Letters from the Editor: 2016 State of Storage

Rich Castagna – the VP of Editorial, Storage – shares his candid, expert, and often very funny view on today’s storage market. In these six “Letters from the Editor,” originally featured in our monthly Storage magazine, Rich covers topics such as flash, data storage, SDS, storage hardware, data protection, convergence, and more.
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As editorial director of TechTarget's Storage media group, Rich Castagna oversees content for Storage magazine, SearchStorage.com, SearchDataBackup.com, SearchDisasterRecovery.com, SearchVirtualStorage.com, SearchCloudStorage.com, SearchSMBStorage.com and the Storage Decisions conferences.

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Every month, Rich succinctly introduces each month’s issue of Storage magazine by summarizing the current storage trends worth your attention. By compiling the last 6 months of Rich’s market analysis and observations, the following document allows IT pros across the enterprise to quickly get up-to-speed on the technologies and trends impacting enterprise storage strategy.

January, ‘The future of storage in 2016’

As the calendar winds its way down to the end of yet another year, I take an oath that I will not (absolutely not!) do one of those predictions-for-the-new-year columns. And just moments later—this happens every year like clockwork—I start to jot down some future of data storage-y things that I think might happen or maybe want to happen. Not predictions, mind you, just sort of things that might happen… And since I’m already in a free-fall slide down the slippery slope of New Year predictions, I’m not going to hold back or play it safe. So, with my first prediction for what’s going to happen in storage in...
2016, I’m going to crawl way out onto the skinny end of a limb and predict that you’re going to hear the word “container” a lot in 2016. By “a lot,” I mean constantly, without end, over and over again, until your ears bleed.

**Prediction #1: Contain thyself**

Don’t blame those poor storage marketers for overworking and overusing the word “container”—they’re really groping for the latest, greatest buzzword now that “virtual” has lost much of its cachet. That’s because everything is virtualized now—storage, servers, networks, data centers—even reality. So there’s really nothing left to compare virtual to. Virtual is in danger of becoming the new non-virtual until something even more virtual comes along. Hey, maybe containers are more virtual than virtual. In any event, get ready to be containerized in 2016. And expect the future of data storage to include a good dollop of DevOps to accompany those containers along with some Agile agitprop.

**Prediction #2: WHITHER NetApp?**

Dell buys EMC. HP develops a split personality. IBM looks to the cloud. And Western Digital has turned into a compulsive buyer of flash companies. What about NetApp? Let’s face it, the last couple of years haven’t been kind to NetApp with dwindling sales and the ever-imminent arrival of an all-flash array that’s getting to seem more and more like a road company production of Waiting for Godot. Even worse, with all those hip, young startups flashing their solid-state wares, NetApp is beginning to look like a stodgy old grandpa in a cardigan sweater.

So, my prediction for the future of data storage when it comes to NetApp is that 2016 will be business as usual, even if that business is getting a wee bit smaller day by day. There’s been a lot of speculation about who would buy NetApp, but
the presumptive buyers—IBM, Cisco, HP (or even the new HP, the one with the E on the end)—don’t seem to be in the market for a traditional storage-only company. In fact, I think the opposite might be true. Maybe NetApp will try to buy its way out of the data doldrums in 2016, possibly picking up Violin Memory or one of the newer, innovative startups like DataGravity or Qumulo. The latter two might fit nicely; NetApp boasts a legacy of being the main repository of file data and the new duo has developed some very interesting ways of managing that data. [Editor’s Note: As we went to press, NetApp’s acquired all-flash array vendor SolidFire.

**Prediction #3: A dash of flash**

In 2015, the big debate related to storage systems was which is better—a hybrid array or an all-flash array. I bet you’re tired of hearing that stuff—a controversy almost exclusively concocted by some of those upstart vendors that sell only the all-flash variety. Before we had solid state, you probably remember those famous 10K rpm vs. 15K rpm hard disk system controversies, right? Or maybe you’re waxing nostalgic about those knock-down, drag-out battles between the DVD vs. CD-ROM camps, right?

