Apacer

Double-barreled Solution: Cloud Edition

White Paper

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1. Introduction

As 5G rolls out worldwide, international manufacturers are considering the challenges and opportunities presented by factory automation. And in a variety of fields, from defense and healthcare to transportation and smart cities, the potential for significant cost savings, quality increases and continuous improvement from the development of the Internet of Things (IoT) is very real. But to transition to factory automation means managing a vast amount of cloud and edge devices equipped with SSDs, and the data on those SSDs must be gathered and analyzed regularly in order to figure out ways to streamline production.

In the past, manual maintenance seemed like the easiest and quickest solution for data storage devices. This was fine when a factory only had to keep track of a dozen or so, and a single engineer could make the rounds in the factory, checking on the status of a storage device and adjusting settings as needed. But in an automated factory, this approach simply isn't feasible on a large scale. There are too many devices in too many compromised environments for even a team of engineers to handle.

What manufacturers need is a simple, centralized software management tool that is connected to all the SSDs in a factory network. From there, they can observe the operation of their devices, perform maintenance as needed, track problem areas and order drive replacements when necessary. Luckily, this isn't a piece of software that manufacturers need to develop themselves: Apacer, the world's leading supplier of industrial-grade SSDs, has already created it. It's called the Double-barreled Solution, and it's already in use by Apacer's clients around the world.

But the Double-barreled Solution wasn't enough. Apacer wanted to go a step further. We knew that customers around the world were already using remote-device management (RDM) systems for factory automation supplied by industry leaders such as Advantech and Allxon. Those customers also needed an SSD management system. But rather than tasking them with running two systems simultaneously, Apacer's software engineering team came up with a more elegant solution. They

redesigned the Double-barreled Solution as a plug-in so that it could run within Advantech and Allxon's RDM systems. This allowed factory operators to access all their networked devices, such as IPCs, edge devices and routers, from within one simple interface. This powerful upgrade is now referred to as the Double-barreled Solution: Cloud Edition (or DBS: Cloud Edition), and its features will be described in more detail in this white paper.

Figure 1-1: Dashboard of the Double-barreled Solution: Cloud Edition

2. Threats to IOT Systems

In the early days of IOT, manufacturers often neglected to consider threats to their IOT systems. They underestimated the resources and motives of hackers. Sometimes a system would be attacked not to make money or in service of a competitor, but simply because it could be hacked, and the hacker wished to make a point or prove his abilities.

But the gradual rollout of IOT systems worldwide has exposed vulnerabilities in systems, often where they were least expected. So it's beneficial to take a moment to review these threats before examining ways to defeat them.

2.1 Downtime due to Blue Screen of Death

A system error, either during boot-up or operation, can result in a display showing a crash report screen called the "blue screen of death." However, if this occurs on a publicly facing screen, users can lose confidence in the system because the flaw is plain for everyone to see. This can lead to damage to a brand's reputation, and downtime can also lead to business losses in general.

2.2 Data Loss and Dropped Frames

Since many IOT systems run 24/7, they tend to record a massive amount of data, especially modern systems. So if a computing error led to a failure to record data, or if a CCTV network lost a significant amount of video frames, the trustworthiness of these systems might be called into question. It could mean a loss of a contract for the manufacturer who assembled these systems.

2.3 Resolving Threats

In the early days of IOT systems, when threats like these were recognized, there was one basic solution: dispatch an engineer to travel to the hardware's location and perform maintenance. Often, this was as simple as performing a reboot, but depending on the case it could be more complicated.

Of course, if there were only a few nodes in a network, this was an acceptable solution. But IOT networks are growing ever more complicated, with hardware endpoints scattered around the world.

The distance that an engineer needs to travel, plus the rising hourly cost of manpower, means that resolving hardware issues is becoming a major financial burden for system operators.

What's needed is a way to resolve these issues remotely, with an engineer overseeing the system from a dashboard where multiple system nodes can be monitored simultaneously. Luckily, such a system is available: Apacer's Double-barreled Solution.

3. The Double-barreled Solution: How It Works

As its name suggested, Apacer's original Double-barreled Solution is divided into two discrete parts. Let's take a look at them first.

