WHITE PAPER

The Introduction of the Universal Storage Module Makes Removable High-Capacity Storage a Reality

Sponsored by: Seagate

Liz Conner   John Rydning
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IN THIS WHITE PAPER

In this white paper, sponsored by Seagate Technology, IDC discusses the need for a removable storage device with a widely available interconnect to make it easy for consumers to move large volumes of digital content between various devices or to share content with others. This white paper explores the Universal Storage Module (USM) as a new standard for removable storage devices and its potential impact on the personal storage (PS) market and the consumer electronics (CE) industry as a whole.

SITUATION OVERVIEW

Since the birth of the personal computer, external, removable personal storage devices have been a key component, allowing users to offload and store digital data on physical media in a convenient form factor. Personal storage devices have migrated from one form factor to another over time, starting with floppy disks, which evolved into higher-capacity zip drive cartridges. Eventually, optical CDs and DVDs replaced floppy disks and zip drives, which are now being displaced by SD cards and USB flash drives. Five critical success factors are required for removable personal storage devices to reach mass adoption: standardization of the form factor and the interface, durability of the storage media, ease of use of the storage media, consumers finding the storage media readily available at relevant capacity points, and confidence that the removable storage media is future proof in the sense that future higher-capacity drives will be compatible with prior-generation slots. Users inherently understand the concept and benefits of removable personal storage devices. They especially value the convenience and portability of moving data between PCs and other devices, including mobile devices.

External hard disk drive (HDD) personal storage devices are popular due to their massive storage capacities offered at compelling price points (up to 4TB on a single 3.5in. drive and up to 2.0TB on a single 2.5in. drive) and the ease of connecting an external HDD to a host device such as a PC. External HDDs are an excellent solution for backing up data and for providing additional storage capacity once storage internal to the host system is fully utilized. However, this use case effectively ties the external HDD to a single computer and/or person and limits the ability for easily moving digital content between devices, especially video content.

The vast majority of externally attached HDDs are directly connected to a PC or CE device via a standard interconnect cable (USB, Thunderbolt, FireWire, or eSATA). Some external HDDs are wirelessly connected, but IDC's research shows that this is more the exception than the norm. For desktop or portable PCs, the cable connection poses little issue for consumers because a keyboard and a mouse are often attached to the PC via USB cables. However, plugging an external HDD into a USB connector residing on a CE device is not always convenient or feasible. Take into consideration, for example, a flat-panel TV hanging on a wall or tucked into a cabinet. It can be difficult or messy to find a place to set the external HDD storage device near the TV or to connect the storage device to the TV using a long USB cable.

Moving video content between CE devices can be an especially challenging endeavor for consumers. Generally, digital video files are larger than digital music or photo files. Moreover, the size of video files often strains the capacity points on standard USB flash drives and can be very time consuming to transfer. It is evident that there is an opportunity to provide a simple yet elegant high-capacity storage solution with fast transfer speeds for the consumer market without the need to carry a cable with the drive.

In a recent IDC consumer survey, more than half of the respondents expressed a desire to share recorded video content between devices, and nearly half would like to share downloaded content (see Table 1).

TABLE 1

Importance of Sharing Data (% of Respondents)

	Very Important	Somewhat Important
Share recorded content	21.3	32.5
Share downloaded content	12.3	35.6

Source: IDC's *Worldwide Personal Storage Survey*, December 2011

Moreover, consumers increasingly desire to move digital content between CE devices such as TVs, gaming consoles, Blu-ray players, and DVRs, as well as mobile devices such as smartphones and tablets. With the growth of digitally based video content, end users are starting to look for a way to transfer recorded movies, TV shows, games, music, and photos from one platform to another.

The Universal Storage Module Interface Is a New Removable Storage Device Option

In January 2011, SATA-IO introduced the Universal Storage Module (USM), a worldwide open standard that revives the removable format for high-capacity storage based on a 2.5in. form factor with a 14.5mm enclosure size. The USM interconnect makes it possible for consumers to store digital content locally on a removable USM storage device and easily share content between various CE devices equipped with a USM slot.

