



3Gen GlobalCluster™ Discussion – White Paper

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Introduction

3Gen's GlobalCluster™ is a unique solution that combines storage-based active-active or active-passive clustering with synchronous mirroring to deliver continuous availability and zero data loss. As a self-contained solution, GlobalCluster™ is able to transparently recover from failures so mission-critical applications continue uninterrupted. It also eliminates repetitive change management activities to reduce the risk of human error and administrative overhead.

You can now benefit from new GlobalCluster™ enhancements:

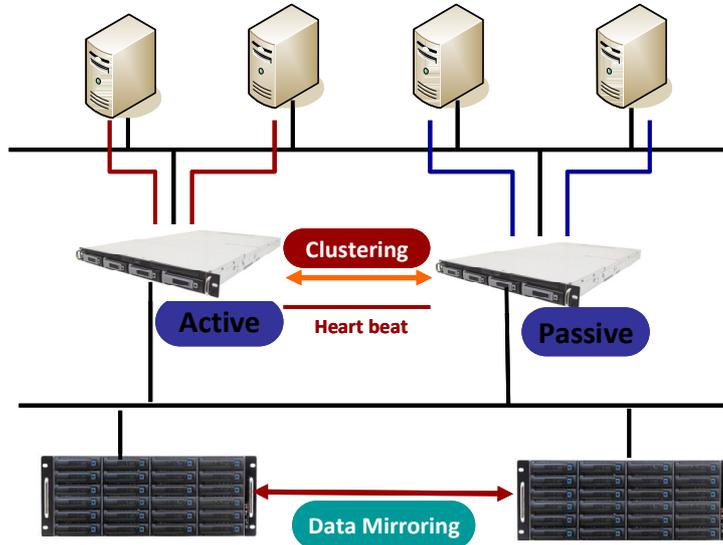
- Nondisruptive upgrades to minimize planned downtime
- Automated site failover to reduce unplanned downtime
- End-to-end continuous availability in a virtualized environment with all major servers HA' solution - e.g. VMware® HA

Whether you have a single data center, a campus, or a metropolitan-wide environment, GlobalCluster™ is a cost-effective solution that provides continuous data availability for your critical business environment.

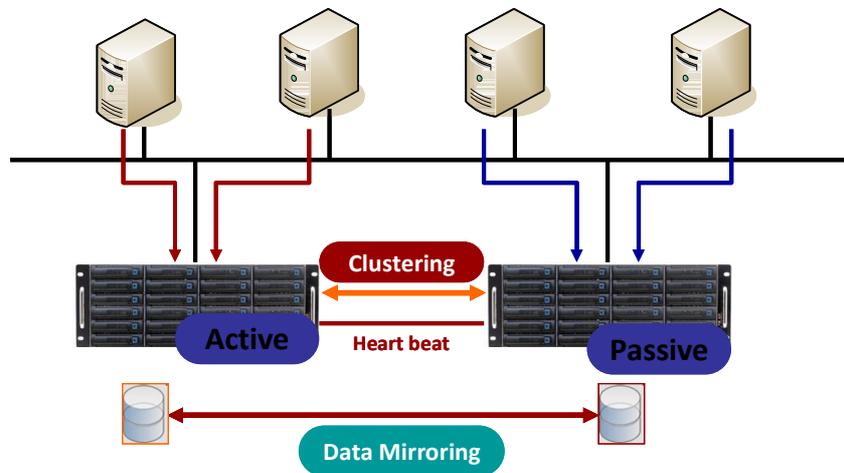
3Gen GlobalCluster™ architecture (cluster + Data Mirroring)

3Gen GlobalCluster™ offers two distinct types of HA designs:

