

Always-On Processing

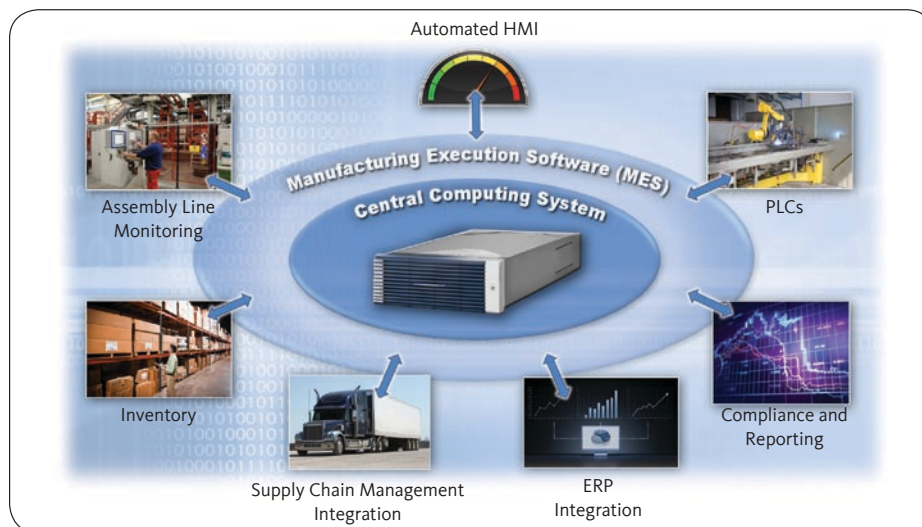
HOW FAULT TOLERANT SERVERS BOOST OUTPUT AND REDUCE COSTS FOR MANUFACTURING & PROCESS CONTROL SYSTEMS

World Class Processing in a Global World

In the world of globalization, manufacturers and process control organizations must use every means to remain competitive. These companies and organizations must reduce lead times, speed time-to-market, cut operations costs and improve business performance visibility. Enterprise automation is indispensable for maintaining a competitive edge or to provide better public services.

The Nerve Center of Manufacturing

Computer hardware is truly the nerve center, or backbone, of today's automated manufacturing and process control plants. On the central server resides the systems used to control and coordinate an intricate system of processing functions, ERP, supply chain, inventory, and compliance and reporting. Consequently, high availability computing has become an imperative in process control systems.



The Need for Always-on Manufacturing

Any downtime on the assembly line or processing system is tremendously costly. Industry experts estimated that aggregate downtime costs U.S. manufacturers over \$1.5 million per hour in lost revenues alone. Furthermore, it can create disastrous ripple effects down the supply chain, or public services resulting in fines and lost business.

Business Continuity in Manufacturing

High availability servers are clearly the must-have hardware for effective automation. Manufacturers and public agencies can ill-afford the risk of revenue loss or loss of competitiveness. NEC Fault Tolerant servers and NEC ExpressCluster as the backbone for automation assure peace of mind.

NEC Fault Tolerant Servers in Next Generation Manufacturing

NEC Fault Tolerant servers are designed and implemented to provide continuous availability for Next Generation processing systems. NEC's fourth-generation Express5800/320F Series Fault Tolerant servers are an affordable solution using the latest Intel CPU technology. With fully redundant hot-swappable server modules running in lockstep, NEC Fault Tolerant servers deliver the utmost in continuous availability, even if hardware in the server fails for any reason. This allows organizations of any size to realize the highest level of availability and system integrity, with the added benefit of operational simplicity.