A USM drive ships with an included cable connection in the box (typically USB 3.0 with other interfaces available), allowing the USM drive to become a cable connect external HDD and direct replacement for a USB, FireWire, eSATA, or Thunderbolt interconnect storage device. When the cable connect is removed, the USM design leverages a standard, high-speed SATA interface and protocol found on nearly all HDDs used in PCs and CE products. The USM interconnect exposes a standard SATA port connector on the back of the USM storage device (see Figure 1). The USM interconnect is durable, allowing a removable storage device to be plugged into or removed from the host connector slot up to 1,500 times, which is equivalent to once daily for three years.

FIGURE 1

USM Storage Device and SATA Port Location

SATA Port Location on Back of HDD Device with USM Interconnect

Source: Seagate, 2012

By eliminating a cable between the host system and the storage device, the removable USM storage device can be plugged directly into any device with a USM slot, such as a TV, DVR, Blu-ray player, PC, gaming console, or other CE devices. Thus, a removable USM storage device provides a more elegant solution for CE storage than a storage device attached with a cable connection.

The direct SATA-to-SATA connection also delivers faster data transfer speeds than most cable-connected storage devices (17x faster than USB 2.0 and 2–3x faster than USB 3.0, according to Seagate) and is significantly faster than wirelessly

streaming data from a storage device. In addition, the use of SATA in the USM standard means the storage device is powered, making additional power cables unnecessary. In terms of size, 2.5in. form factor removable USM storage devices are available, which is not much bigger than a deck of playing cards.

USM Benefits to Consumers

In a recent survey of consumers within the United States in which IDC provided a detailed description of the removable USM storage device, nearly 50% of the respondents said they would find some benefit from using a USM device to move and share data within the home (see Table 2).

TABLE 2

The Ability to Move Data from One CE Device to Another via a Removable PS Device Is…

	% of Respondents
Very beneficial, would do this frequently	13.2
Somewhat beneficial, would do this occasionally	36.5

Source: IDC's *Worldwide Personal Storage Survey*, December 2011

The removable USM storage platform addresses growing consumer market needs: an ability to easily add storage capacity to a stationary CE device such as a DVR, TV, game console, or PC and the desire to move content between CE devices that are of a sufficient size to be equipped with a USM slot or watch the same content on different CE devices.

The USM removable drive is not technically intimidating, as many consumers are very familiar with using similar removable storage products such as floppy drives, zip drives, CDs, DVDs, or SD cards. As with other removable storage devices, consumers can easily add capacity incrementally by simply purchasing another USM removable drive as needed.

USM removable drives have the added benefit of being able to be fit with a traditional cable connection (e.g., the Seagate external retail drive family), allowing the USM drive to switch between a slot connection and traditional cable (USB, FireWire, or other interface) connection. The interface cable simply plugs into the back of the USM drive's open/exposed SATA connector, using its shielded guided clips to allow the drive to plug into any traditional device port (such as a USB). This connector flexibility benefits end users who may not want to immediately upgrade all of their CE devices to become USM compatible. End users can purchase a PC with a USM slot, gaining the benefits a USM drive provides with easy connection and faster speeds with their PC. When the time comes to use the USM drive with an older computer or CE device, consumers can simply attach the appropriate interface cord and "cable connect" to these other devices. With USM's flexible connections, end users gain the best of both worlds: the benefits of USM removable and portable storage with any USM-enabled device and the ability to maintain the usability of older PC/CE devices with a cable-connected USM drive.

USM Benefits to Partners

USM technology also presents significant benefits to partners and OEMs that implement the technology. Specifically:

- ☑ USM technology makes it possible to shift the cost of the HDD storage device from the OEM to the consumer: Often, the internal HDD is a significant portion of the bill of material for a CE device. A USM slot is a lower-cost bill-of-material item for a CE device than for an internal HDD. Moreover, it gives consumers freedom to purchase the amount of capacity they desire with the storage device separately from the CE device.

- ☑ USM is an open standard similar to the USB standard. It can also be adopted by numerous markets and device vendors, allowing for widespread availability of USM slots and USM removable storage devices from a large number of suppliers. There is a current worldwide install base of millions of USM hard drives in the market today. Moreover, any type of SATA 2.0 storage device, including AV drives designed to run 24 x 7, solid state drives (SSDs), or hybrid solid state hard drives (SSHDs), can be packaged into a USM removable drive cartridge.