3.1 CoreAnalyzer2

The first part of the Double-barreled Solution is CoreAnalyzer2. After interpreting data from a customer's workload simulation, it scans Apacer's extensive product line and selects the most suitable SSD for the customer's needs. In some cases, it will also recommend firmware optimizations that may better serve the customer.

Figure 3-1: The CoreAnalyzer2 Interface

3.2 SSDWidget 2.0

Now that the ideal SSD has been selected, the customer can install it in their system. After doing so, the customer can carry out remote monitoring of the SSD via SSDWidget2.0. Many crucial aspects of the SSD can be observed via SSDWidget 2.0's dashboard, including total read/write cycles, temperature tracking, and so on. Firmware can be upgraded remotely, and the estimated remaining lifespan of the SSD can be tracked. For this last option, the customer can choose to enable the sending of alerts when the SSD reaches certain operational benchmarks that indicate it's nearing the end of its operational lifetime. This is essential for maintaining data integrity, since an SSD can therefore be replaced before it stops working.

Figure 3-2: The SSDWidget 2.0 Interface

4. The Double-barreled Solution: Cloud Edition

When other manufacturers figured out how beneficial the Double-barreled Solution was to their market base, they contacted Apacer to develop a plug-in edition that could integrate seamlessly with their own RDM systems. DBS: Cloud Edition was born. All the functionality of the Double-barreled Solution can be accessed from within an alternate RDM platform, making monitoring of a complex system much easier and more efficient.

The Double-barreled Solution: Cloud Edition also offers one new feature that was not previously available. In cases where SSDs are storing operating systems for other devices, a data and OS recovery process can be carried out over DBS: Cloud Edition in the event that the OS becomes corrupted due to an unexpected power shutdown or some other circumstance. The process of backing up and recovering the data and OS stored on an Apacer SSD is known as CoreSnapshot, and it is described in more detail in section 5.6 of this white paper.

4.1 Within Advantech's DeviceOn System

Advantech's DeviceOn System offers a variety of RDM options to operators of automated factories. Since Advantech offers a large range of networked devices, there are many customized integration solutions that can be configured to make the management process more streamlined. Like Apacer's Double-barreled Solution, DeviceOn presents itself to the user as a series of dashboards that can be customized to track individual devices or networks. And once DBS: Cloud Edition is installed as a plug-in, all its functionality is then available to the operator within the DeviceOn system.

Figure 4-1: DBS: Cloud Edition running within Advantech's DeviceOn System

4.2 Within Allxon's ADM System

Allxon is another industry leader that has created a highly competitive RDM system for factory automation, known as Allxon Device Management (ADM). Using ADM, engineers can provision and retire devices or groups of devices, update software configurations over the air, update AI modules on edge computers, and remotely monitor the network to ensure security and system reliability. ADM even includes disaster recovery technology to minimize downtime in the event of a crisis, as well as proactive alert management that helps avoid critical system issues in the first place. Custom solutions can also be created to cater to specific business needs.

