About Dynamic Provisioning

While basic or traditional provisioning strategies can be appropriate and useful in specific scenarios, they can be expensive to set up, time-consuming to configure, difficult to monitor, and error prone. Dynamic Provisioning allows you to reserve virtual storage capacity based on anticipated future capacity needs, using virtual volumes instead of physical disk capacity. Although Dynamic Provisioning requires some additional setup steps, it can provide a simpler and more beneficial alternative to traditional provisioning methods.

Overall storage use rates can improve because you can potentially provide more virtual capacity to applications while using fewer physical drives. Dynamic Provisioning can provide lower initial cost, greater efficiency, and ease of storage management for storage administrators. The Dynamic Provisioning feature offers the following benefits:

- Simplifies storage management
- Provides a better balance of resources and performance optimization by default than traditional provisioning
- Optimizes physical drive usage
- Reduces device address requirements over traditional provisioning by providing larger volume sizes

When to use Dynamic Provisioning

Dynamic Provisioning is a best fit in an open-systems environment in the following scenarios:

- When the aggregation of storage pool capacity usage across many volumes provides the best opportunity for performance optimization.
- For stable environments and large consistently growing files or volumes.
- When device addressing constraints are a concern.

Dynamic Provisioning concepts

Dynamic Provisioning is a volume management feature that allows storage managers and system administrators to efficiently plan and allocate storage to users or applications. It provides a platform for the array to dynamically manage data and physical capacity without frequent manual involvement.

Dynamic Provisioning provides three important capabilities: as-needed provisioning of storage, enhanced volume performance, and larger volume sizes.

Dynamic Provisioning is more efficient than traditional provisioning strategies. It is implemented by creating one or more
Dynamic Provisioning pools (DP pools) of physical storage space using multiple LDEVs. Then, you can establish virtual DP volumes (DP-VOLs) and associate them to the individual DP pools. In this way, capacity to support data can be optimally assigned on demand within the pool.

DP-VOLs are of a user-specified logical size without any corresponding physical space. Actual physical space allocated (in 42-MB pool page units) is automatically assigned to a DP-VOL from the associated DP pool as that volume's logical space is written to over time. A new DP-VOL does not have any pool pages assigned to it. The pages are loaned out from its associated pool to that DP volume until the volume is reformatted or deleted. At that point, all of that volume's assigned pages are returned to the pool's free page list. This handling of logical and physical capacity is called thin provisioning. In many cases, logical capacity will exceed physical capacity.

Dynamic Provisioning also enhances volume performance. This is an automatic result of how DP-VOLs map capacity from individual DP pools. A pool is created using from one to 1024 LDEVs (pool volumes) of physical space. Each pool volume is sectioned into 42-MB pages. Each page is consecutively laid down on a number of RAID stripes from one pool volume. The pool's 42-MB pool pages are assigned on demand to any of the DP-VOLs that are connected to that pool. Other pages assigned over time to that DP-VOL randomly originate from the next free page of some other pool volume in the pool.

Setting up a Dynamic Provisioning environment requires a few extra steps. Similar to basic provisioning, you still configure various array groups to a desired RAID level and create one or more volumes (LDEVs) on each of them. Then set up a Dynamic Provisioning environment by creating one or more DP pools of physical storage space that are each a collection of some of these LDEVs (DP pool volumes). This pool structure supports creation of Dynamic Provisioning virtual volumes (DP-VOLs), where 42-MB pages of data are randomly assigned on demand.

### Advantages of using Dynamic Provisioning

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<th>Advantages</th>
<th>Without Dynamic Provisioning</th>
<th>With Dynamic Provisioning</th>
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<tr>
<td>Reduces initial costs</td>
<td>You must purchase physical drive capacity for expected future use. The unused capacity adds costs for both the storage system and software products.</td>
<td>You can logically allocate more capacity than is physically installed. You can purchase less capacity, reducing initial costs and you can add capacity later by expanding the pool. <strong>Note:</strong> Some file systems take up pool space. For details, see <a href="https://knowledge.hitachivantara.com/Documents/Management_Software/SVOS/8.1/Volume_Management/Provisioning/Abou%E2%80%A6">Operating system and file system capacity</a>.</td>
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<td>Reduces management costs</td>
<td>You must stop the storage system to reconfigure it.</td>
<td>When physical capacity becomes insufficient, you can add pool capacity without service interruption.</td>
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<td>Advantages</td>
<td>Without Dynamic Provisioning</td>
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<td>In addition, with Dynamic Tiering you can configure pool storage consisting of multiple types of data storage, including SSD, SAS, and external volumes. This eliminates unnecessary costs. For VSP Fx00 models, SAS drives cannot be specified.</td>
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<td>Reduces management labor and increases availability of storage volumes for replication</td>
<td>As the expected physical drive capacity is purchased, the unused capacity of the storage system also needs to be managed on the storage system and on licensed products.</td>
<td>Licenses for storage system software products are based on used capacity rather than the total defined capacity. You can allocate volumes of up to 256 TB regardless of physical drive capacity. Dynamic Tiering allows you to use storage efficiently by automatically migrating data to the most suitable data drive.</td>
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<td>Increases the performance efficiency of the data drive</td>
<td>Because physical drive capacity is initially purchased and installed to meet expected future needs, portions of the capacity may be unused. I/O loads may concentrate on just a subset of the storage which might decrease performance.</td>
<td>Effectively combines I/O patterns of many applications and evenly spreads the I/O activity across available physical resources, preventing bottlenecks in parity group performance. Configuring the volumes from multiple parity groups improves parity group performance. This also increases storage use while reducing power and pooling requirements (total cost of ownership).</td>
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**Dynamic Provisioning advantage example**

To illustrate the advantages of a Dynamic Provisioning environment, assume you have 12 LDEVs from 12 RAID1 (2D+2D) array groups assigned to a DP pool. All 48 drives contribute their IOPS and throughput power to all DP volumes assigned to that pool. Instead, if more random read IOPS horsepower is desired for a pool, then the DP pool can be created with 32 LDEVs from 32 RAID5 (3D+1P) array groups, thus providing 128 drives of IOPS power to that pool. Up to 1024 LDEVs can be assigned to a single pool, providing a considerable amount of I/O capability to just a few DP volumes.
Dynamic Provisioning workflow

The following diagram shows the workflow for setting up Dynamic Provisioning on the storage system.

Use Device Manager - Storage Navigator or Command Control Interface to create pools and DP-VOLs.

1. Preparing for operations
   - Creating and formatting LDEVs to be made into pool-VOLs
   - Creating pools and adding the pool-VOLs
   - Creating V-VOLs
   - Defining DP-VOL LU paths
   - Copying data to V-VOLs
   - Reclaiming zero pages
   - If the V-VOL migration is required

2. Operating
   - Monitoring the pool's free area
   - Expanding the pool capacity
   - Expanding the DP-VOL capacity
   - If expansion is required

3. Discontinuing operations
   - Deleting DP-VOL LU paths
   - Deleting V-VOLs
   - Deleting pools

Next steps

- Review the requirements for provisioning
- Learn about interoperability considerations for DP-VOLs and pool-VOLs
- Read about the capacity saving feature