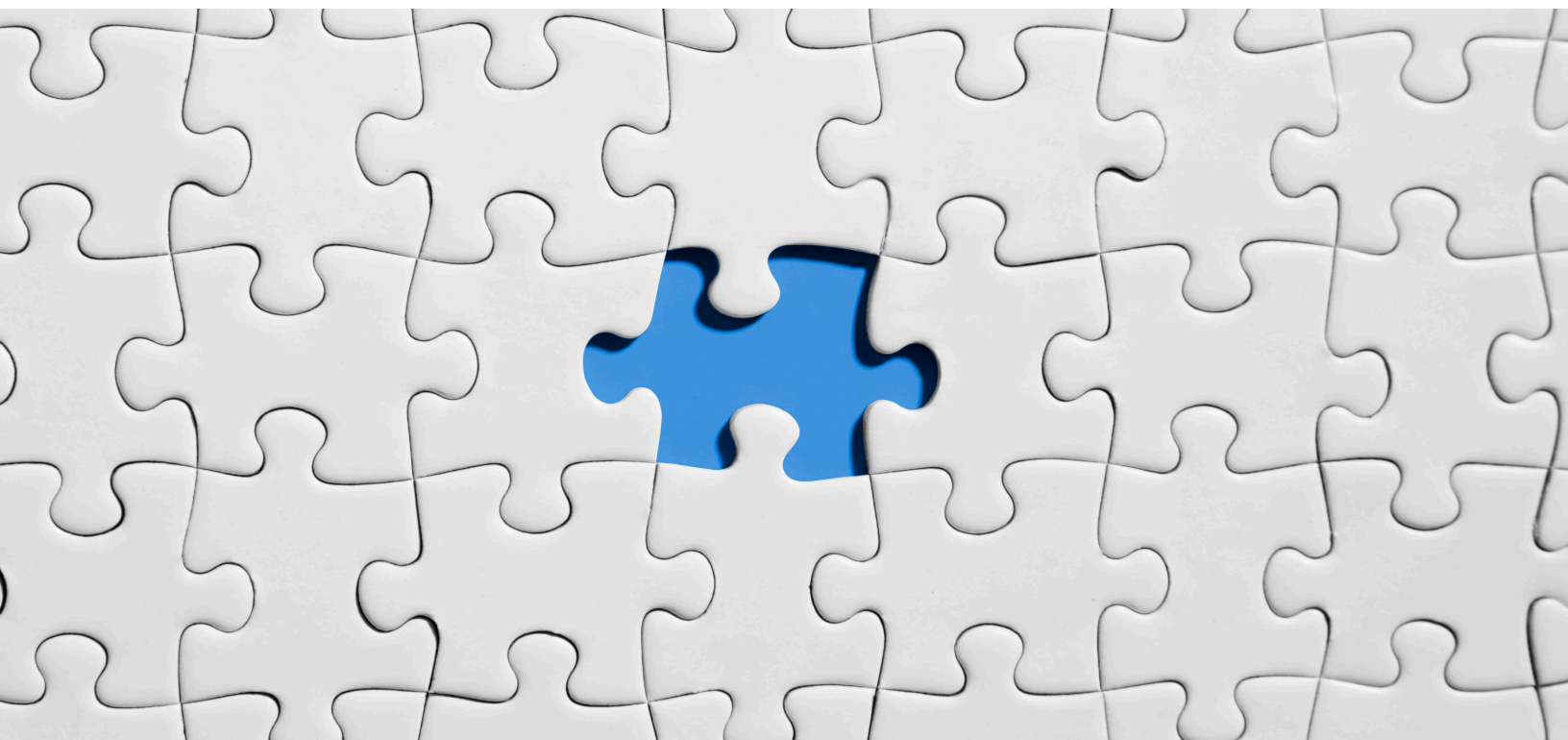


ISILON SIZING: SIZING FOR ACCURATE CAPACITY



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Abstract

It is important to size a solution with accurate usable capacity to ensure sufficient storage capacity is available to meet customer requirements.

Multiple factors affect usable capacity of the Isilon cluster, i.e. protection scheme, number of small files, and so forth. This Knowledge Sharing article examines how small files affect the storage efficiency of the Isilon cluster, how the Isilon sizing tool calculates usable capacity of the cluster and how to avoid sizing wrong usable capacity by considering small file efficiency. We will also explore how to use available tools to calculate capacity overhead due to small files and then utilize the same information to size an Isilon solution with accurate capacity.

Introduction

Solution design is a method that examines the requirement of a customer and provide a solution that meets the requirements.

A key qualifying question for sizing a solution is “How much capacity is the customer looking for?”. The sized solution must provide accurate capacity; a wrong capacity solution for the customer can result in CSAT issues or even lost business deals.

An important factor affecting the required capacity for a solution is the “File Size” of the workload .