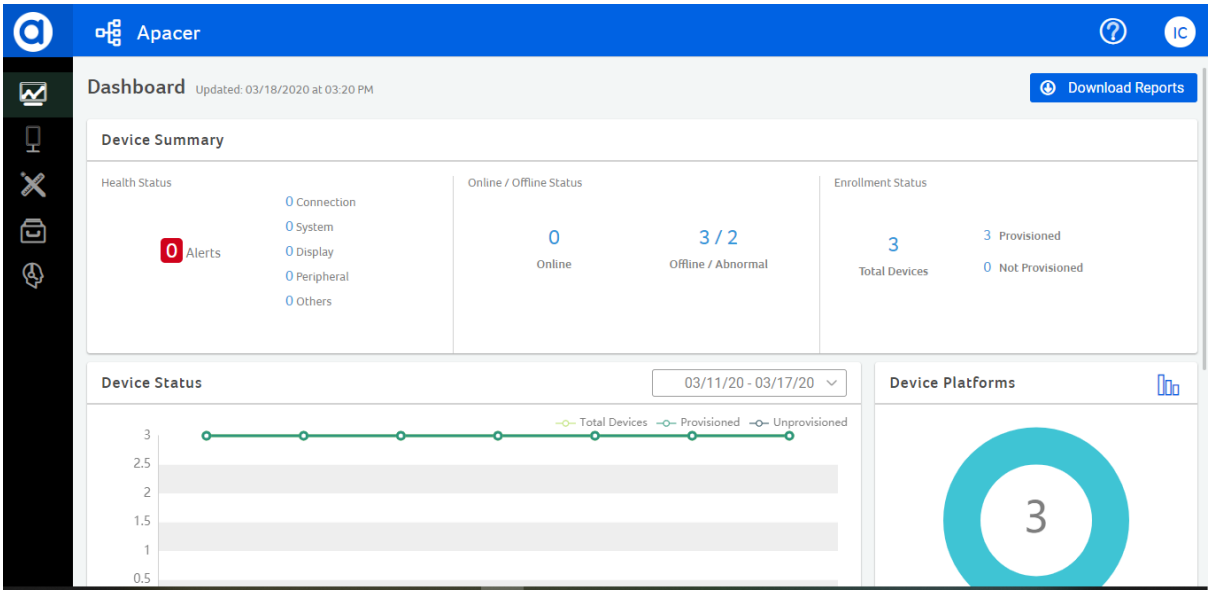

Figure 4-2: DBS: Cloud Edition running within Allxon's ADM System

5. Key Features of DBS: Cloud Edition

DBS: Cloud Edition is absolutely packed with user-friendly features, which are designed to make factory automation and networked device management easier than ever before. A few of the more popular features are described in detail here.

5.1 At-risk SSDs and Notification System

DBS: Cloud Edition analyzes all the SSDs that are connected at a particular time, and sorts them into categories that are likely to require the attention of maintenance engineers. With that in mind, one of the most important categories that needs to be observed is At-risk SSDs. These SSDs are approaching the end of their operational lifetimes, and will probably need to be replaced sooner rather than later. DBS: Cloud Edition uses this section of the dashboard to bring these SSDs to the maintenance engineer's attention. If desired, DBS: Cloud Edition can also be configured to send automatic notifications to an engineer's smartphone or PC when certain thresholds are reached. These notifications can be sent by email, SMS, or popular chat apps such as WeChat, LINE and WhatsApp.

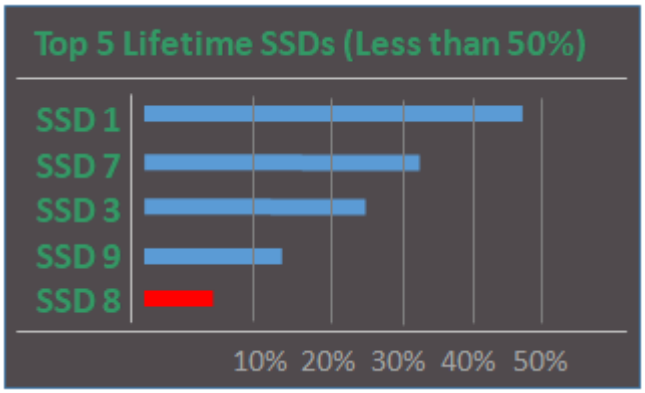

Figure 5-1: DBS Dashboard showing the SSDs with the shortest remaining lifetimes

5.2 Heavy Workloads

DBS: Cloud Edition also keeps track of which SSDs have the heaviest workloads. These are divided into read workloads and write workloads. The intensity of an SSD's workload depends on its application. So sometimes a heavy read or write workload may not be an anomaly at all, but rather the natural result of a specific operation. In other cases, a heavy read or write workload may be an indicator that something in the network is out of balance, in which case it would be a heavier read or write workload than expected. Either way, a maintenance engineer will easily be able to identify SSDs with heavy workloads by monitoring this section of the dashboard, and will be able to take steps to solve the problem if there is one. And depending on the circumstances, the kind of SSD originally recommended by CoreAnalyzer2 might be changed if the real-world workloads differed from the simulated ones. This means the manufacturer can constantly improve SSD selection while also learning more about real-world workload conditions.

