IT@Intel Perspective
Intel IT
IT Best Practices
Data Centers and IT Continuity
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A Cost-Effective Disaster Recovery Solution for Intel Factories

Key Features

- Capitalizes on existing infrastructure and investment
- Provides the ability to resume factory operation within 24 hours
- Flexible tiered design

To minimize factory downtime and associated loss of revenue, Intel IT has successfully implemented a cost-effective business continuity (BC) and disaster recovery (DR) solution at two factories by "stretching" mission-critical systems between two different data centers within the same facility.

Business Challenge

Keeping Intel's assembly and test manufacturing (ATM) automation systems running 24x7 is critical to our company's bottom line. Even a small glitch in factory operation can cost millions of dollars and impact Intel's ability to ship products to customers. A cost-effective and efficient BC and DR solution is vital to our business—so that if downtime does occur for any reason, a factory can resume operation as quickly as possible.

Background

Intel places high demands on ATM factory automation infrastructure to deliver an aggressive product roadmap and high-volume output. Typically, the automation systems that support a factory reside in a single data center within same facility; any data center failure adversely impacts factory operation. To enhance our existing BC and DR plans, Intel IT evaluated five options:

- **Pack and ship.** Ship required components to the affected factory from a test lab with the same equipment setup.
- **Storage replication.** Protect data by replicating the storage system at a second onsite data center or at a nearby site.
- **Integration test lab.** Build a new integration test lab at each site for backup.
- **Cross-site.** Use a nearby factory or other facility as the DR site.
- **Intra-site.** Stretch high-availability mission-critical components between two data centers within the same site.

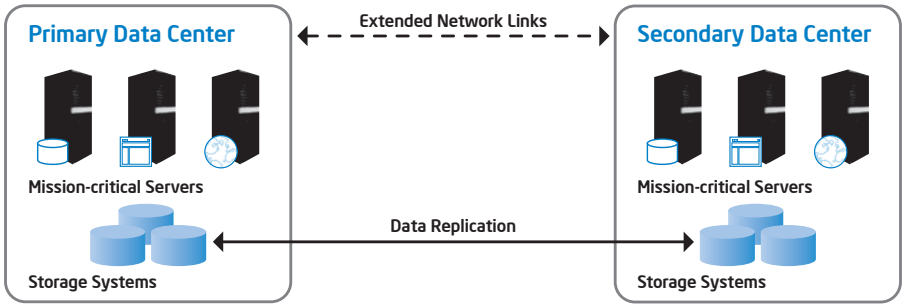

Figure 1. Intel IT's intra-site disaster recovery solution stretches mission-critical components between two data centers.

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After careful analysis, we determined that the intra-site solution would help us achieve the best balance between cost and recovery time.

From an operational perspective, an effective BC and DR solution needs to enable speedy recovery of automation systems in the event of data center failure. However, an earthquake, flood, or other disaster would most likely affect the operation of the entire site, so offloading production to another factory makes more sense than trying to recover the automation system. "Stretching" the application cluster nodes as well as secondary storage systems to an alternative data center enables us to recover factory operation in a more timely and controlled fashion during a crisis.

Solution

The design scope covers all mission-critical application systems as well as storage, including SAN and network-attached storage systems. Each storage system is configured with real-time data replication to help ensure application data are fully protected; virtual LANs connect the primary and secondary data centers, allowing cluster nodes to form the logical cluster system (Figure 1). In the event of primary data center failure, automation systems in the secondary data center enable faster recovery of factory operations.

Results

The intra-site solution eliminates the risk of a single point of failure and uses current infrastructure to offer the best return on investment. Because the original design of mission-critical systems provided redundancy, including failover cluster nodes and a standby frame for storage systems, stretching these components between two locations incurs minimal cost.

Tier-level flexibility gives us more granular control over each level of the solution—from networking to server and storage systems to applications. This enables tier-level failover as opposed to full data center failover. We have performed various levels of failover in actual production mode with minimal impact to factory operations. For example, we were able to quickly recover a SAN storage system in one factory within an hour due to the tier-level design; it would have taken more than 24 hours to recover the storage frame. Since deployment, coupling the solution with controlled processes has enabled speedy operation recovery and shortened the mean time to repair compared with historic trends.

By implementing an intra-site DR solution, we are able to resume factory operation within acceptable service-level agreements. Overall, the intra-site solution provides the best results in terms of:

- **Cost.** We are able to take advantage of existing infrastructure and investment to meet current business needs.
- **Industry standards.** We align to industry best practices by transforming the current high-availability design with redundant components and stretching the components across two data centers to address potential disruption.
- **Tiered design.** We cover mission-critical components that allow us to resume operation in the shortest time possible, ranging from cluster and load balancing servers to the network layer and various storage systems.

Currently, we have stretched mission-critical systems at two factories and plan to implement this solution at all ATM factories by early 2011. We closely monitor automation systems to help ensure the solution reflects environmental changes, and we conduct annual drills as part of Intel IT security policy so that in the event of an incident, we can quickly recover our ability to ship products to customers. This solution has the lowest capital and sustain costs and has become the plan of record for our ATM factories.

Developing IT Best Practices

Based on our experiences, we have developed IT best practices for future implementations:

- **Team structure.** Assign a dedicated technical lead for each focus area, including server, storage systems, networking, application domain, performance and testing, and relocation logistics—as well as a key contact for each equipment supplier, data center owner, and building security officer.
- **Capacity management.** Plan to scale the solution to accommodate business growth, including secondary data center space for new application systems and storage frames. Networks must be able to deliver more bandwidth as well. Our forecast model looks out three years and is reviewed annually.
- **Performance analysis.** Perform thorough application verification testing and collect performance data such as CPU, memory, and network utilization before and after solution deployment for trending analysis. Applications need to undergo stress or volume testing; in the event of a crisis they may be running on fewer nodes within the secondary data center.

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