Is RAID Dead? - Part 1

30+ years of deployment and evolution

RAID (Redundant Array of Independent Disks) was first invented in 1987 and still in use till today. It was designed to create a large storage system, made up of smaller HDDs (Hard-Disk Drives), to provide the capacity and to automatically recover and rebuild data around failed drives.

It is a proven system, otherwise it would not have lasted so long. However, newer storage systems, based on SDS (Software-Defined Storage), have eschewed RAID in favour of either Replica or Erasure Coding in building storage arrays.

This Insight article is a 3-part series, which first provides a quick primer on RAID, then an introduction to Replica and Erasure Coding, and finally a posit that RAID is at the end of its useful life.

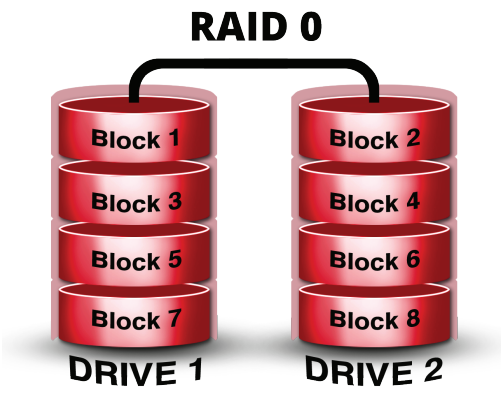
If you would like to read more about SDS, you can refer to our earlier Insight article “TThe Future of Software Defined Storage Is Now”

Primer on RAID

RAID is a storage system, made up of many independent HDDs, forming a large logical storage pool. There are a few RAID methods in use today, with each one providing different capacities and failure options. We will explain how the different RAID methods work, and how they handle drive failures.

RAID 0

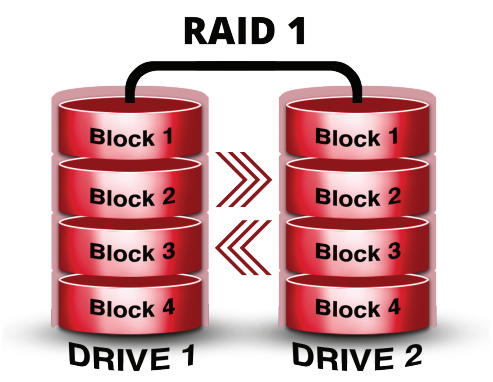
RAID 0 combines 2 similar capacity drives to form a single logical drive, with the total capacity of 2 drives combined. The diagram below illustrates RAID 0:



- Data is written across the 2 drives.
- The 2 drives are combined to form 1 logical drive with twice the capacity of 1 drive.
- There is no failure option.
- A drive failure is catastrophic and will mean data loss.

RAID 1

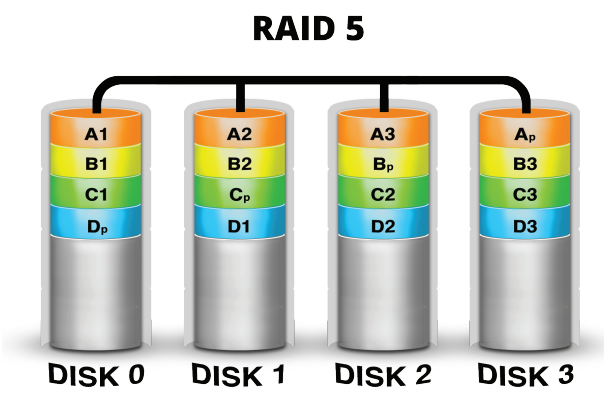
RAID 1 combines 2 similar capacity drives to form a single drive, with the total capacity of 1 drive. The diagram below illustrates RAID 1 :



- Data is written to 1 drive and mirrored to the other drive. The 2 drives are combined to form 1, logical drive, but with the capacity of only 1 drive.
- 1 drive can fail, and operations can continue uninterrupted.
- The failed drive can be replaced with a new one while the system is running.
- Once replaced, the data will be copied to the new drive.

RAID 5

RAID 5 combines 3 or more similar capacity drives to form a single logical drive. It can tolerate any 1 drive failure within the RAID set, without interruptions or data loss. The diagram below illustrates RAID 5.



In this example, there is a total of 4 drives in a RAID 5 set. A chunk of data is broken up into 4 smaller shards, eg **A** is broken up into A1, A2, A3, Ap, and written across the drives. **A** can be read back, as long as any 3 of the 4 shards are available, therefore RAID 5 can suffer any 1 drive failure without interruption or data loss.

The total usable capacity is (N -1) x C, where N is the number of drive, and C is the capacity of each drive. The failed drive can be replaced with a new one while the system is running. Once replaced, the data will commence rebuilding.

RAID 6

RAID 6 combines 4 or more similar capacity drives to form a single logical drive. It is similar to RAID 5, but it can withstand 2 drive failures. The diagram below illustrates RAID 6.

In this example, there is a total of 5 drives in a RAID 6 set. A chunk of data is broken up into 5 smaller shards, eg **A** is broken up into A1, A2, A3, Ap, Aq, and written across the drives. **A** can be read back, as long as any 3 of the 5 shards are available, therefore RAID 6 can suffer any 2 drive failures without interruption or data loss.

The total usable capacity is (N-2) x C.
The failed drive can be replaced with a new one, while the system is running. Once replaced, the data will commence rebuilding.

RAID 10, 50, 60

RAID 10, 50 and 60 is a hybrid between RAID 1/5/6 with RAID 0. It offers higher reliability and faster rebuilding times during drive failures, but with a higher overhead of unusable space. If you are interested to know more about these advance RAID, let us know, and we will be happy to write another Insight article about it.

Replica and Erasure Coding

In modern SDS, RAID is no longer used, instead alterative technologies such as Replica or Erasure Coding is used. This is discussed in part 2 of this series of Insight, so make sure you follow our Facebook or LinkedIn.

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