Storage Redundancy

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What is a Storage Redundancy?

Azure Storage always stores multiple copies of your data so that it's protected from planned and unplanned events, including transient hardware failures, network or power outages, and massive natural disasters. Redundancy ensures that your storage account meets its availability and durability targets even in the face of failures.

When deciding which redundancy option is best for your scenario, consider the tradeoffs between lower costs and higher availability. The factors that help determine which redundancy option you should choose include:

- How your data is replicated in the primary region.
- Whether your data is replicated to a second region that is geographically distant to the primary region, to protect against regional disasters (geo-replication).
- Whether your application requires read access to the replicated data in the secondary region if the primary region becomes unavailable for any reason (geo-replication with read access).

Redundancy in the Primary Region

Data in an Azure Storage account is always replicated three times in the primary region. Azure Storage offers two options for how your data is replicated in the primary region:

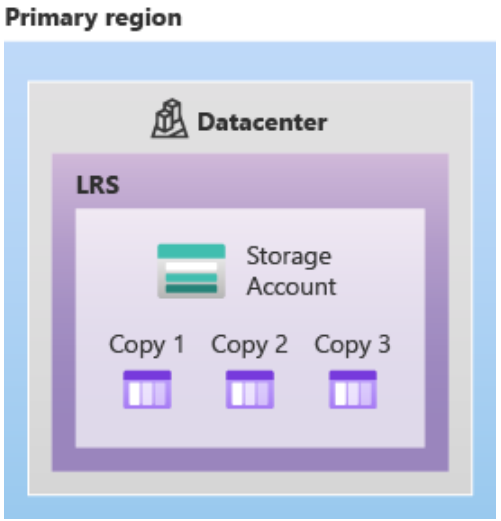
- **Locally redundant storage (LRS)** copies your data synchronously three times within a single physical location in the primary region. LRS is the least expensive replication option, but isn't recommended for applications requiring high availability or durability.
- **Zone-redundant storage (ZRS)** copies your data synchronously across three Azure availability zones in the primary region. For applications requiring high availability, Microsoft recommends using ZRS in the primary region, and also replicating to a secondary region.

Locally Redundant Storage (LRS)

Locally redundant storage (LRS) replicates your storage account three times within a single data center in the primary region. LRS provides at least 99.999999999% (11 nines) durability of objects over a given year.

LRS is the lowest-cost redundancy option and offers the least durability compared to other options. LRS protects your data against server rack and drive failures. However, if a disaster such as fire or flooding occurs within the data center, all replicas of a storage account using LRS may be lost or unrecoverable.

A write request to a storage account that is using LRS happens synchronously. The write operation returns successfully only after the data is written to all three replicas.

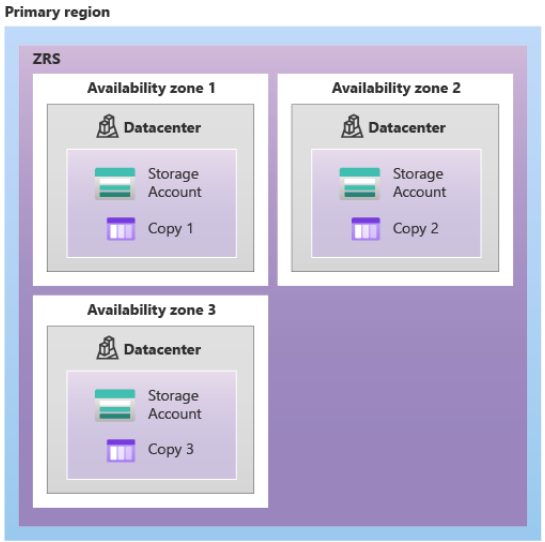


Zone-Redundant Storage (ZRS)

Zone-redundant storage (ZRS) replicates your storage account synchronously across three Azure availability zones in the primary region. Each availability zone is a separate physical location with independent power, cooling, and networking. ZRS offers durability for storage resources of at least 99.9999999999% (12 9's) over a given year.

With ZRS, your data is still accessible for both read and write operations even if a zone becomes unavailable. If a zone becomes unavailable, Azure undertakes networking updates, such as DNS repointing. These updates may affect your application if you access data before the updates have completed. When designing applications for ZRS, follow practices for transient fault handling, including implementing retry policies with exponential back-off.

