S/390 Division

Five Nines / Five Minutes — Achieving Near Continuous Availability

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The information technology revolution of the 90's is having a profound effect on how business will be conducted in the new millennium. With the emergence and growth in popularity of the "Net" the traditional barriers for conducting business have been removed, dramatically altering the competitive landscape. Companies can buy and sell products and services over the network, literally bringing the business to the consumer's home — 24 hours, 365 days a year. Using the "Net," companies can easily transcend geographical territories to enter new business areas that were previously unreachable and compete in electronic marketplaces for additional business.

Whether a business is moving to take advantage of e-business or growing to support traditional business applications, the demands placed on IT technology will be taken to new dimensions. With customers that are more technically sophisticated and looking for convenience, and with the competition being only a "click away," IT systems must be reliable, responsive, and continuously available. They also must be able to react to periods of rapid growth and dynamic fluctuations in customer demand. Businesses that are not able to meet these new demands will suffer obvious availability consequences, which can translate to negative business publicity and loss of customer satisfaction.

To address growing availability requirements, many IT vendors, including IBM, are moving to forms of clustering as a means to attain high availability. S/390® clustering, called Parallel Sysplex® technology, uses a form of clustering where all servers appear to the business application as a single server. This form of clustering, known as "single system image," enables Parallel Sysplex clusters to provide industry leading availability by allowing workloads to be balanced across multiple servers to provide near continuous availability. S/390 Parallel Sysplex clustering is the business solution for helping to ensure that applications are available through any downtime event and that revenues from sales and other business opportunities are not lost to the competition.

S/390 Parallel Servers provide an excellent base for S/390 Parallel Sysplex Clusters. Designed to meet strategic business objectives well into the next millennium, the S/390 Parallel Server technology incorporates high availability characteristics, such as:

- Processor unit sparing
- Dynamic memory sparing
- Fault error correction code
- Subsystem storage protection
- Concurrent hardware maintenance
- Capacity Upgrade on Demand

These characteristics combined with the S/390 Parallel Server's enhanced processor and fault toleration design, make the S/390 Parallel Server a highly reliable and highly available enterprise server. With a meantime to failure of 30 years, S/390 Servers define the standard for mission critical computing.

Despite this high level of availability, businesses are demanding more. IBM is addressing these needs with the S/390 Parallel Sysplex clustering architecture. With a design point of 99.999 percent availability or about 5 minutes of downtime per year (Five Nines/Five Minutes), a properly configured Parallel Sysplex cluster can deliver near continuous availability. A recent GartnerGroup[1] study of 240 observations from 190 firms shows that S/390 Parallel Servers coupled with Parallel Sysplex technologies lead the IT industry in availability. S/390 Parallel Sysplex technology outages were limited to 10 minutes over a 24 by 365 period (99.998% availability). UNIX® systems in the study averaged 23.6 hours of downtime per year.

S/390 Parallel Sysplex technology builds on and extends the strengths of S/390 Parallel Servers by linking up to 32 S/390 servers, with near linear scalability, to create the industry's most powerful commercial processing clustered system. Every server in a S/390 Parallel Sysplex cluster has access to all data resources and every "cloned" application can run on every server. Using S/390's "Coupling Technology," Parallel Sysplex technology provides a "shared data" clustering technique that permits multi-system data sharing with high performance read/write integrity. This "shared data" (as opposed to "shared nothing") approach enables workloads to be dynamically balanced across all servers in the Parallel Sysplex cluster. This approach allows critical business applications to take advantage of the aggregate capacity of multiple servers to help ensure maximum system throughput and performance during peak processing periods. In the event of a hardware or software outage, either planned or unplanned, workloads can be dynamically redirected to available servers providing continuous application availability.

Another significant and unique advantage of using S/390 Parallel Sysplex technology is the ability to

[1] *Decision Framework Platform Availability Data: Can You Spare a Minute,* 10/20/98 — GartnerGroup Advisory Services

perform hardware and software maintenance and installations in a non-disruptive manner. Through data sharing and dynamic workload management, servers can be dynamically removed from or added to the cluster allowing installation and maintenance activities to be performed while the remaining systems continue to process work. Furthermore, by adhering to IBM's software and hardware coexistence policy, software and/or hardware upgrades can be introduced one system at a time. This capability allows customers to roll changes through systems at a pace that makes sense for their business. The ability to perform rolling hardware and software maintenance in a non-disruptive manner allows business to implement critical business function and react to rapid growth without affecting customer availability.

Parallel Sysplex technology is an enabling technology, requiring highly reliable, redundant, and robust S/390 technologies to achieve near continuous availability. A properly configured Parallel Sysplex cluster is designed to have no single points of failure, for example:

- Hardware and software components provide for concurrency to facilitate non-disruptive maintenance, like S/390's Capacity Upgrade on Demand that allows processing or coupling capacity to be added, an engine at a time, without disruption to customer workloads.
- DASD subsystems that employ disk mirroring or RAID technologies to help protect against data loss, and exploit technologies like RAMAC RVA's concurrent copy and Snapshot features to enable point-in-time backup, without the need to shutdown applications.
- Networking technologies that deliver functions like VTAM® Generic Resources, Multi-Node Persistent Sessions, and Virtual IP Addressing to provide fault tolerant network connections.
- I/O subsystems support multiple I/O paths and dynamic switching to prevent loss of data access and improved throughput.
- S/390 software components allow new software releases to coexist with lower levels of that software component to facilitate rolling maintenance.
- Business applications are "data sharing enabled" and cloned across servers to allow workload balancing and to prevent loss of application availability in the event of an outage.
- Operational and recovery processes are fully automated and transparent to users, and reduce or eliminate the need for human intervention.

These configuration points are many of the design factors inherent in S/390 Parallel Sysplex technology and required to achieve continuous availability. Businesses must determine the level of availability required to support their applications and ensure that their IT infrastructure is designed and configured to attain those desired levels of availability.

S/390 Parallel Sysplex technology has continued to evolve to deliver solutions that are flexible, scaleable, and continuously available to help meet all your critical business needs. IBM has invested heavily in Parallel Sysplex technology by enhancing existing S/390 technologies and embracing the latest technology trends to deliver new features and functionality, such as Parallel Web Serving and Object Technology through Component Broker for S/390. IBM's investment in S/390 Parallel Sysplex technology has resulted in robust exploitation of leading edge hardware features and software function, thus helping to protect and add value to your investment in S/390.

In Summary, Five Nines/Five Minutes is the IT industry's defining standard for availability. In enterprises exploiting IBM's S/390 Parallel Sysplex clustering technology, the capability to achieve near continuous availability is today's reality. If continuous, low-cost, high-capacity computing is crucial to your business, investment in IBM's S/390 Parallel Servers and S/390 Parallel Sysplex technologies as your enterprise computing platform will clearly distinguish your business as a leader in providing high performance and continuously available applications. Don't let continuous availability become just a vision in your IT enterprise, make it a reality by investing in IBM S/390 Parallel Sysplex cluster technology.

For S/390, Five Nines/Five Minutes is not just a vision. With planning, implementation, and proper exploitation of S/390 Parallel Sysplex clustering technology, your business can achieve near continuous availability today!

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