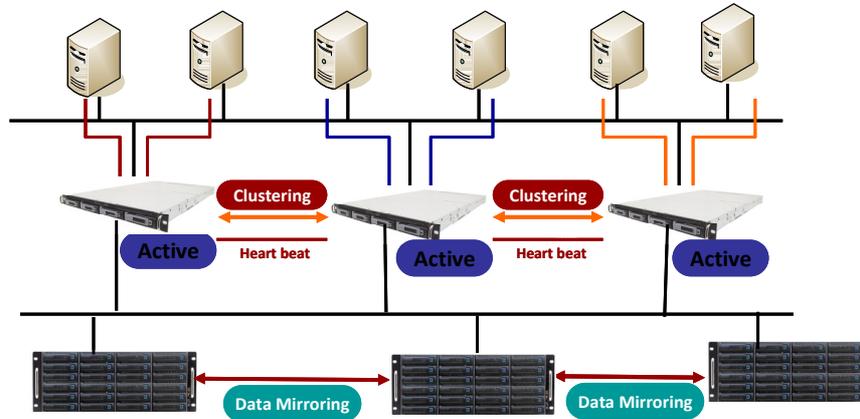
1. Active-Passive — provides a fully redundant instance of each node, which is only brought online when its associated primary node fails. This configuration typically requires the most extra hardware. Two configurations to choose from:
 - a. Shared Storage between two cluster members – ability to choose number of data mirroring copies from zero to many.



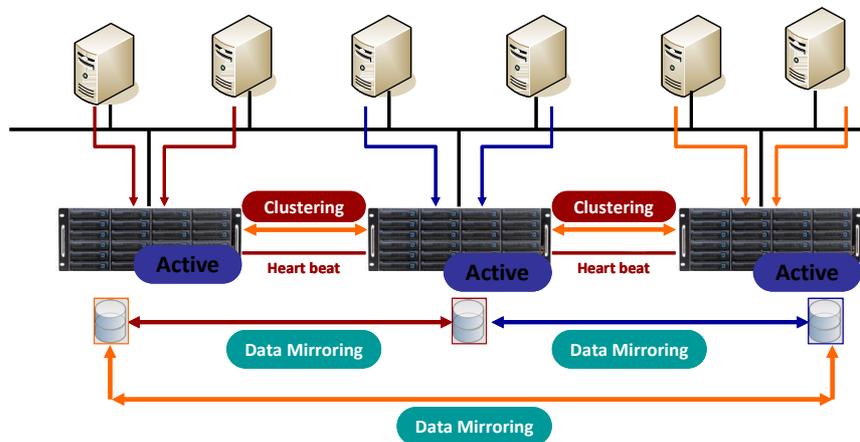
- b. Independent Storage between cluster members – This configuration requires data mirroring.



2. Active/Active — Traffic intended for the failed node is either passed onto an existing node or load balanced across the remaining nodes. 3Gen GlobalCluster™ supports up to 256 nodes. Two configurations to choose from
- a. Shared Storage among all the cluster members - ability to choose number of data mirroring copies from zero to many.



- b. Independent Storage between cluster members - data mirroring is required. In order for each cluster member to support failover for all cluster members, each member must have all the data for each cluster members. Therefore, number of mirroring copies must be equal to number of clustering members. Example: If you have 10 clustering members, you will have 10 data mirroring copies. The cost and complexity approaches diminishing returns when more than 5 cluster nodes are configured.



Active-Active vs. Active-Passive

Understanding how applications can be distributed across multiple servers in a cluster is important in deciding your clustering options. In the simplest case, an enterprise wishes to run several unrelated applications. Each application is set up to access files located on different disk partitions. In a Cluster environment, one can simply spread the application



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services across the clustered servers with all nodes actively running a share of the total load. This is called Active/Active clustering, since all servers are indeed active. If one server shuts down, the other servers will pick up the load of running all its services.

Key Advantages of Active-Active:

1. Easy to justify in term of Return on investment (ROI) - Maximum utilization of all hardware resources
2. Since all clustering members are worked together virtually as a single storage system, it is easy to scale and achieve the highest performance possible.
3. Achieve close to 100% system availability

In the event that a single large application is run on the cluster, it must be remembered that servers cannot access the same disk partition at the same time - because few applications available today provide support for concurrent data update from multiple systems (Oracle RAC is one of the few applications that does support multi-system concurrent update). So, it is necessary to restrict these applications to a single server, leaving the other servers as ready-to-go backups in case of failure. This is called Active/Passive operation. This style of operation typically leaves the Passive systems idle.

