



# Considering checksum type when planning array LUN size and number

ONTAP FlexArray

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# Considering checksum type when planning array LUN size and number

When planning the number and size of array LUNs that you need for ONTAP, you must consider the impact of the checksum type on the amount of usable space in the array LUN. A checksum type must be specified for each array LUN assigned to an ONTAP system.

When an array LUN on the storage array is mapped to be used by an ONTAP system, ONTAP treats the array LUN as a raw, unformatted disk. When you assign an array LUN to an ONTAP system you specify the checksum type, which tells ONTAP how to format the raw array LUN. The impact of the checksum type on usable space depends on the checksum type you specify for the LUN.

## Characteristics of checksum types that ONTAP supports

ONTAP supports block checksum type (BCS) and advanced zoned checksum type (AZCS) for array LUNs, disks, and aggregates.

The type of checksum assigned to an array LUN in ONTAP can impact performance or the usable space of an array LUN. Therefore, the number and size of array LUNs you need can be impacted depending on the checksum type you assign to array LUNs.

### Block checksum (BCS)

BCS is the default and recommended checksum type for array LUNs. BCS provides better performance for array LUNs than AZCS.

BCS has a greater impact on the usable space in an array LUN than AZCS. BCS uses 12.5 percent of the usable space in an array LUN.

### Advanced zoned checksum (AZCS)

AZCS is an alternative to BCS. The impact of AZCS on usable space in an array LUN is less than with BCS; AZCS uses 1.56 percent of the device capacity. However, you must weigh the need for more usable space against performance. AZCS can sometimes cause performance problems for array LUNs.

AZCS is not recommended for array LUNs for high-performance random workloads. However, you can use AZCS with array LUNs for DR, archive, or similar workloads.

There is no AZCS performance impact on native disks.

The guidelines for checksum types differ according to disk size and type. See *TR3838 Storage Subsystem Configuration Guide* for more information.

### Related information

[NetApp Technical Report 3838: Storage Subsystem Configuration Guide](#)

# Formulas for calculating array LUN size based on checksum type

A number of elements, including checksum type, impact the usable capacity of an array LUN. You can use a formula to calculate how much usable capacity there would be in a given size array LUN, or to calculate how large an array LUN has to be to provide the amount of storage that you want.

A number of elements, including checksum type, impact the size of the array LUN you require for the amount of *usable capacity*. Usable capacity is the amount of space that is available for storage.

The following table shows the ways of calculating the array LUN size you require:

If you know...	You want to find out...
How large your array LUNs are	How much capacity is available for storage (usable capacity). You have to consider the amount of space required for all elements.
How much storage that you want in the array LUN	How large an array LUN you require. You have to take into account your required amount of storage and space required for other elements.



2 TB in these formulas represents 2 TiB, or 2199023255552 bytes, which is 2097.152 GnaB or 2.097 TnaB according to the way that ONTAP calculates measurements.

## Formula for calculating the usable capacity

When you know how large your array LUNs are, you can use the following formula to determine the usable capacity for storage in an array LUN. This formula takes into account the Snapshot reserve.

- Y is the usable capacity for storage.
- N is the total capacity of the array LUN.

Checksum type	Formula
BCS—array LUNs less than 2 TB	$N \times \{0.875 \times 0.9 \times 0.99 \times (1 - \text{Snapshot reserve})\} = Y$
BCS—array LUNs greater than 2 TB	$N \times \{0.875 \times 0.9 \times 0.998 \times (1 - \text{Snapshot reserve})\} = Y$
AZCS—array LUNs less than 2 TB	$N \times \{0.984 \times 0.9 \times 0.99 \times (1 - \text{Snapshot reserve})\} = Y$
AZCS—array LUNs greater than 2 TB	$N \times \{0.984 \times 0.9 \times 0.998 \times (1 - \text{Snapshot reserve})\} = Y$

### Example 1: calculations *with* a Snapshot reserve

In the following example, the total capacity of the array LUN is 4 GB, with a volume Snapshot reserve set at the default for Data ONTAP 8.1.1 (5 percent).

The following examples are for an array LUN less than 2 TB:

Checksum type	Formula
BCS (array LUN less than 2 TB)	$4 \times \{0.875 \times 0.9 \times 0.99 \times 0.95\} = 2.96$ GB usable space for storage
AZCS (array LUN less than 2 TB)	$4 \times \{0.984 \times 0.9 \times 0.99 \times 0.95\} = 3.33$ GB usable space for storage

## Formula for calculating maximum array LUN size needed

When you know the array LUN capacity needed to obtain the storage capacity you want, you can use the following formula to determine the total array LUN size you need, considering elements that require space in the LUN.

- Y is the exact amount of space in the array LUN that you want.
- If you are using Snapshot copies, the Snapshot reserve is taken into account.

The following examples are for an array LUN less than 2 TB:

Checksum type	Formula
BCS (array LUN less than 2 TB)	$Y \div \{0.875 \times 0.9 \times 0.99 \times (1 - \text{Snapshot reserve})\} =$ Actual capacity required
AZCS (array LUN less than 2 TB)	$Y \div \{0.984 \times 0.9 \times 0.99 \times (1 - \text{Snapshot reserve})\} =$ Actual capacity required

## Example 2: calculations *with* Snapshot reserves

In this example, the volume Snapshot reserve is the default setting for Data ONTAP 8.1.1 (5 percent).

The following examples are for an array LUN less than 2 TB:

Checksum type	Formula
BCS (array LUN less than 2 TB)	$10 \text{ GB} \div \{0.875 \times 0.9 \times 0.99 \times 0.95\} = 13.5$ GB actual capacity required
AZCS (array LUN less than 2 TB)	$10 \text{ GB} \div \{0.984 \times 0.9 \times 0.99 \times 0.95\} = 12.05$ GB actual capacity required

## Example 3: calculations *without* Snapshot reserves

You want 10 GB of usable capacity for storage. The following example shows calculating actual array LUN size when you are not using Snapshot copies.

The following examples are for an array LUN less than 2 TB:

<b>Checksum type</b>	<b>Formula</b>
BCS (array LUN less than 2 TB)	$10 \text{ GB} \div \{0.875 \times 0.9 \times 0.99\} = 12.8 \text{ GB actual capacity required}$
AZCS (array LUN less than 2 TB)	$10 \text{ GB} \div \{0.984 \times 0.9 \times 0.99\} = 11.41 \text{ GB actual capacity required}$

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