The following types of thin-provisioned volumes are available:

- *Autoexpand volumes* allocate real capacity from a storage pool on demand, which minimizes required user intervention. However, a malfunctioning application can cause a volume to expand until its real capacity is equal to the virtual capacity, which potentially can starve other thin provisioned volumes in the pool.
- *Non-autoexpand volumes* have a fixed amount of assigned real capacity. In this case, the user must monitor the volume and assign more capacity when required. Although it prevents starving other thin provisioned volumes, it introduces a risk of an unplanned outage. A thin-provisioned volume goes offline if host tries to write more data than what can fit into the allocated real capacity.

The main risk that is associated with using thin-provisioned volumes is running out of real capacity in the storage volumes, pool, or both, and the resulting unplanned outage. Therefore, strict monitoring of the used capacity on all non-autoexpand volumes and monitoring of the free space in the storage pool is required.

When you configure a thin-provisioned volume, you can define a warning level attribute to generate a warning event when the used real capacity exceeds a specified amount or percentage of the total virtual capacity. You can also use the warning event to trigger other actions, such as taking low-priority applications offline or migrating data into other storage pools.

If a thin-provisioned volume does not have enough real capacity for a write operation, the volume is taken offline and an error is logged (error code 1865, event ID 060001). Access to the thin-provisioned volume is restored by increasing the real capacity of the volume, which might require increasing the size of the storage pool from which it is allocated. Until this time, the data is held in the Storwize V7000 cache. Although in principle this situation is not a data integrity or data loss issue, you must not rely on the Storwize V7000 cache as a backup storage mechanism.

Space is not allocated on a thin-provisioned volume if an incoming host write operation contains all zeros.

Important: Set and monitor a warning level on the used capacity so that you have adequate time to respond and provision more physical capacity.

Warnings must not be ignored by an administrator.

Consider the use of the autoexpand feature of the thin-provisioned volumes to reduce human intervention required to maintain access to thin-provisioned volumes.

When you create a thin-provisioned volume, you can choose the grain size for allocating space in 32 kibibytes (KiB), 64 KiB, 128 KiB, or 256 KiB chunks. The grain size that you select affects the maximum virtual capacity for the thin-provisioned volume. The default grain size is 256 KiB, which is the preferred option. If you select 32 KiB for the grain size, the volume size cannot exceed 260,000 gibibytes (GiB). The grain size cannot be changed after the thin-provisioned volume is created.

Generally, smaller grain sizes save space, but require more metadata access, which can adversely affect performance. If you are not going to use the thin-provisioned volume as a FlashCopy source or target volume, use 256 KiB to maximize performance. If you are going to use the thin-provisioned volume as a FlashCopy source or target volume, specify the same grain size for the volume and for the FlashCopy function. In this situation, ideally grain size is equal to the typical I/O size from the host.