How to configure OP on the Kingston DC400 SSD

Kingston realizes datacenter use of SSD's cannot be a one-size-fits-all approach. Some applications are more read intensive and others more write intensive. Some applications will require an extended service life so endurance will be a key consideration. For DC400, Kingston has made it possible for a user to manually configure the OP on their SSD to best fit the goals of the application and/or workload.

The Kingston Storage Manager (KSM) is a Windows-based graphical user interface designed to make configuring OP on the DC400 quick and easy. The DC400 line of SSD's is manufactured with a standard OP configuration of approximately 7% from the factory. For example a 960GB DC400 actually has 1024GB of Flash Memory on the PCB but after Kingston configures the 7% OP at manufacturing time the user has 960GB of usable capacity available to them.

With KSM, the user can set any amount of OP they desire above the factory set OP configuration which will increase the OP space available to the controller above the standard 7% OP . If at a later time the required expectation of the drives change and more useable capacity is needed, the user can simply adjust the OP for more usable capacity or set the drive back to the factory OP configuration. Note: Any change in the OP configuration will result in data loss.

Figure 1 below shows an example of the "Operations Tab" in KSM where OP can be configured on a DC400. In this example we are beginning with a DC400 with a default factory configuration of 960GB. The user will simply enter the user capacity they desire in GB in the "desired capacity settings box" and commit their changes.

Figure 1

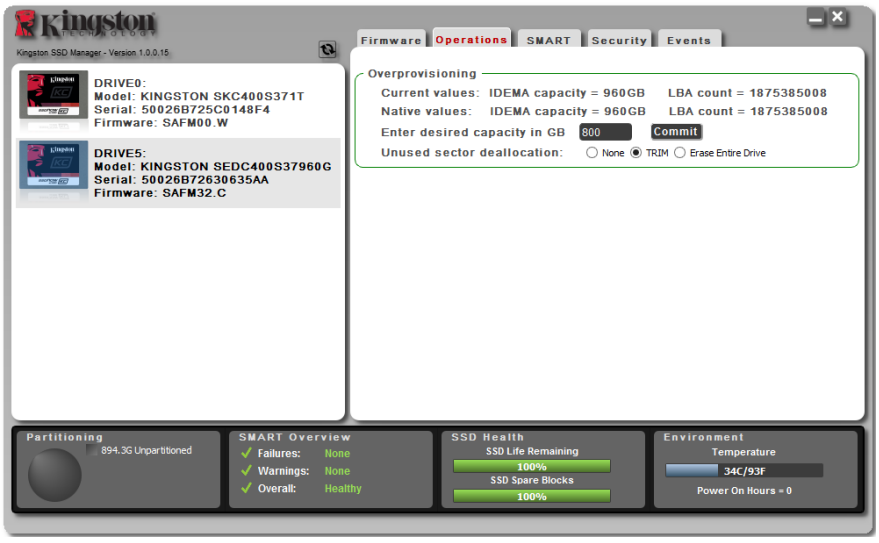
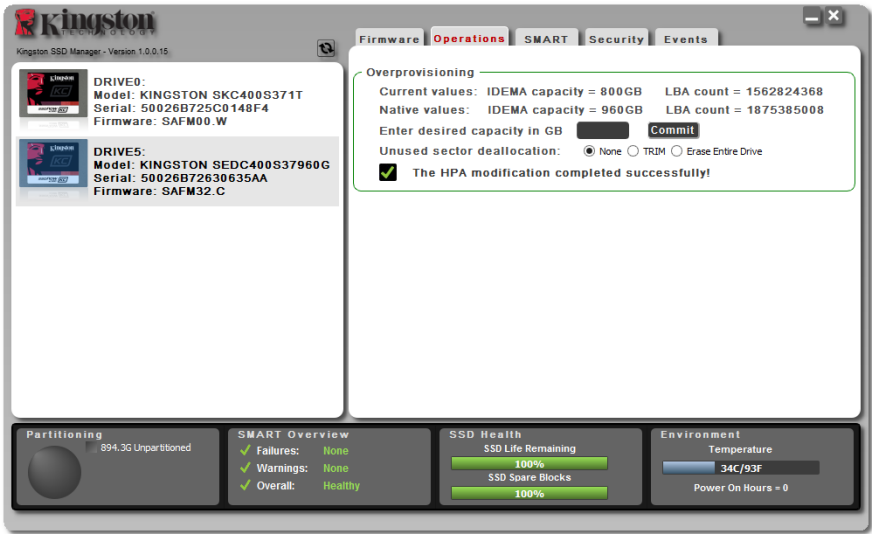


Figure 2 shows the configuration of the DC400 after committing the new OP configuration. The “current value” of 800GB is what your operating system will identify when the OS disk utility is run when creating and formatting the new partition. The remaining hidden OP area will be used by the SSD controller for all those important background operations.