- ☑ Use of a USM slot instead of an internal HDD allows for the design of a smaller CE device. An internal HDD can occupy a significant portion of the physical space inside a CE device.

- ☑ USM technology can increase the CE device's reliability. In gaming consoles and DVRs, the internal HDD is often labeled as a point of failure, even though the majority of the time a hard drive returned to the HDD vendor is tested to have "no trouble found." Still, when the host system flags the HDD device as having failed, it requires the CE device to be serviced. In most CE devices, the internal HDD is not serviceable/removable by the consumer. Thus, either service costs go up for the manufacturer or service provider or the consumer bears the cost of repair. Oftentimes there are lengthy delays in getting new CE devices to consumers, all of which decreases customer satisfaction. The USM solution helps to disassociate potential HDD failures from a failure by the manufacturer of the CE device. Moreover, it shifts the cost of servicing a USM device failure to the maker of the USM removable storage device. Service providers no longer have to do truck rolls and can eliminate costly in-house service calls to replace the entire CE device.

USM Target Markets/Partners

USM technology lends itself as an alternative solution to any CE device or market that currently uses an internal HDD. However, certain markets could benefit greatly from the USM technology as well as help speed up adoption of USM devices by end users.

Personal Computer Manufacturers

The desktop PC market is a compelling target market for USM technology adoption. All PCs use some form of internal storage (HDD or SSD) for primary storage capacity. Coupled with this, over the past five years, direct-attached external HDDs have grown in popularity, allowing for additional PC storage capacity and the ability to back up data. The inclusion of a USM slot would allow storage capacity expansion in smaller desktop PCs, especially all-in-one desktop PC form factors. Many desktop PCs,

especially those aimed at professional users and gamers, are equipped with a number of internal HDD slots or bays. Most often, these slots are not fully populated at the time the PC is shipped. These slots make it possible for the user to add more internal storage capacity in the future. However, multiple internal storage slots also increase the volumetric size of the desktop PC. Use of the USM technology allows for the elimination of these additional internal bay slots. End users can simply purchase any number of USM removable drives to increase the PC's storage capacity, allowing PC manufacturers to shrink the footprint or volumetric size of the desktop PC.

The ability to shrink the size of a desktop PC provides the added benefit of reducing the size and weight of the computer. This enables PC OEMs to ship more PCs on a pallet, allowing for more PC units per shipping container, which leads to lower shipping costs per PC.

Adopting USM technology also provides PC manufacturers with the opportunity to add a USM slot to a notebook PC, bringing greater value to end users at minimal cost. USM drives are an easy way to back up important files and take them offsite. It is also the easiest way to expand the primary storage without the need to open the device case and change jumper cables with internal drives. The introduction of the USM slim standard also in a 2.5in. form factor, but only a 9mm enclosure size (smaller than a No. 2 pencil), as well as the potential to adapt USM to SSD drives, allows for smaller form factor drive slots to be designed into a traditional optical disc drive bay in a notebook PC chassis. Notebook PC manufacturers can differentiate by offering users an easy way to upgrade the capacity of a notebook in a manner that does not detract from the notebook's design.

The addition of USM technology can help PC manufacturers better target various demographics, including:

☑ **Families.** USM technology allows each person to have his/her own drive on which to store music, documents, video, games, etc. Families will no longer have to negotiate on who gets how much space on the internal drive. Also, accidental erasing or saving over of another person's files is minimized. Individuals will be able to store their personal data on a separate USM drive and easily take it with them on the go and not have to worry about lost cables.

☑ **Businesses.** Business users will have the ability to save large files on a single drive, files that might not be able to fit on a USB flash drive. USM drives can be used in a similar fashion as a tape backup system and archived offsite, and they can be considered as a great tape replacement strategy. USM drives are portable and thus allow for easy transportation of files to and from home, between coworkers on a joint project, to client meetings, etc.

☑ **Gaming/media professionals.** Performance, as well as the need to avoid latency, is a key for this demographic. The USM SATA connector is faster than USB 3.0 and provides greater performance than most other external HDDs on the market (e.g., the Lenovo IdeaCentre K430 offers a USM connector and is targeted at the media and gaming demographic).