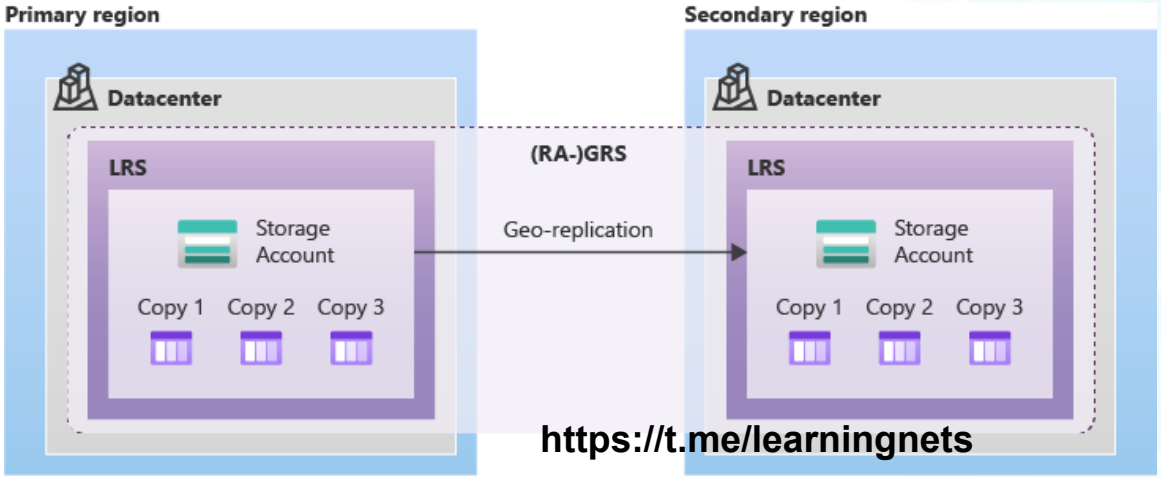
A write request to a storage account that is using ZRS happens synchronously. The write operation returns successfully only after the data is written to all replicas across the three availability zones.



Geo-Redundant Storage (GRS)

Geo-redundant storage (GRS) copies your data synchronously three times within a single physical location in the primary region using LRS. It then copies your data asynchronously to a single physical location in a secondary region that is hundreds of miles away from the primary region. GRS offers durability for storage resources of at least 99.99999999999999% (16 9's) over a given year.

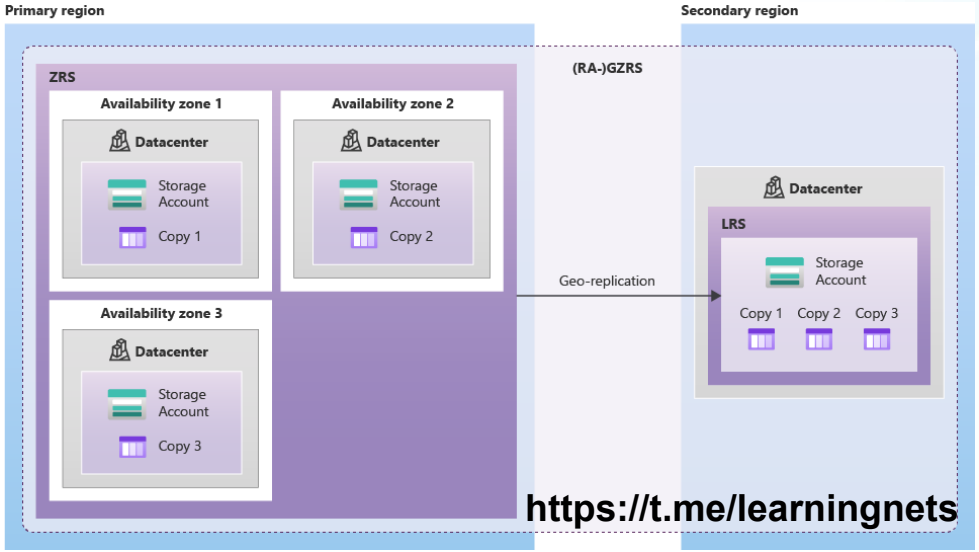
A write operation is first committed to the primary location and replicated using LRS. The update is then replicated asynchronously to the secondary region. When data is written to the secondary location, it's also replicated within that location using LRS.



Geo-Zone-Redundant Storage (GZRS)

Data in a GZRS storage account is copied across three Azure availability zones in the primary region and is also replicated to a secondary geographic region for protection from regional disasters. Microsoft recommends using GZRS for applications requiring maximum consistency, durability, and availability, excellent performance, and resilience for disaster recovery.

With a GZRS storage account, you can continue to read and write data if an availability zone becomes unavailable or is unrecoverable. Additionally, your data is also durable in the case of a complete regional outage or a disaster in which the primary region isn't recoverable. GZRS is designed to provide at least 99.99999999999999% (16 9's) durability of objects over a given year.



Read Access to Data in the Secondary Region

Geo-redundant storage (with GRS or GZRS) replicates your data to another physical location in the secondary region to protect against regional outages. With an account configured for GRS or GZRS, data in the secondary region is not directly accessible to users or applications, unless a failover occurs.

If your applications require high availability, then you can configure your storage account for read access to the secondary region. When you enable read access to the secondary region, then your data is always available to be read from the secondary, including in a situation where the primary region becomes unavailable. **Read-access geo-redundant storage (RA-GRS) or read-access geo-zone-redundant storage (RA-GZRS)** configurations permit read access to the secondary region.