Affordable Fault Tolerance

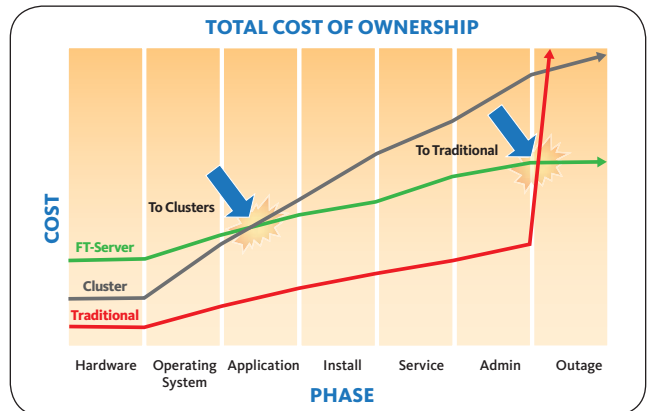
Equipped with fully-redundant and hot-swappable components, including redundant memory processors and I/O subsystems, NEC Fault Tolerant servers achieve up to 99.999% uptime equating to about 5 minutes average downtime per year. NEC's Fault Tolerant redundant server architecture eliminates single points of failures. NEC Fault Tolerant servers deliver the highest performance and highest availability with Intel® Xeon® processors at an affordable price.

“Non-stop” Software Upgrades

NEC Fault Tolerant servers offer Active Upgrade™, a feature that eliminates the need to disrupt server operations to conduct essential software maintenance. Active Upgrade enables non-stop server operation while performing software maintenance that often removes other servers from operation for several hours.

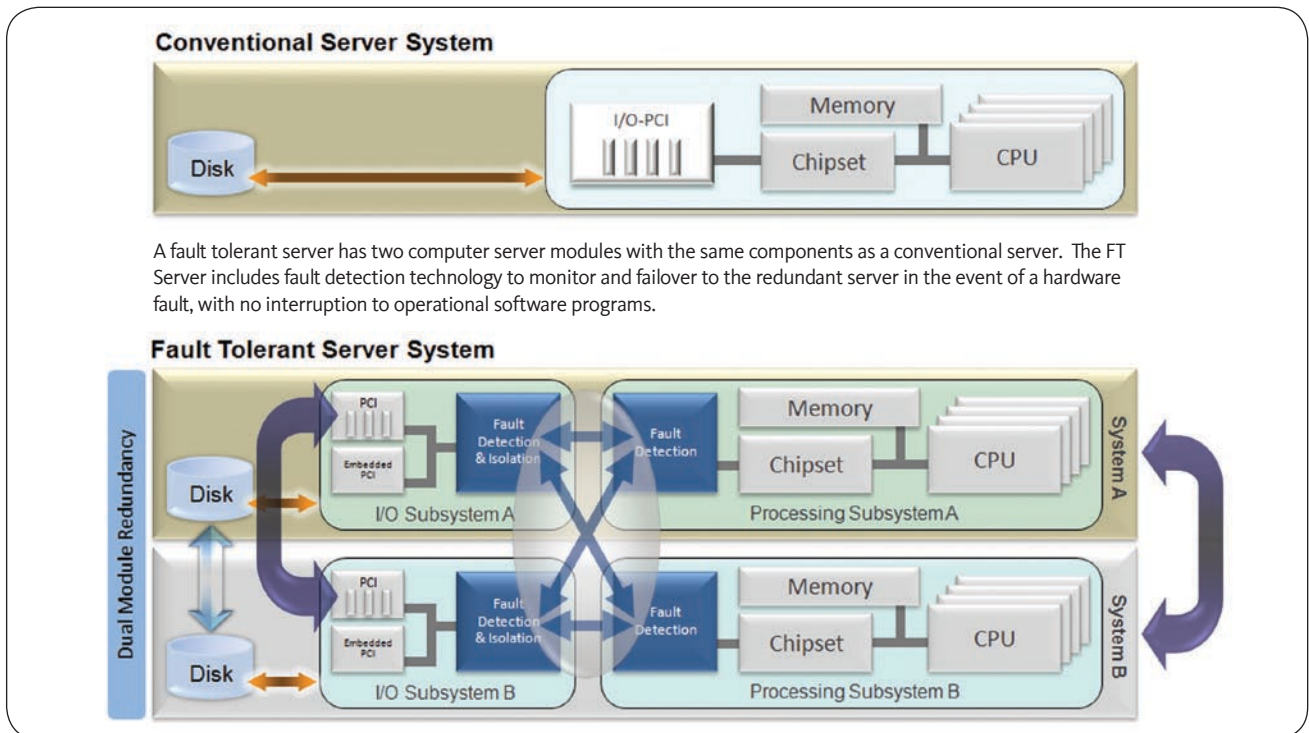
Lower Total Cost of Ownership

NEC is able to deliver continuous availability at substantially reduced operational costs. Since the FT server is a single system, it requires only one operating system and one application software license. Compared to clustered systems, the FT is a turnkey solution with rapid and easy system deployment and application setup. It does not require the administrative resources typically associated with clustering systems for upgrades and maintenance. It also results in productivity improvements by avoiding unplanned hardware outages.