Media Service Providers and DVR Manufacturers

DVR usage is increasing as consumers desire to time shift recorded programs. However, the amount of video content that can be stored by consumers is limited by the capacity of the HDD internal to the DVR. Consumers must often delete recorded content to make room for future recordings. Third-party DVR storage expander devices are available, but again they require the use of a cable to connect the storage device to the DVR. Moreover, not all DVR manufacturers have embraced support of DVR expanders, and compatibility is a major issue for the end user.

The adoption of USM technology by media service providers and DVR manufacturers provides several benefits, including:

☑ **Reduced bill of materials.** The use of a USM slot in a DVR could make it possible to eliminate the internal HDD altogether. Activating DVR functionality and adding DVR storage capacity could be shifted to the consumer. Cost savings would result from shifting the purchase price of the HDD from the manufacturer (or service provider) to the end user. Consumers can choose the capacity that meets their needs.

☑ **Smaller DVRs.** DVR manufacturers could eliminate the internal HDD from the DVR and shrink the DVR box accordingly. The weight of the DVR could also be reduced because the USM drive is acquired separately by the end user. Lower weight and a smaller footprint result in lower freight/transportation costs, providing additional savings to the DVR manufacturer and the service provider.

☑ **Reduced service/maintenance costs.** Internal HDDs are a point of failure within a DVR and often require a home visit from a media service provider repair technician to resolve. Adopting USM technology could lead to DVR designs that continue to function without an internal HDD but have limited recording capacity until a replacement USM drive is inserted into the USM slot. The inclusion of a USM drive transforms the DVR's formerly internal HDD into an external, user-serviceable drive. The USM technology allows consumers to replace faulty or full drives, resulting in fewer service inquiries and fewer technician visits to the home. Service and repair costs for the media service provider will be lowered as conceivably fewer service calls will be fielded, fewer house calls will be needed, and the burden of replacing a drive will now fall on the consumer.

☑ **Increased customer satisfaction.** USM technology offers a number of unique benefits to DVR customers and can provide a DVR manufacturer or media service provider with the following competitive advantages:

❑ USM technology provides the flexibility for the consumer to add storage capacity as needed and to avoid having to delete recorded content to ensure sufficient storage capacity is available to record future programs.

❑ The USM slot delivers power to the drive through the connection. Current DVR expanders require an outlet for power. Depending on the home theater setup, an unused outlet might not be available or the power cord for the DVR expander could detract from the aesthetics of the home theater setup.

❑ A USM slot connection provides a cleaner, more elegant solution than a cable-connected DVR expander.

- ☑ Some DVRs are designed to provide multiroom support, but this capability often comes at a higher cost for consumers, as they may have to buy multiple DVR STB receivers for each room. In the future, DVRs could be designed with USM technology and in compliance with digital rights management to allow pre-recorded video content to be easily shared between multiple DVRs within a home. Moreover, end users could upgrade the cartridge to a larger capacity for recording more programs as household receivers and viewer needs increase.

- ☑ With removable USM storage, consumers would also benefit from the ability to "archive" and "catalog" content for an extended period of time by removing the USM cartridge and labeling it for future reference.

- ☑ USM technology would allow end users to share or move recorded video content with devices outside of the home, similar to VHS tapes or DVDs.

Game Console Manufacturers

Another target market where both manufacturers and end users alike can benefit from USM technology is the game console industry. According to a recent IDC survey, 53.3% people have game consoles in their homes, third on the list of CE devices in the home only to TVs at 95.4% and DVD/Blu-ray players at 85.4% (see Table 3).

TABLE 3

CE Devices in the Home

	% of Respondents
TV	95.4
DVD and/or Blu-ray player	85.4
Game console	53.3
Smartphone	51.8
iPod (or similar device)	46.4
DVR	45.1
Portable DVD player	39.9
Tablet	25.8
Streaming media player	11.8
Embedded vehicle player	10.4

Notes:

All respondents to the survey were required to own a home computer.

Multiple responses were allowed.

Source: IDC's *Worldwide Personal Storage Survey*, December 2011

Historically, the game console industry has relied on removable cartridges or optical disks to sell and distribute games. An internal HDD was added to consoles initially to speed up game play and to save game content. However, the value of an HDD in a game console is increasing as new games are now being offered in higher resolutions that increase the size of the data files. At the same time, downloadable content from gaming networks (i.e., Microsoft Live or PlayStation Network) is pushing storage requirements on game consoles higher. Quite often, game console owners are forced to choose what game content they must delete or overwrite to free up storage capacity space for new games.