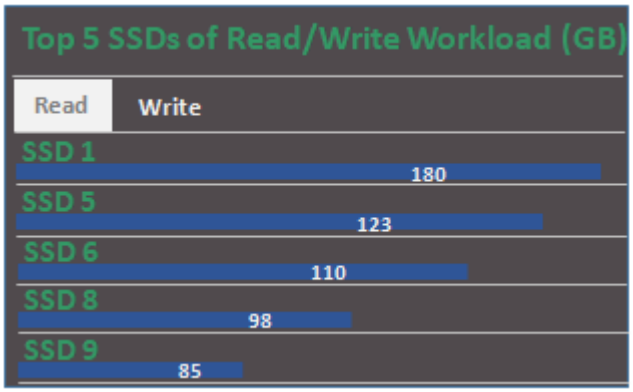

Figure 5-2: SSDs with Heavy Read/Write Workload

5.3 Temperature Abnormalities

Changes in temperature, especially wide and fast ones, can have a negative effect on the lifespan of an SSD. Many Apacer SSDs ship with temperature tracking technology, and this can be easily monitored through this portion of DBS: Cloud Edition. But it's important to keep in mind that the operational temperature of an SSD might be due to internal causes, such as the speed of read-write

operation, as well as external causes, such as heat generated by machinery operating on the factory floor and the dissipation patterns of that heat. No matter the cause, the operating temperatures of SSDs can be easily tracked with this dashboard interface, and maintenance engineers can investigate and regulate any heat dissipation issues that may be contributing to the problem if they think it's appropriate. What's more, the fluctuations in temperature can also be examined in detail over a seven-day period as displayed in a graph. Manufacturers who operate their system over many years will gradually get a clearer picture of unexpected or unknown environmental issues, such as high or low temperature anomalies. And those who operate in particularly challenging locations, perhaps in the defense or mining industries, will benefit from the ability to learn more about the extreme temperatures which threaten their hardware and the failure rates associated with them so they can take preventive action.

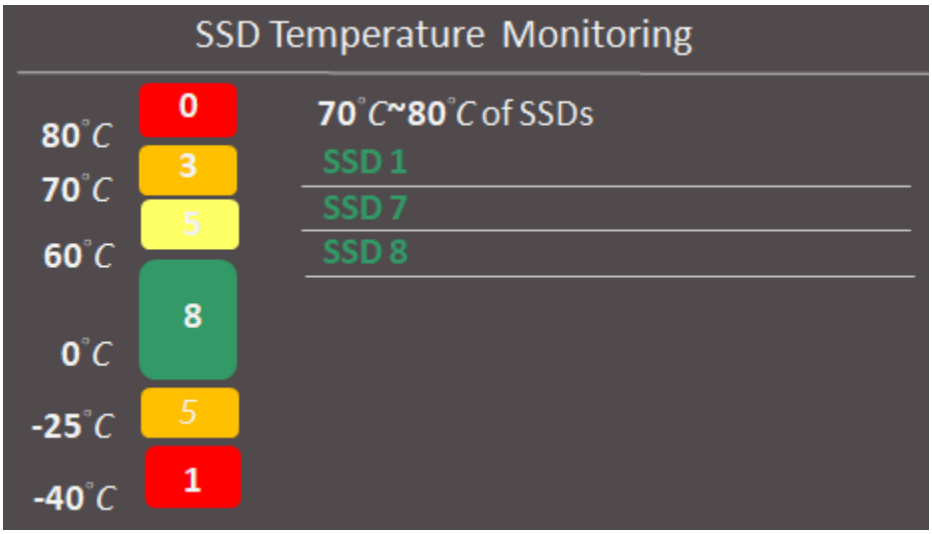

Figure 5-3: SSD Temperature Monitoring

5.4 Unexpected Power Loss Events

Another issue that affects automated factories is unexpected power cycling, or power loss events. If a networked SSD suddenly has its power cut without warning, the shutdown process may not be completely carried out. This can result in data loss as well as damage to the SSD or the device it's connected to. The problem is that before factory automation, it was hard to keep track of when

unexpected power failures were occurring, as well as the causes of those failures. But with DBS: Cloud Edition, the system automatically tracks unexpected power cycles in SSDs, and sorts them to show the SSDs which have experienced the greatest number of unexpected power cycles. Knowing this information can assist maintenance engineers who are investigating the causes of power cycling, which might be poor connections, human error or national grid issues. Whatever the cause, DBS: Cloud Edition gives maintenance engineers the data they need to dig deeper into these issues and resolve them as soon as possible.