OneFS Data Layout & Protection

Isilon is designed to lay out data in the most efficient, economical, and high performance manner. It uses the Reed-Solomon algorithm, an industry standard method to create error-correcting codes at the file level. When data is ingested in to the isilon cluster it is striped across the nodes available in the cluster. Striping protects the cluster’s data and improves performance.

Three variables combine to determine how data is laid out.

- Number of Nodes (determines the width of the stripe)
- Protection Level
- File Size

The file size affects data layout because OneFS employs different layout options for larger files than for smaller files to increase efficiency and performance.

Stripe Width = Data stripe + FEC stripe

- **Data Stripe:** A part of user’s file (N)
- **FEC Stripe:** Data protection part (M)

As of OneFS 7.2, the maximum N is 16 and maximum M is 4. Thus, maximum Stripe Width can be 20.

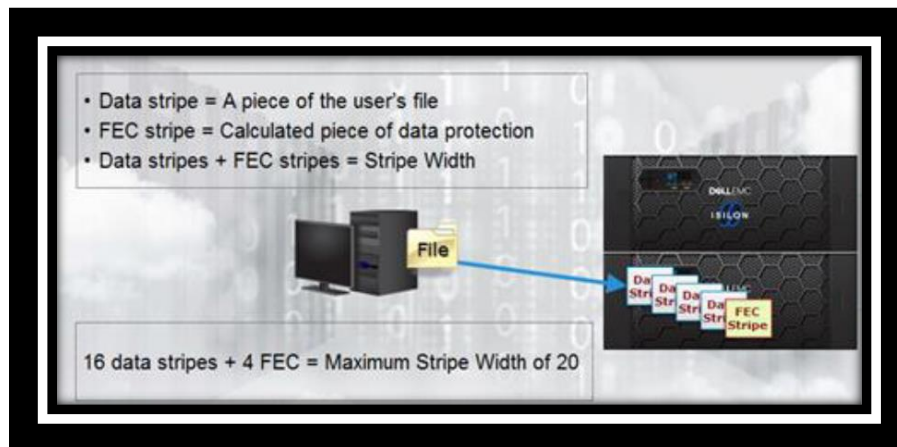


Figure 1: File Striping

When a client connects to a node, the connected node calculates the data stripe units and the data protection needed for the file. The number of FEC (Forward error correction) stripes will depend on the level of protection configured for the cluster. Each data stripe contains a maximum of 16 blocks. Since each block is 8 KB in size, the size of our data and FEC stripes will come as 128 KB.

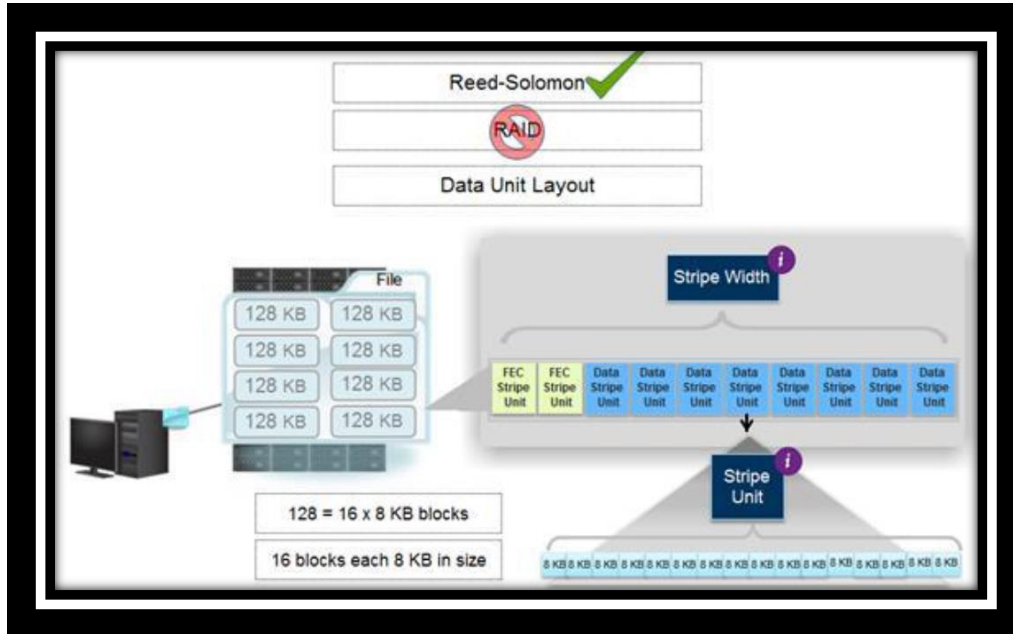


Figure 2: Data Layout : FEC Stripes

Files greater than 128K are protected with FEC and striped across nodes. Based upon per file policy, it allows files to use the combined resources of up to 20 nodes. However, files smaller than 128KB are unable to fill a stripe unit, so are mirrored rather than FEC protected, resulting in a less efficient on-disk footprint. This is hardly an issue for most of the data set because the existence of a smaller number of larger FEC protected files balances the mirroring of the small files.