Additionally, game console owners lack a legitimate way to upgrade the storage capacity of a game console or to service the HDD in case of a drive failure. The inclusion of a USM slot in a game console would allow end users to save and download content as they see fit and provide an easy means for additional storage capacity instead of overwriting or deleting stored content to make room for new data.

In addition, most gaming consoles can be and are being used as a link to move downloaded or streamed media from the computer or Internet to the TV. This move often requires a network Internet connection through the household and is not always stable. A USM drive would allow for faster and more reliable transfer of video content from the computer to the TV rather than relying on a streamed/wireless Ethernet connection.

The inclusion of a USM slot as opposed to the use of an internal HDD would allow game consoles to hit lower price points and game console manufacturers to sell the storage device as an accessory item because the operating system could be loaded on a small amount of Flash memory. The USM slot could also potentially supplant the optical drive, especially as downloaded game content gains in popularity. In addition, USM technology could provide game console OEMs and game designers with the opportunity to preload several games and content onto a USM storage device and sell it as a "game package." Microsoft has recently taken this path with its media hard drive for Xbox 360 that was introduced in October 2011. The removable hard drive is based on proprietary technology and is preloaded with *LEGO Star Wars III: The Clone Wars.* Although the proprietary nature of Microsoft's hard drive limits its usage to just the Xbox 360, it does demonstrate the desire for upgradable storage among game console owners as well as the additional selling point of preloading content onto the hard drive.

TV Manufacturers

A small but growing trend in the TV industry is the inclusion of hard drives within a TV. TV manufacturers view embedded hard drives as a way to bring DVR functionality directly to the TV while bypassing third-party devices that will act as a gateway, such as a game console, an Apple TV, a Roku box, or even a Slingbox that shifts video content to other screens within the home and could oftentimes have issues streaming HD content over wireless networks. However, the adoption of USM technology can potentially provide lower costs and greater customer satisfaction than an embedded hard drive within the TV.

Many TV manufacturers also support USB Flash media connected to the side of the TV, but with the limited size of Flash media today, consumers will struggle to try and fit more than one or two HD movies to playback. In comparison, a 500GB USM drive module would hold over 125 hours of HD content

Similar to DVRs and gaming consoles, USM technology allows the hard drive to be separate from the TV, thus lowering the bill of material for TV manufacturers and providing cost savings to the TV manufacturers while still offering end users the option of a television with an integrated hard drive.

By using a USM slot instead of an internal drive, USM TV manufacturers avoid having the internal hard drive determine the life span of the TV. While hard drive failures are decreasing, they still occur; thus, a certain percentage of TVs with an internal hard drive will experience a drive failure before the full life span of the TV has been reached. USM technology circumvents this scenario, allowing end users to replace a faulty USM drive easily with another drive if necessary.

USM technology also provides an elegant solution for providing storage capacity for a TV without the use of data and power cables to connect the storage device, which can detract from the aesthetic of the home theater. USM drives are able to obtain the necessary power directly from the USM slot, eliminating the need for power cords and providing a significantly cleaner look than traditional external HDDs.

Future Use Cases

USM technology can easily lend itself to any CE technology that currently employs hard disk drives. However, we highlight three standout future potential use cases:

- **Video surveillance.** USM technology allows for the easy removal and addition of drives storage capacity when a video surveillance storage system becomes full. Moreover, removable USM drives can easily be moved to offsite, secure locations. For home users, a video surveillance system could be configured with one USM slot. The consumer could swap multiple USM storage devices in and out of the system, allowing storage of several days, weeks, or months of video surveillance content.

- **Automotive entertainment.** A USM removable storage device would provide an ideal way for people to bring several video programs and movies into a vehicle for playback. Automotive manufacturers already support USB and media player docks in several models. Inclusion of a low-cost USM slot by automotive makers would allow for high-capacity HDD storage in vehicles equipped with entertainment systems without the up-front cost of adding an HDD in dash or the ongoing service costs to maintain the HDD over the life of the vehicle.

- **Home networked-attached storage (NAS).** The complexity of a home NAS can be reduced by designing storage systems with "smart docks" that allow for RAID data protection capabilities when multiple USM drives are plugged into the dock.