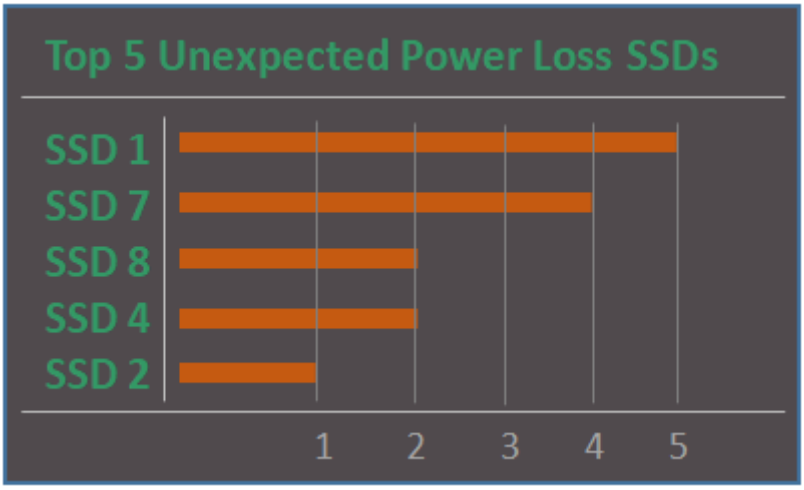

Figure 5-4: SSDs with Unexpected Power Loss Events

5.5 Overview Table and Filtering

Automated factories may start with just a few dozen networked SSDs, but as time passes and more processes are automated, the total number of SSDs under network control may be measured in hundreds or even thousands. With this in mind, Apacer's software engineers added an overview table to DBS: Cloud Edition. This allows for easy filtering of SSDs by a variety of parameters, no matter where they are physically located in the network. This powerful feature has already become an Apacer customer favorite when it comes to deep-dive analysis of SSDs by application and region. The color-coded light indicator shown on the left side of Figure 5-5 below makes it particularly easy to identify and isolate SSDs in abnormal status and perform preventive maintenance.