Operational Simplicity

With the leading operating systems and virtualization providers, FT servers implement redundancy at the hardware level. This approach significantly reduces the complexity associated with other forms of high availability such as clustering systems. It also simplifies system management and recovery operations, since administration and configurations are performed as a single system view.



NEC's Fault Tolerant Data Center Disaster Recovery Solution

NEC offers a powerful combination of fault tolerant servers and disaster recovery software to meet the mission-critical needs of processing systems. The NEC Express5800/320F Fault Tolerant servers deliver 99.999% uptime for continuous availability of server hardware. ExpressCluster® X builds in high availability disaster recovery in case of catastrophic events at the primary server data center.

In the event of a data center disaster, application processes and resources are activated on the standby system so that the manufacturing systems are recovered within minutes. Together NEC Fault Tolerant servers and ExpressCluster X deliver the high availability components needed to make the manufacturing system as resilient and survivable as possible.

Ultimate Integrated Disaster Recovery Solution

ExpressCluster X is the next generation, integrated disaster recovery solution that provides continuous protection of critical applications and data with near-instant recovery across local or wide area networks up to over hundreds of miles. Built on the award winning and field-proven technology foundation, it has been helping customers worldwide maintain critical system continuity for over a decade. Unlike other solutions, it dramatically simplifies the recovery process and reduces maintenance and operational costs.

Full Protection for Applications and Data

ExpressCluster X provides protection for virtually all manufacturing solutions and associated data. They are supported without requiring source code changes or specially-designed versions. Standard data repositories such as file and databases stored on conventional disks are also readily supported without requiring data format changes.

Automotive manufacturing is typical of industries with extended enterprises, complex supply chains, many partners and vendors, and complex compliance issues. When an auto plant stops due to a computer failure, as much as \$40,000 per minute of profit is lost to the company, directly. Indirect costs can include penalties from \$5,000 to \$50,000 if shipments are missed, and audits and fines from the federal government if compliance data is lost.

Once manufacturing companies weigh the costs and the risks of the high availability hardware they are using now, the decision to switch to FT servers is an obvious one.

Lary Marshall,
Business Development Manager,
Rockwell International



Flexible Data Mirroring for Data Protection

ExpressCluster X WAN provides an application transparent data mirroring function that allows users to easily choose between synchronous and asynchronous data mirroring modes to meet a wide range of data protection needs. Synchronous data mirroring technology enables full data protection by ensuring data written to the mirrored disk on the primary system is also written to the mirrored disk on the standby system in real time as a single transaction. If a failure occurs, users can readily access an up-to-date copy of all data on the standby system.

High Availability

NEC Mirrored Software Cluster

Uptime: 99.9% - 99.99%
Downtime: 1-9 hrs/yr
Hardware Availability: 99.9%
Software Availability: 99.99%
Scope: LAN

- Local high availability for transactional systems
- Synchronous data integrity
- Full software redundancy

Continuous Availability

NEC Fault Tolerant Server

Uptime: 99.99%
Downtime: 5 MIN/yr
Hardware Availability: 99.999%
Software Availability: N/A
Scope: Local Only

- Redundant hardware operates as a single server
- Lockstep failover for hardware
- Hot-swap server modules

Continuous Availability + Disaster Recovery

Mirrored Software & Redundant Server WAN Cluster

Uptime: 99.999%+
Downtime: 5 MIN/yr, plus disaster recovery
Hardware Availability: 99.999%
Software Availability: 99.99%
Scope: LAN/WAN

- System disaster recovery
- Synchronized data integrity
- Low bandwidth and long distance WAN support

