Achieving Continuous Availability

Configuring Server Blades for Fault and Disaster Tolerance

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Simple, Affordable Uptime
Why is Availability Important?

Downtime is Costly

- Lost Revenue
- Reduced Employee Productivity
- Disrupted Operations
- Damaged Public Reputation
- Drained IT Resources
- Damaged Customer Satisfaction
- Lowered Financial Performance
- Regulatory Fines
## Cost of Downtime by Industry

<table>
<thead>
<tr>
<th>Business Operation</th>
<th>$Rev./hour</th>
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Source: META Group
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“In a recent survey, 30% of companies did not have a disaster recovery program in place and 2 in 3 companies felt that their data backup and disaster recovery plans had significant vulnerabilities.”

Source: Imation Data Protection Survey (August, 2003)
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*Source: META Group*

"30 to 40 percent of businesses never reopen after a disaster"

*Source: Dept. of Homeland Security, Federal Emergency Management Agency*
Trend Toward Continuous Availability

Dependence on existing automation and increasing number of systems automated

More Threats to Security and Physical Systems

Server Density & Consolidation (Blades)

Stringent regulations requiring data retention and availability
Inhibitors to Adopting Availability Solutions

- Increased complexity
- Unclear benefit
- Technology limitations
- Poor cost justification
- Lack of knowledge about solutions
Recovery Technology Tradeoffs

- **Recovery Time Objective (RTO)**
  - How long can you afford your system to be down?

- **Recovery Point Objective (RPO)**
  - How out-of-date can you afford the data to be when the system comes back up?
Fault & Disaster Tolerance
FT+Protection from Physical Threats

Fault Tolerance
“Mainframe-like” Availability

Continuous Availability
RTO & RPO = 0

High Availability
Fail-over Technologies--
Cold Stand-by, Hot Stand-by & Clusters

Recovery
Data Backup, Data Replication

Reliability
Hot swappable components
ECC memory

Unprotected Servers

Availability Spectrum
Continuous Availability Through Fault and Disaster Tolerance

✓ Continuous Operation
  - Fault tolerance: no downtime during and after a system failure
  - Disaster tolerance: no downtime during and after a data center disaster
  - Zero recovery time (RTO)
  - Zero lost transactions, current data (RPO)

✓ Highest Level of Protection
  - **No loss** of system, transaction, or data state in the event of a failure

✓ Simplest Technology
  - Deployment and management the same as standard server
Disaster Tolerance vs. Disaster Recovery

Continuous Availability Technologies
- Disaster Tolerant
  - Site Protection
- Fault Tolerant
  - System Protection

Recovery Technologies
- Data Vaulting
- Hot Site
- Cluster
- Tape Backup

Recovery Time Objective
- Best to Worst

Recovery Point Objective
- Best to Worst

Zero Downtime
Achieving Continuous Availability

Replication/backup solutions preserve data

Clusters preserve application operations

Reliable application recovery must preserve data, application, and OS
Achieving Continuous Availability

Replication/backup solutions preserve data = Storage

Clusters preserve application operations = Application

Continuous availability preserves application, OS, and data - redundant & synchronized = Application

OS

Data
Marathon Fault & Disaster Tolerance

- Fault and disaster *tolerance* — not just recovery
  - Continuous application and data access through failures
  - No loss of state or application context
  - No failover — zero downtime
- In-flight data transactions are preserved
- Failures do not affect performance
- Repairs while system is operating
- Integrated mirrored storage, delta copy recovery
- Compatible with external storage
- Appropriate for blades and conventional servers
How Does it Work?

