating systems. While "off-the-shelf" Intel-based, Windows platforms offer limited redundancy of components such as power supplies and fans, Stratus ftServer systems incorporate total hardware redundancy that includes processor boards, processors, memory and IO channels. The processor-memory units operate in synchronized lock-step to help ensure uninterrupted 24/7/365 processing. In the event of a hardware failure, the duplicate component simply continues normal processing. There's no performance degradation or loss of transactions, application state, or memory contents.

Engineered for real-time, high volume transaction processing, today's ftServer systems come equipped with Intel Xeon™ multi-core processors, QuickPath Interconnect technology, up to 96 GB memory and 8TB of physical storage. In addition to industry-leading uptime and performance, financial institutions that implement mission-critical solutions on these industry-standard servers often achieve the following benefits:

- Lower overall cost per transaction and reduced overhead expenses
- Faster time to market for new services and added features
- Easier expansion of services through existing delivery networks
- Flexibility to accommodate network and transaction growth

Protects Against Planned and Unplanned Downtime

The ftServer systems' redundant architecture and lock-step operation help eliminate unplanned downtime due to hardware failures while protecting in-process transactions and memory contents. These systems also allow components – including processor-memory units – to be replaced online, helping eliminate downtime associated with hardware repairs and upgrades.

Stratus Active Upgrade™ technology helps address planned downtime by enabling administrators to temporarily split the duplicated components of a Stratus ftServer system into two separate computing environments. Software patches or upgrades are then applied to one environment while the other environment continues running the production software. The upgraded environment can be tested and then, depending on the results, either merged into the production environment or reverted back to the original, pre-upgrade state. This unique capability often dramatically reduces planned downtime associated with software patches and upgrades.

Online service and support

Stratus ftServer systems include Continuous Processing® technology that detects and resolves problems before they can cause downtime. These features include automatic fault detection and isolation, online component replacement, automatic call-home notification and advanced remote service access. Stratus support provides fast access to experts that are usually able to resolve problems online nearly 98% of the time, often eliminating the delays and uncertain outcomes associated with many on-site service calls. Stratus may also provide same-day on-site service when needed.

These worldwide, 24/7 services include optional support of the Windows operating system. Stratus is a Microsoft Gold Certified partner and maintains a relationship with Microsoft that allows rapid escalation and effective cooperation to resolve any Windows operating system issues.

Best Practices for Mission-Critical Financial Transaction Processing

Success in building and maintaining mission-critical financial environments requires addressing a broad range of downtime risks. These risks include both unplanned and planned downtime for servers, software, application, and supporting infrastructure; system security; protection against site disasters; and services and support that can help with initial planning, installation and testing, and can also help quickly address many hardware or software problems that do arise. The combined experience of Microsoft, Stratus and ACI has led to specific solutions and best practices for many of these risks. Some of these are discussed below.

Implement a proven robust IT infrastructure

Redundancy, in the form of active fault-tolerance or backup systems with rapid failover, is essential for all critical infrastructure elements including networking, external storage, directory and security services and even power and cooling.

Stratus fault-tolerant servers, with online hardware maintenance and Active Upgrade technology for software upgrades and patches help address both unplanned and planned downtime for 7x24 financial processing environments. Windows Server 2008 R2 and SQL Server 2008 R2 provide the core operating system and database for many mission-critical environments and include the latest RAS features like hot patching.

Make security a top priority

Security has become a major issue for all systems since the rise of the Internet. Windows has certainly received the most publicity of any operating system in regard to security issues, but this must be viewed in the real-world context:

- Far more systems run Windows than any other operating system
- Most Windows systems and associated security problems are on desktops
- Many Windows systems are running older versions of Windows; many are home systems; and many do not keep up with security patches or use updated anti-virus or anti-spyware software (this is even true of many business systems)
- There is a significantly different level of risk between an internet-connected desktop or web server and a dedicated, tightly managed application server located behind a firewall

Starting with Windows 2003, Microsoft has made many improvements to Windows security and security management. This is especially true for Windows Server 2008 and 2008 R2. Windows servers today, running the latest Windows Server versions and using established security management policies, offer security features and protection that is often equal to or better than other competing operating systems. The following features and guidelines can be used to help improve security and reduce downtime associated with security management:

- Install Windows Server 2008 with only the required server roles (a dedicated application server should require only a minimum of roles). This will help reduce the code footprint for security risks and eliminate future patches associated with uninstalled server roles.
- Microsoft patch management tools, along with advice from both Stratus and ACI can help identify security patches that apply to a specific customer installation and eliminate those patches that are unnecessary.
- Hot patching helps eliminate downtime associated with many security patches.
- Stratus Active Upgrade reduces downtime for patches that do require a system restart.
- Proper network security design including a robust firewall and properly configured and managed anti-virus software are necessary to help protect the application from external security threats

ACI payments solutions are tested to help ensure that they conform to the comprehensive industry requirements for enhancing payment account data security.