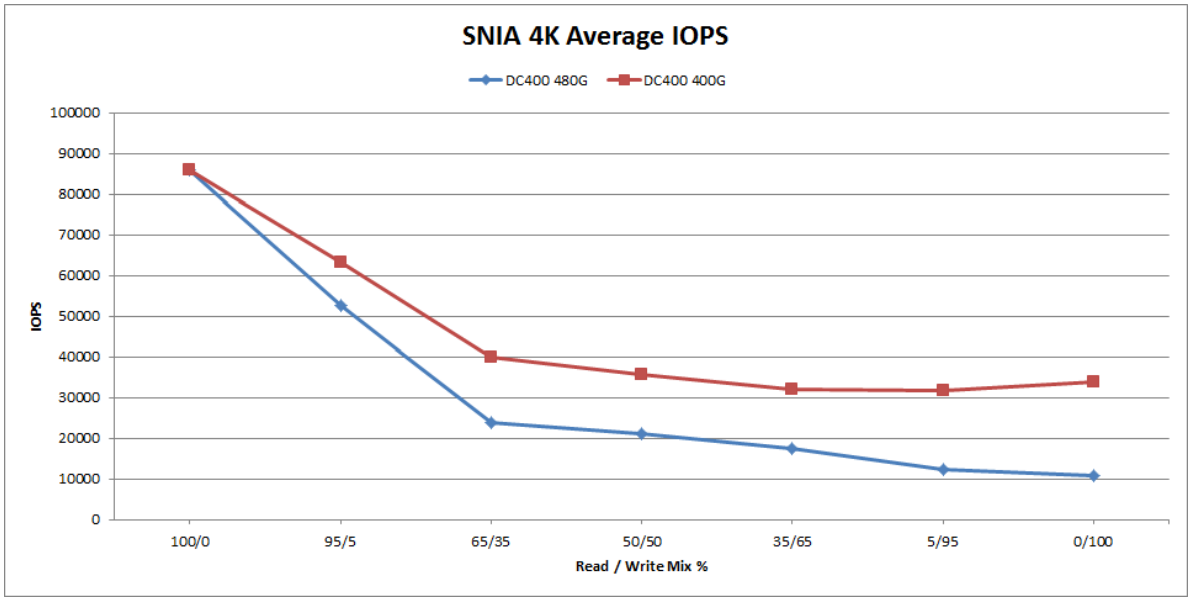
Figure 2



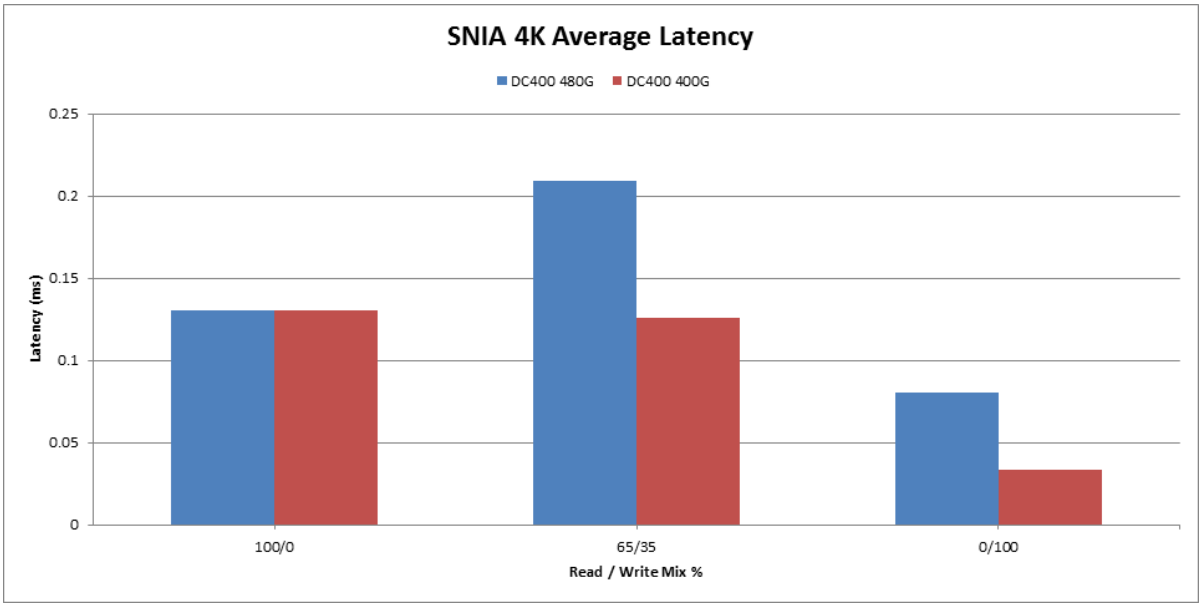
Performance gains to expect from different levels of OP