Key Advantages of Active-Passive:

1. Supports all operating systems and file system formats
2. When disaster strikes, failover system has low wear and tear on all its electronic components
3. No system performance impact before and after the failover

3Gen's GlobalCluster™ Advantages

While the significant cost savings (~50 percent) is the primary advantage of the GlobalCluster™ storage system option, other advantages arise from this 3Gen offering. Most significantly, the GlobalCluster™ design is much less complex than the typical Disaster Recovery (DR) IT solution. For example, a common scheme for data center DR might include two high availability storage subsystems with replication between them. In this case the data center

- Must configure two separate storage subsystems, one at each site with the same number of LUNs or volumes for each subsystem,
- Must operate two separate storage subsystems, one at each site, doubling the management burden, and
- Must initiate and monitor storage replication on a LUN by LUN basis between the two storage subsystems.

In contrast, the GlobalCluster™ features just a single subsystem split across two sites. LUNs or volumes are configured only once and are automatically defined to the other site. Additionally, the GlobalCluster™'s two sides operate as a single subsystem and automatically initiates replication when volumes are added to the GlobalCluster™, mirroring any new volumes when configured.

For partial data center failures, the GlobalCluster™ solution again simplifies IT's response by providing a fully automated failover remedy. For example, using GlobalCluster™, the storage subsystem, automatically and without operator intervention starts accessing data from the secondary site on loss of access to drives or a controller failure at the primary site. In a more common data center DR configuration similar failures would not be automated and would require a manual command/disaster declaration and an expensive activation of a secondary site.

Another significant advantage of the GlobalCluster™ is the performance that is available from the single subsystem image. This performance boost results from the single RAID1 array formed by the two sites. With the RAID 1 array formed, read requests perform better because the request can be issued and executed by either side of a RAID 1 mirror. In GlobalCluster™'s case, the RAID 1 mirror happens to be located across two different sites but the RAID 1 performance advantage is still present. 3Gen's GlobalCluster™ performance is also enhanced by its full support of data deduplication technology, which can reduce the amount of data that needs to be stored and replicated at both sites. Indeed, storage deduplication capabilities can significantly reduce the storage footprint for most data loads. Furthermore, another benefit is that GlobalCluster™ configurations can support dual active/operational data centers where both sides of a cluster are active. Specifically, there are two symmetrical pools of disks, one owned by side A and the other owned by side B with both being mirrored to the alternate side. As such, both storage service active, local data requests while providing redundant hardware for the other side outages.

Other disaster recovery options

While GlobalCluster™'s supported distances are impressive, synchronous replication imposed constraints may not suffice for some customers requiring region - wide disaster recovery. For these customers, 3Gen also offers SAN Volume Mirroring, an IP or FC based asynchronous storage replication feature that spans distances over 100km and adds local site resiliency. Any choice between implementing GlobalCluster™ or the longer distance SAN volume mirroring will ultimately depend on one's DR requirements. But by supplying both options, 3Gen provides the increased flexibility needed to recover from almost any failure scenario imaginable.

Summary

GlobalCluster™ effectively provides an exceptional solution to high availability, partial site failure and disaster recovery for NAS and SANs. In fact, the GlobalCluster™ is designed to provide continuous data availability whether in a partial site or complete site failure scenario. Its price and functionality make it a much more cost effective solution as compared to the standard DR processes. While GlobalCluster™ may only support limited distances, many customers may find such constraints fulfill their requirements. For those needing longer distance DR, adding SAN volume mirroring satisfies all needs for business continuity. In short, GlobalCluster™ just makes installing and using storage replication much easier to setup, much simpler to operate, less expensive to run over time and is available at a great price.

Here are the key points of 3Gen's GlobalCluster™:

1. Designed for zero unplanned downtime through transparent failover with protection from hardware plus network and environmental faults
2. Designed for zero planned downtime through nondisruptive upgrades for storage hardware and software
3. Designed for zero change management through automatic mirroring of changes to user, configuration, and application data
4. Set-it-once simplicity: easy to deploy, with no complex scripting or dependencies on the application or operating system
5. Improved read performance
6. Added efficiency through data deduplication and server virtualization

For more information about 3Gen High Availability solutions, please contact our regional sales offices and visit 3Gen website, www.3gendata.com