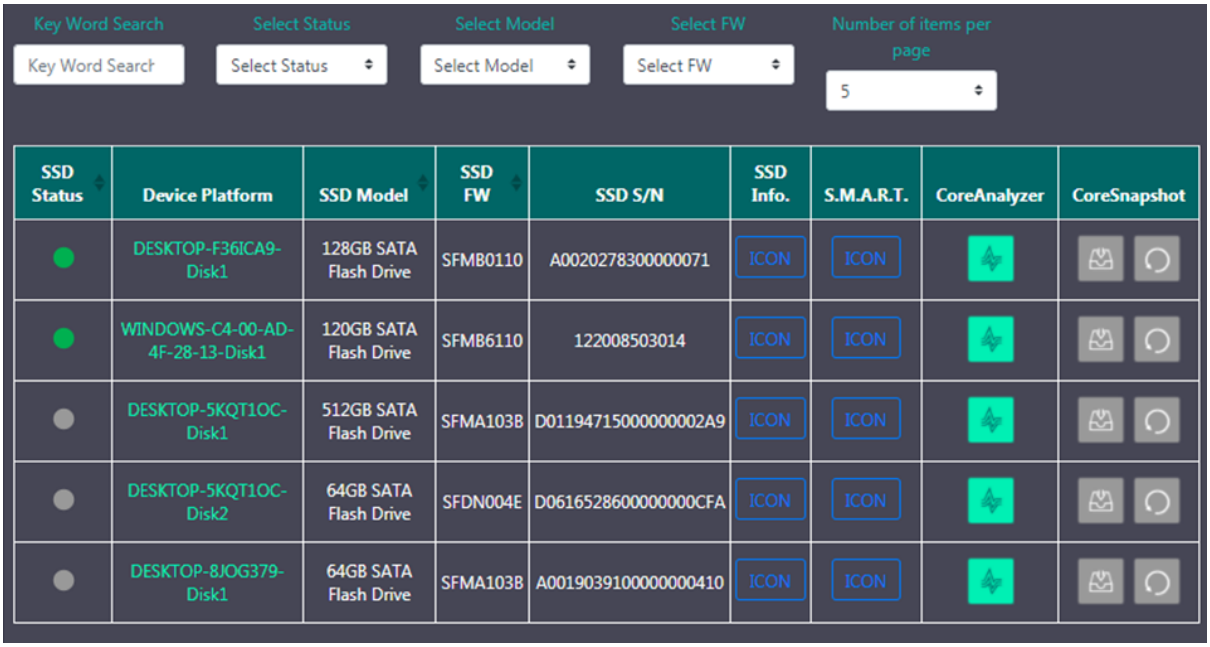

Figure 5-5: SSD Overview Table

5.6 CoreSnapshot

Many SSDs in operation on the factory floor are tasked with storing a device's OS. But when power is lost or some other anomaly occurs, the OS may become corrupted and the device will be unable to boot properly and safely. DBS: Cloud Edition takes the trouble out of solving problems like these. It allows for an OS to be recovered remotely, using a technology Apacer developed known as CoreSnapshot.

CoreSnapshot's primary function is to make a complete backup of all the data on a drive, including an installed OS if it's configured as a boot drive. This is accomplished when a user triggers CoreSnapshot's Backup function in DBS: Cloud Edition. Once this process is complete, the drive will continue to function normally. This is shown in Figure 5-6.

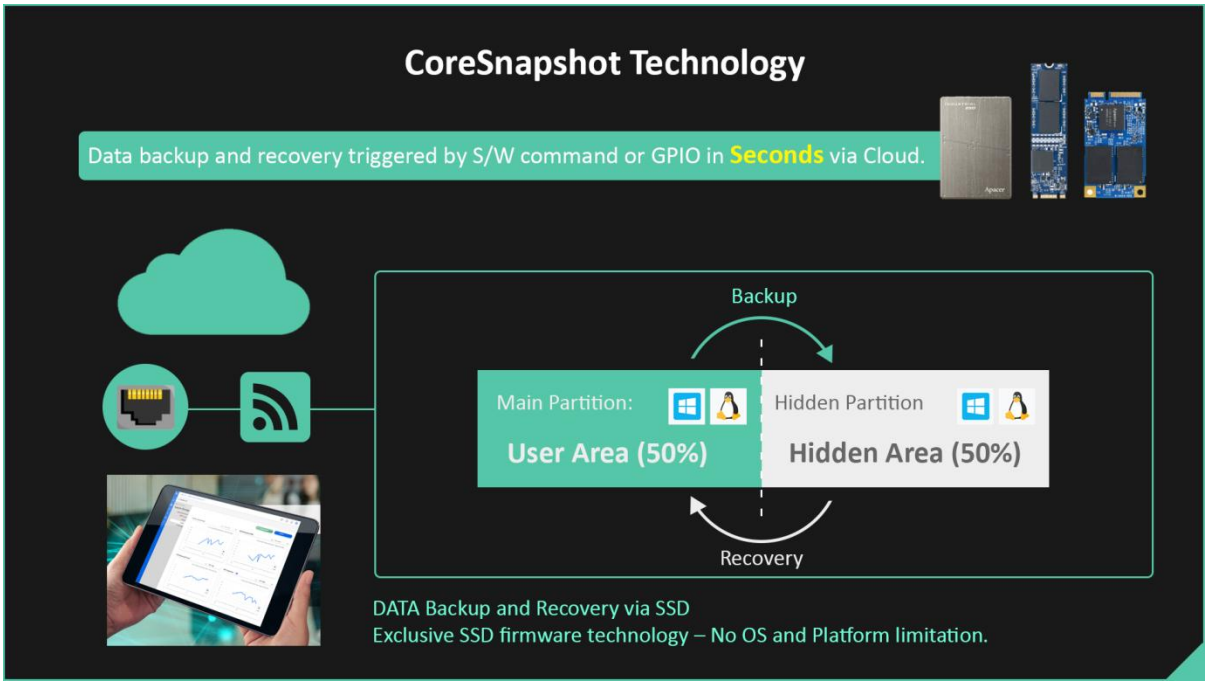

Figure 5-6: CoreSnapshot's Backup and Recovery Functions

At some point in the future, a disaster might occur that caused corruption in the original OS or data. This would lead to erroneous operation, incomplete booting or perhaps a Blue Screen of Death. If this should come to pass, the user would simply have to trigger the Recovery function in CoreSnapshot. CoreSnapshot would edit the drive's partition path, directing it to use the undamaged copy of the OS and data that was made when Backup was triggered. The device will then boot normally, using the uncorrupted version of the OS.