	Conventional Server with HDD RAID	NEC ExpressCluster LAN Edition with NEC general purpose servers	NEC Fault Tolerant Servers	NEC Fault Tolerant Servers with NEC ExpressCluster WAN Edition
Availability Level	Standard Availability	High Availability	Continuous Availability	Continuous Availability & Disaster Recovery
Availability Level Description	99.5% uptime or about 44 hours downtime per year on average	99.9% to 99.99% uptime or about 5 hours downtime per year on average	99.999% uptime or about 5 minutes downtime per year on average for hardware protection	99.999%+ uptime or less than 5 minutes downtime per year on average
Data Protection Methods	RAID for application data	Synchronous data mirroring of application data	Dual servers running in lockstep with full redundancy of application processing and data	Dual servers running in lockstep for local protection, plus data mirroring and application monitoring for fast restart at a remote location for disaster recovery
Potential Loss	Application state is lost, but data is maintained under RAID. Data must be transferred manual to new server and restarted	Application state is momentarily lost, but data is maintained on a backup server for fast restart	No loss of application functional and data. Application continues to run	No lost of application functionality or data. For disasters, application state is momentarily lost, but data is maintained at a remote location on a backup server for fast restart
Minimum Platform Requirements	One server	<ul style="list-style-type: none"> • 2 NEC general purpose servers • 1 ExpressCluster LAN license 	1 NEC Fault Tolerant server	<ul style="list-style-type: none"> • 1 NEC Fault Tolerant server • 1 NEC general purpose server • 1 ExpressCluster WAN license
Protection and Recovery Scope	Data protection	<ul style="list-style-type: none"> • Hardware failures • Software crashes • Data protection 	<ul style="list-style-type: none"> • Hardware failures • Data protection 	<ul style="list-style-type: none"> • Site disasters • Hardware failures • Software crashes • Data protection
Supported Configurations	Standard Server	Up to 32 servers over LAN in one location with up to 8 mirrored data sets per server	One server resides in one location	Up to 32 servers over WAN in two locations over hundreds of miles with up to 8 mirrored data sets per server
Software Licenses	One OS and one application license for each server	Two OS, two ExpressCluster and at least two application licenses	One OS and one application	Two OS, two ExpressCluster and at least two application licenses
Active/Standby Hardware Ratio	Standby server only	Up to 8 active and 1 standby servers	Single server, but both server modules are continuously active	FT server modules are continuously active as 1 server, plus up to 8 active and 1 standby servers
User Experience of Failure	Extended downtime for manual system recovery and repair	Goes offline and system is down until the clustered server comes back up. All in-flight transactions will need to be re-initiated	Failover is transparent to the application and there is no interruption, no lost transactions, and no degradation in performance	For hardware failures, failover is transparent to the application and there is no interruption, lost data, or poor performance. For software and disaster failovers the system will go offline until the clustered server comes back online
OS support	Implementation dependent	<ul style="list-style-type: none"> • Windows® Server 2003/2008 Standard or Enterprise (32- and 64-bit) • Red Hat® Enterprise Linux 4/5 (32- and 64-bit) • Novell® SUSE Linux Enterprise Server 9/10 (32- and 64-bit) 	<ul style="list-style-type: none"> • Windows® Server 2003/2008 Standard or Enterprise (32- and 64-bit) • Red Hat® Enterprise Linux 4/5 (32- and 64-bit) • Novell® SUSE Linux Enterprise Server 9/10 (32- and 64-bit) 	<ul style="list-style-type: none"> • Windows® Server 2003/2008 Standard or Enterprise (32- and 64-bit) • Red Hat® Enterprise Linux 4/5 (32- and 64-bit) • Novell® SUSE Linux Enterprise Server 9/10 (32- and 64-bit)
Implementation and setup	Implementation dependent	Advanced IT skills required to set up, configure and install two servers with operating, application and cluster software	Turnkey solution with rapid system deployment; fewer IT resources required	Advanced IT skills required to set up, configure and install two servers with operating, application and cluster software
Cost Range for Minimum Configuration	\$3K - \$7K per server	\$22K - \$30K	\$26K - \$30K	\$50K - \$60K
Hardware Warranty	1 to 3 years	3 to 5 years	3 years	3 to 5 years

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