CHALLENGES/OPPORTUNITIES

For USM to gain significant traction in the market, a number of challenges must be overcome:

- Showing end users the benefits of using USM compared with using a pure cloud model for data storage and sharing. Cloud storage has garnered much interest in the consumer industry and is seen as a way to transfer data between PCs,

smartphones, ultrabooks, and tablets. However, many end users still prefer to keep their data in the home (almost 70%, according to a recent IDC survey). To a lesser extent, consumers also have concerns about the security of the data they store in the cloud. In addition, the cost and fee structure of cloud storage offers an opportunity for USM. Currently, the lifetime cost per capacity of a USM drive is significantly cheaper than the lifetime cost of the same capacity in the cloud.

☒ USM needs to become a widespread standard and marketed as heavily as USB. The appeal of USM lies within a multitude of CE devices in the home that are USM capable, giving the consumer the ability to use one or more USM storage devices in any of these slots. However, for this to happen, USM technology must be adopted by numerous CE and PC manufacturers and by media service providers. Without widespread adoption, USM runs the risk of becoming a niche product.

☒ The introduction of USM in two form factors (standard and slim) could lead to consumer confusion over which form factor to purchase or — worse — frustration with having multiple size USM slots on various CE devices or PCs within the home that require different form factor USM drives. This lack of compatibility could make it difficult to share content between devices in the home. Moreover, launching USM in two form factors increases the number of SKUs in the retail channel. Adopting and promoting the slim form factor could help accelerate USM adoption.

☒ Consumers must be educated on how USM technology works and its benefits before they will be able to fully buy into the new USM standard. If this education does not take place, consumers are unlikely to make the inclusion of a USM slot a key "must have" feature when buying a new PC or CE device.

☒ Partnerships with vendors in the right markets must be made to guarantee that USM will become a widespread technology and a household standard. Specific focus must be placed on service providers, especially those offering DVRs, and game console manufacturers.

☒ In some regions, digital rights management standards must be established for consumers to easily move content from one device to another using a USM drive.

☒ The USM community must remain vigilant of technology that could potentially "leapfrog" USM, specifically consumer cloud services and home NAS systems. USM must demonstrate that its use cases, cost savings, and ease of use are better options than those of rival storage technologies.

☒ USM on its own has no data protection/backup built into the drive. There needs to be a way for end users to back up data from a USM drive. This is an excellent opportunity for USM within a home NAS or for offering flexible connections to other systems lacking a USM slot. In addition, with the USM cable connection, end users are able to dock multiple USMs to a single computer, one via USM slot and another via cable connection. This allows data to be easily copied from one drive to another. End users just need to be educated on this feature in order to take full advantage of USM's diversity.

FUTURE OUTLOOK

IDC expects the demand for external HDD personal storage devices will progressively be driven by the growth of digital data, especially higher-resolution video and game content. Consumers increasingly desire the ability to easily share or move content between devices and between people within the home. USM technology provides a simple, low-cost, and low-tech solution for both consumers and device manufacturers.

In the long term, cloud storage may provide the ultimate solution for consumers to store, share, and access content from any device at any time. However, IDC believes that broad adoption of cloud storage solutions by consumers will take many years. The long transition period from local storage to cloud storage of consumer content leaves the door open for other technologies to fill the void. USM is an ideal solution because it is very easy for consumers to understand. It leverages past consumer experience with other removable storage devices such as floppy disks, CDs/DVDs, SD cards, and flash drives. USM also has the ability to mimic other storage options, such as a home NAS or local storage/cloud hybrid device, giving USM greater flexibility and use cases than other storage options.

CONCLUSION

For USM to become a viable, ubiquitous storage standard, five critical success features must be met: standardization of the form factor and the interface, durability of the storage media, ease of use of the storage media, readily available USM removable storage devices from service providers or via traditional retail outlets, and backward compatibility of future high-capacity USM removable storage devices with older-generation slots. Use of standard USM technology in combination with time-tested HDDs at steadily increasing capacity points promises to fulfill all five criteria to make USM removable storage devices a viable solution. The value of USM will be strengthened as OEMs in specific target markets move quickly to establish the USM removable storage device as a standard where no high-capacity removable storage solution currently exists.