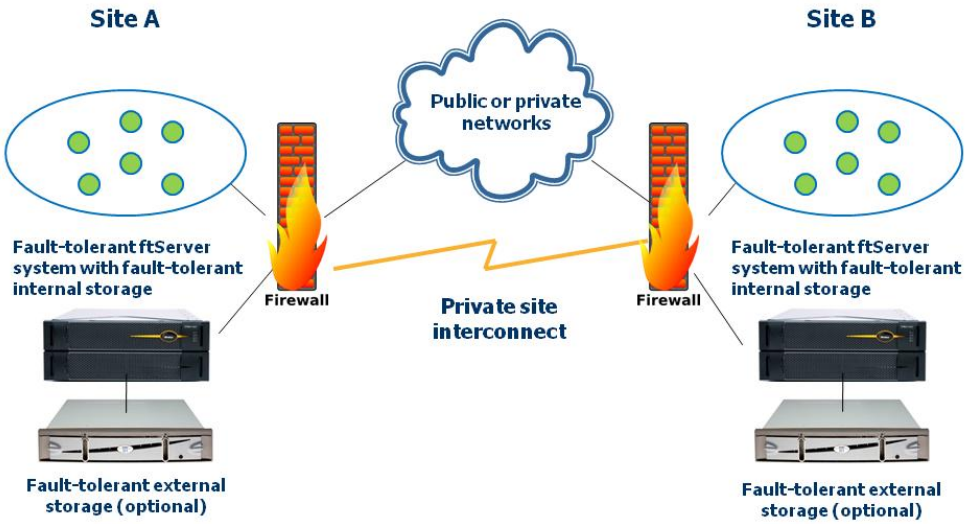
Implement a two-site disaster recovery solution

Site failures caused by power disruption, network failures, fires or natural disasters can be addressed by the use of a geographically-separated disaster site.

A disaster recovery solution requires synchronization of data across the two sites. There are a multitude of solutions available that provide both asynchronous and synchronous data replication across wide area networks. Synchronous data replication is the preferred solution if 100% data protection is required, but synchronous replication does require higher network bandwidth and lower latency to avoid performance problems.

The active/active option offered by ACI includes built-in synchronization between two application servers, providing a fully-integrated disaster recovery solution that helps eliminate the need for third-party data replication products along with many of the integration, configuration and testing challenges that are usually associated with implementing a DR solution.

Figure 2: ACI active/active dual-site implementation using Stratus fault tolerance



An active/active deployment of ACI payments solutions allows two servers to operate simultaneously, providing uninterrupted application operation in the face of hardware, software or site failures.

Another benefit of a highly available solution is protection against downtime for planned events that cannot be addressed by online patching or ftServer Active Upgrade technology. Application processing can be transferred to the disaster site while major software or hardware upgrades are performed at the primary site.

Give special attention to implementation and operational procedures

Mission-critical applications require extra attention in all phases of the application life cycle, including planning, installation, integration testing and change management. Careful attention to these activities can help avoid many problems altogether and resolve others before applications enter production use. Microsoft, Stratus and ACI assist in these efforts based on the relationships among these three companies. Microsoft often tests its software throughout the development cycle on Stratus ftServer systems located in Microsoft labs. Stratus does comprehensive integration testing, including extensive fault-insertion testing, with Windows releases, updates and patches running on ftServer models. ACI often tests its payments application on ftServer systems in the company's development labs to both help with proper operation and to develop sizing guidelines.

Leverage mission-critical services and support

Stratus and ACI both provide installation services and assist with pre-installation planning. Stratus will pre-install the Microsoft Windows operating system and assist in operating system configuration on ftServer systems. All three companies offer mission-critical support and will work together to resolve problems that cross the boundaries between server, system software and application.

Conclusion

ACI payments solutions, hosted on Windows-based ftServer systems, have been providing cost-effective uptime assurance for mission-critical transaction processing for nearly 15 years. Of the many thousands of ftServer systems that have shipped to customers across the world, more are being used in financial services than in any other industry. Customers running mission-critical financial applications on ftServer systems include retail and corporate banking institutions, credit card issuers and payments networks as well as regional banks and credit unions.

Successive generations of ftServer hardware and software, Windows operating systems, SQL Server database software, and ACI solutions have helped to increase the reliability, functionality, performance and cost-effectiveness of industry-standard banking solutions. Today, the combination of mission-critical technologies from ACI, Stratus and Microsoft provides a compelling alternative to often more costly and proprietary mainframe or UNIX financial services solutions.

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