What makes this process even more user-friendly is that the Recovery function can be sent via either an In-band or Out-of-band connection, as shown in Figure 5-7. (In the case of an Out-of-band connection, the GPIO pin header on the SSD will be used.) Either way, the Recovery function will be executed and the drive will be ready to boot after just a few seconds.

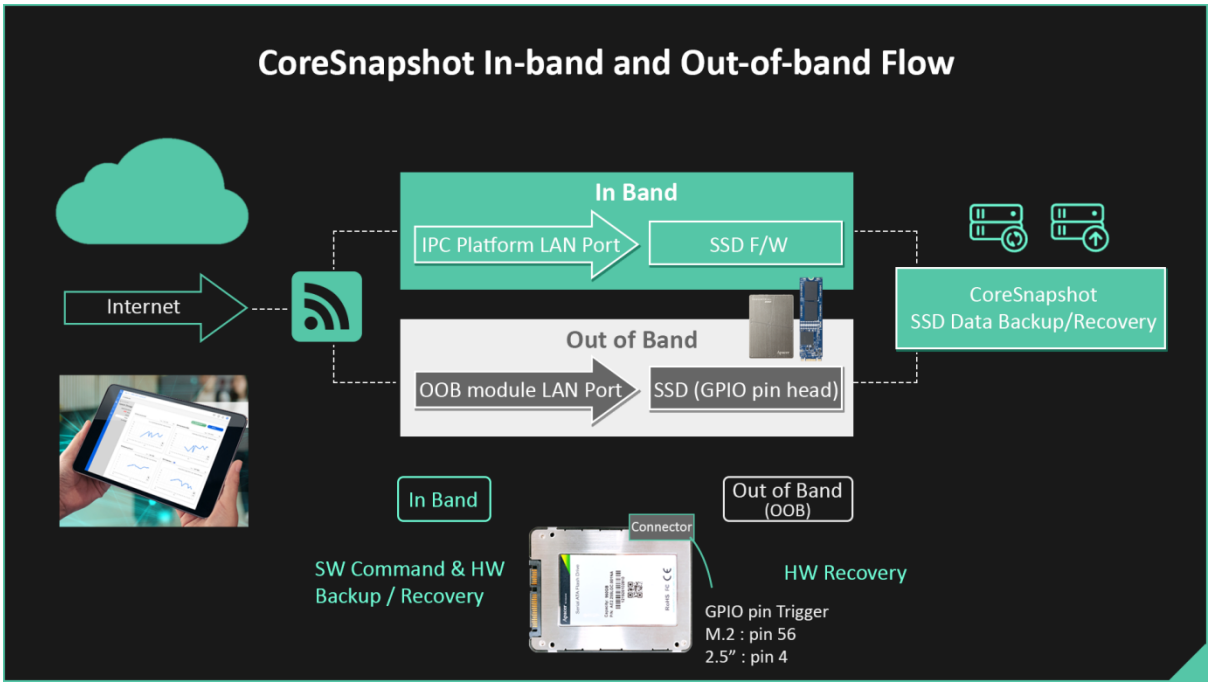

Figure 5-7: CoreSnapshot In-band and Out-of-band Flow

6. Conclusion

In an age of big data, it's sometimes overwhelming for human operators to look at an extremely complex networked system and try to make sense of it all. But really, this is where DBS: Cloud Edition succeeds. Its greatest advantage is its simplicity: one glance at a dashboard is all it takes to instantly digest the relevant information about any SSD connected to the network. And since it runs as a plug-in within powerful cloud service platforms such as Advantech's DeviceOn System and Allxon's ADM System, the amount of information at one user's fingertips can be awe-inspiring – yet, amazingly simple to navigate.

But a white paper isn't even the easiest way to visualize DBS: Cloud Edition in operation. Contact an Apacer representative today to take a virtual online tour of the DBS: Cloud Edition interface, and experience it for yourself.

Revision History

Revision	Description	Date
1.0	Official release	11/10/2020

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