For example, if the file size is 24KB, it will take 3 blocks of 8KB. If it has two mirrors for protection, it will occupy a total of 72KB; this will be required to store and protect it on disk. Files in the range of 150KB to 300KB typically see efficiency of nearly 50%.

Isilon Sizing tool, its assumption and capacity variation

Isilon's sizing tool is a web-based tool (<https://isilon-sizing-tool.herokuapp.com/legacy/apps/v3/>) used by Isilon sales team to design solution for their customers. By default, the Isilon Sizer Tool assumes that the data being stored on the cluster is large enough to utilize the full width available within the protection group resulting in maximum efficiency.

Example: Assume a customer is looking for 300 TB of Usable capacity and they request for H500 nodes. When we size the solution for this capacity and node type, sizer recommends the solution below.

Nodes	Family	Usable @ 100%	Raw	Efficiency	Protection	HDD	SSD	SED	RAM	Internal Net	External Net		
4	H500	324 TIB / 357 TB	480 TB	75%	+2d:1n	15	8 TB	1	1.6 TB	None	128	Ethernet	10 GbE

In this case sizer assumes that the data to be stored on the cluster is large enough to use the full width available within the protection group, hence, providing a solution which gives 75% storage efficiency.

Now assume what if all of the files were 128k @ 2d:1n?

$128k * 3 = 384k$ (Physical) = 68% overhead.

File Size Calculator

This calculator has only been qualified for OneFS 8.0 and below with Isilon generation 5 platform.

Total File Sizer Inputs 1



	Protection +2d:1n	Nodes 4	File Size 128	Unit KB	File Quantity 1
					
			On Disk Size 394.752 KB	Storage Efficiency 32%	Overhead 68%

Figure 3: File Size Calculation(<https://isilon-sizing-tool.herokuapp.com/legacy/apps/v3/calculators/file-sizer>)

Now the Pool Usable Capacity would be: 153TB not 357TB

How to size for accurate Capacity

Clearly, File size plays an important role in calculating actual capacity required for the customer.

Thus, it is important to know how the real time workload looks and how to leverage IIQ to capture the real time data.

Under File System Reporting->File System Analytics (Data Usage)

Dirs	Files	Other	Logical	Physical
20	348	0	9.61 MiB	24.6 MiB
2	1	0	660 B	80 KiB
1	1	0	423 B	56 KiB
1	0	0	0 B	24 KiB
1	0	0	0 B	24 KiB
1	0	0	0 B	24 KiB
1	0	0	0 B	24 KiB
1	0	0	0 B	24 KiB
1	0	0	0 B	24 KiB
1	0	0	0 B	24 KiB
1	0	0	0 B	24 KiB

16 directories

Figure 4: File System Reporting

Hence in the above example if we calculate the efficiency, it will be 39% (9.61 / 24.6). Now, considering this efficiency percentage and if the customer is asking for a 100 TB Usable capacity solution, we need to size for = $100 / .39 = 256$ TB RAW. **This calculation does not include any SSD strategy.**

Enhancing small file storage efficiency

To maximize the long-term value of their critical business data and reduce storage management complexity and cost, Dell EMC came up with Small File Storage Efficiency solution. It is specifically designed for infrequently modified, archive datasets.

Archive applications such as PACS is now moving away from storing large archive file formats to storing the small files individually. Efficiency is attained by reading the on-disk data for small files and then packing them into larger OneFS data structures, called shadow stores. Erasure coding is used to protect the shadow stores using the parity. It usually provides efficiency of 80% or greater.

Architecture

Predicated on the idea of containerization of files, Isilon SFSE consists of 6 main components:

- File pool configuration policy
- SmartPools Job
- Shadow Store
- Configuration control path
- File packing and data layout infrastructure
- Defragmenter

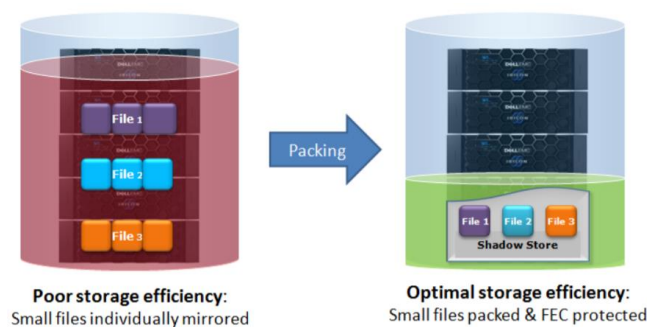


Figure 5: OneFS small file containerization

Conclusion

To size an optimal solution with accurate capacity, it is important to calculate the storage efficiency and know the file size. Isilon Small File Storage Efficiency integration with the industry's leading Scale-Out NAS architecture delivers on the promise of simple data efficiency at scale by providing significant storage cost saving. With its intelligent default settings, Dell EMC Isilon Small File Storage Efficiency is automated, extensible, and easy to manage, providing enterprise data efficiency within a single storage pool.

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