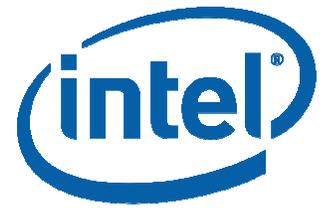


Intel[®] High Performance SATA Solid-State Drive

Over-provisioning an Intel[®] SSD



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Introduction

Over-provisioning is a term used to describe the process of increasing the spare area on a solid-state drive (SSD). Much like “short stroking” a hard disk drive (HDD), over-provisioning an SSD increases the performance and endurance of an SSD. This document provides details on the items that can be modified to over-provision an Intel SSD.

Spare Area Allocation

Increasing the spare area allocation of an SSD will result in performance and endurance gains. Increasing this area, also known as “over-provisioning”, is similar to the concept HDD users term “short stroking” the drive. Enlarging the spare area increases the available “ready to be written” resource pool which decreases write amplification. Since there is less background data movement required, performance and endurance increases.

The performance benefits of over-provisioning are most relevant to the Intel® X25-M SSD because the SSD already has a larger spare area set by design. For this MLC device, which is architected with 7% spare area, increasing the spare area can boost performance by 10% or more depending on the amount of spare area assigned. Figure 1 shows the performance scaling benefits at different usable capacities (160 GB, 144 GB, 128 GB, and 96 GB) and Figure 2 shows the endurance scaling benefits at different usable capacities. Both figures are based on the Intel X25-M 160GB SSD. Your results may vary depending on the usage model.

Steps to Increase Spare Area

The spare area of an SSD can be modified by a user. It must be performed on an SSD that is in a completely clean state. This can be an SSD that is fresh out of the box that has never been used or by secure erasing the SSD.

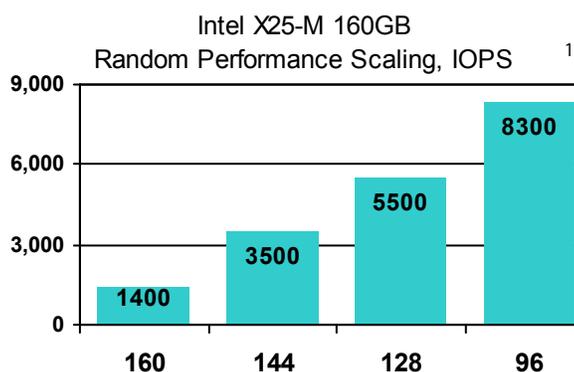


Figure 1: 160GB Performance Scaling with Over-Provisioning

To secure erase an Intel SSD, download Intel® Solid-State Drive Toolbox 2.0 from <http://www.intel.com/go/ssdtoolbox> and follow the steps for performing a secure erase on the SSD. (Industry tools are also available to secure erase an SSD using ATA commands.)

Once the SSD is in a clean state, reduce the usable capacity (which increases the spare area) using one of two methods:

- Issue the SET MAX ADDRESS command (part of the ATA specification) to set the maximum address the operating system (OS) can see. HDPARM² and HDAT2³ are third-party industry tools that can be used to issue this command.
- Define a partition that is less than the maximum available capacity of the SSD. This option can be found in the OS drive configuration tools.

Both SET MAX ADDRESS and partitioning will reduce the user addressable space and allow the SSD to use the remaining space as part of the “ready to be written” resource pool.

Conclusion

Users can increase the performance of a solid-state drive by over-provisioning the SSD. Users must ensure a “clean” SSD before setting the maximum address or partitioning the SSD.

For more information about Intel SATA Solid State Drives, visit www.intel.com/go/ssd

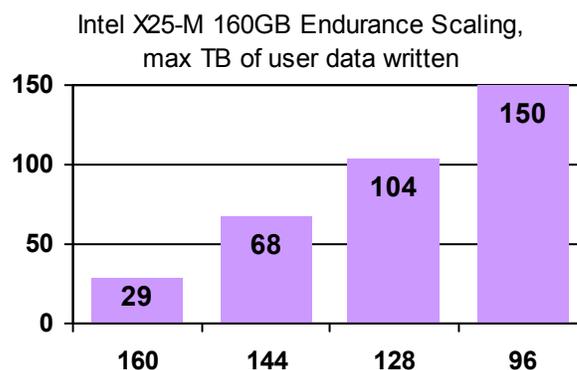


Figure 2: 160GB Endurance Scaling with Over-Provisioning

¹ Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Firmware: 2G9 measured with 8KB transfer size with a 2:1 Read:Write mix 100% Random

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Third-party tools require a separate non-Intel license agreement and are not supported by Intel.
Reference Document: SATA Rev 2.6 Specification, February 2007, <http://www.sata-io.org>