For increased performance, a larger over-provisioned area on an SSD will primarily improve write IOPS performance and lower application latency. As a general guideline, the largest improvements in performance are obtained with an OP area between 7% and 28%. Configuring OP beyond 28% will result in higher endurance for the SSD but the performance benefits may begin to diminish at this point.

Based on the SNIA standardized test data below you can see that the DC400 configured at 400GB delivers 3x the sustained write IOPS performance over a standard DC400 configured at 480GB. Application latency is also reduced with more OP across the read/write workload mix.



The DC400 configured at 400GB delivers 3x the write IOPS performance (100% write) than the drive configured at 480GB and 2x the performance in a 65/35 read/write mixed workload.

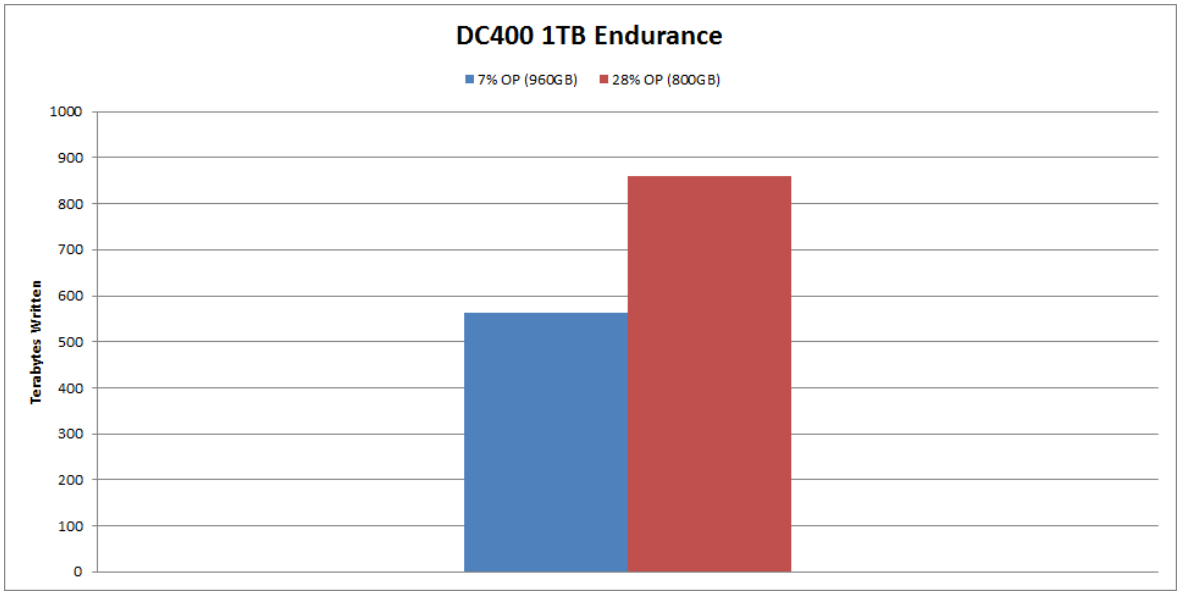


OP helped to reduce application latency by nearly half in both 100% random write and in mixed workload tests.

Endurance benefits of OP

It is well known that SSD's have a finite number of program and erase cycles per Flash Memory Cell. Over-provisioning the DC400 SSD can offer greater Flash endurance by effectively lowering the write amplification factor.

The example below shows a 1TB DC400 configured at both 7% and 28% OP and their respective lifetime write endurance measured in terabytes written(TBW). The DC400 configured at 800GB capacity delivers 65% more write endurance than the drive configured at 960GB.



The DC400 configured at 800GB capacity delivers 65% more write endurance than the drive configured at 960GB.

Closing Thoughts

OP, while already popular among SSD enthusiasts, is now becoming a key strategy for datacenters deploying Flash based storage to run high performance server applications. Whether the goal is tuning for performance or tuning for endurance OP allows datacenters users the ability to fine tune their storage investment to their own particular workload and/or production life cycle goals. By increasing performance and extending the useful life of the SSD, buyers will not only get more storage for each dollar, but that storage will perform faster and last longer than other options available.