- Two standard Intel-based server or blades
- Two standard gigabit Ethernet links
- Marathon software synchronizes redundant components:
  - CPU, Memory, Networks, Disk

CoServer 1

Redundant CoServer Links

CoServer 2

LAN
Fault & Disaster Tolerant Virtual Server

Marathon FTvirtual Server

CoServer 1  Redundant CoServer Links  CoServer 2

LAN
Administrator/User Perspective

- Application management is performed in the FTvirtual OS environment
- Identical to a standard Windows server
Marathon FTvirtual Server™
Joining and Synchronization

FTvirtual Server

Memory
Copy

FTvirtual Server

FTvirtual Server

Booting

Joined
Device Virtualization
Disk Mirroring

FTvirtual Server

Application Environment

Virtual Disk

Mirrored Disks
Fault Management
Disk Failure

Marathon FTvirtual Server

Disk Failure Occurs

Marathon FTvirtual Server
Fault Management
Server Failure

Marathon FTvirtual Server

Both Servers Operating Redundantly

Server Failure Occurs

Operational Server

Failed Server

Marathon FTvirtual Server
Fault Management
Network Failure

Marathon FTvirtual Server

Standby Path  Active Path

Network Failure Occurs

Active Path  Failed Path
SplitSite® for Disaster Tolerance

Surviving a Disaster Rather than Recovering from One

- CoServers are physically separated
  - Different rooms in a building
  - Different buildings on a campus
  - Different towns
  - Up to 100 mile separation via dedicated or routable IP links

- If one fails, the other continues uninterrupted
Fault Tolerance for Server Blades

- Marathon FTvirtual Server complements blades’ high availability features
  - Eliminates Single Points of Failure
  - Simple Repair
- Blade = CoServer
- Blades and on-board storage become fault tolerant for critical applications
Typical Fault Tolerant Server Blade Configuration

- Blade = CoServer
- CoServer links via blade chassis backplane
- On-blade or network storage
- Multiple FTvirtual Servers per chassis
- FT and non-FT servers in same chassis
Disaster Tolerance for Server Blades

- Two chassis - 1 in each data center
- CoServer blades paired across chassis
- Chassis separated across LAN / WAN
Typical Disaster-Tolerant Server Blade Configuration
Blade Repair While Online

1. Remove, repair and replace the blade
2. Provision onboard disk with CoServer boot image
3. Insert the repaired blade
4. Blade automatically rejoins and data is remirrored to on-board disks
Managing Network Failures Across a Wide Area

- “Heart-beat” datagrams continuously communicate CoServer health
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- Quorum server negotiates split-brain scenario
Managing Network Failures Across a Wide Area

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- Simultaneous break in all communications causes “split-brain”:
  - Both halves run away and independently update data
- Quorum server negotiates split-brain scenario
- CoServer losing quorum server communication goes offline
- Continuous availability provided through failure
Quorum Server Failures

- Quorum Server failure leaves blades susceptible to “split-brain”
Quorum Server Failures

- Quorum Server failure leaves CoServer blades susceptible to “split-brain”
- Requiring one CoServer blades to shutdown
  - Application availability continues but redundancy is reduced
Quorum Server Failures

- Quorum Server failure leaves blades susceptible to “split-brain”
- Requiring effected CoServer blades to shutdown
  - Application availability continues but redundancy is reduced
- A second Quorum Server provides needed redundancy
Quorum Server Site Selection

- Co-locating Quorum Server and blades leaves blades susceptible to “split-brain” on site failure
Quorum Server Site Selection

- Co-locating Quorum Server and blades leaves blades susceptible to “split-brain” on site failure
- Locating Quorum Server at independent site preserves continuous availability
Storage Configurations For Disaster Tolerance

- Blade attached internal storage mirrored by Marathon software

![Diagram showing storage configurations for disaster tolerance with Blade attached internal storage mirrored by Marathon software.](image-url)
Storage Configurations For Disaster Tolerance

- SAN Storage device at each location
- Marathon software manages synchronous data updates at each site
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- Fabric failures cause loss of redundancy
Storage Configurations For Disaster Tolerance

- SAN Storage device at each location
- Marathon software manages synchronous data updates at each site
- Fabric failures cause loss of redundancy
- Multipath IO solutions provide higher availability
  - No loss of redundancy on fabric or HBA failure
  - Mirror copy avoided on service restoration
  - Multipath load balancing
Conclusion

- Availability is critical to many IT systems
- Emerging business and technology trends such as server blades increase the need for availability
- Continuous availability is the most effective HA technology
- Marathon software supports cost-effective, flexible blade configurations that provide continuous availability in the event of a site disaster
Thank You

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