Well, probably not, because those scraps never really materialized. Storage pros did the logical thing and chose the media that was right for the apps and the data it would host. With flash, we can add another media choice to the mix, but the considerations are still the same: match apps to the media that best serves them. So the hybrid vs. allflash thing isn’t really any kind of techno religious war, it’s just a war of words among marketers that has managed to spin off its axis and into irrelevancy. Storage pros buy the storage that will work best for them. Period.
Prediction #4: Data protection will actually get modern

You can say anything you want about cloud storage, how it’s not safe for the corporate family jewels, how getting stuff in and out is a pain, how it could fly in the face of regulatory compliance, blah, blah, blah, but there’s no denying that cloud backup—the ageless ancestor of all cloud storage services—is finally having a profound effect on data protection. Storage shops now see the impeccable logic behind using the cloud as a backup tier so that they don’t have to keep expanding the capacity of their backup targets. As we look into the future of data storage, expect to see more backup cloud-tiering options in 2016 as all the key backup hardware and software vendors build in links to cloud services. The concept of flat backups will gain steam in 2016, and in a throwback to CDP (continuous data protection), backup jockeys will learn to love the combination of application-consistent snapshots and remote replication. Both of those data protection developments are pretty cool, but the coolest thing by far is the rise of cloud DR or DR as a service (DRaaS). This is the one area where it’s not taboo to use the words “virtualization” and “cloud” in the same sentence, as those two techs have been paired to create the fastest, most-efficient method of disaster recovery yet. And if that’s not enough, it’s dirt cheap compared to most other alternatives. If you’re not looking at cloud-based DR now, put it on your 2016 to-do list.

Prediction #5: Same time, same place

As 2016 draws to a close, I’ll swear on a stack of VMAX user manuals that I absolutely won’t do another predictions column on the future of data storage. Then I will.
February, ‘Predictions to give you a leg up on 2016’

By now everyone’s probably well past scratching out “2015” and writing “2016” on their checks (remember checks?) and have already forgotten just exactly what New Year’s resolutions they made. But, hey, it is a new year, and you’re all probably raring to go and ready to take on new projects, bolstered by a still mostly unspent budget and a lot of great expectations. It’s that traditional recharging of our psyches and souls, and it fills us with all kinds of optimism. And if we need a little nudge into the future of data storage—even just a subtle shove—we can always count on the annual prognostications of storage industry pundits, analysts, vendors and—ahem—maybe a storage editorial writer. Having already shared my forward-looking visions in this space, I soon discovered that there was still a lot of ground to cover as my email inbox spilled over with dozens—nay, scores!—of predictions on the future of data storage, pouring in from the aforementioned constituencies. Some were pretty insightful, most were blatantly self-serving, and still others were good for a chuckle or two. Without naming names, here are some inbox gems.

“Contrary to popular belief, tape will not die in 2016 …”

Tape is taking longer to die than Generalissimo Franco did back in 1973 … and 1974 … and 1975. This prediction on the future of data storage—boldly suggested by a backup software vendor, not the LTO Consortium—goes on to make a very good point by adding that tape is still a “reliable and cheap” offline medium for cold archive. The prediction then swerves a bit in the opposite direction and says that cloud storage will replace tape in some cases. So maybe tape dies in 2017 …?
“Orchestrations and automation will ensure smoother operations and shorter scaling time …”

This is another vendor contribution on the future of data storage—and a curious one at that. My mind might be stuck in the storage world and maybe I don’t see the big picture, but isn’t doing things faster and easier the whole point of orchestration and automation? Maybe they just didn’t want to go too far out on a limb and make the data center of the future sound too good.

“Hardware is the new software, the emergence of scale-in hardware architecture …”

I’m not even sure I know what this one means. But if we’re living in the age of software-defined storage and this prediction is correct, does that mean we should look forward to hardware-defined storage—or hardware-defined software? Whatever it means, I’ll be sure to keep an eye out for it in 2016. I guess what they really mean is that hardware does actually matter and despite “software-defined” showing up in front of every conceivable data center thing these days, we still have hardware and it’s still pretty darned important. I couldn’t agree more—although I might’ve said it a little differently.

“Dell-EMC chaos will ensue …”

I suppose this prediction hinges on your interpretation of the word “chaos.” And, to be honest, this prediction came from a vendor of—yes, you guessed it—storage systems. So this is more of a prayer than a prediction.
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“What excites me about the future of tape is the new use cases that LTFS is opening up …”

In this case, the prognosticator’s excitement is understandable as this prediction on the future of data storage does come from one of the LTO Consortium members. I was once excited by LTFS, but it’s been many years now and there are only a handful of products built around that technology. What really caught my eye, however, was the use of the acronym “tNAS.” That got me revving up the Google machine to see who minted that acronym. Frankly, I was afraid that I wasn’t “in the know” and maybe tNAS was the storage buzzword du jour. It actually means “tape as NAS” so feel free to toss that acronym around.

“High-profile security breaches are set to continue in 2016, and more executives will become the targets of hackers …”

Those of us who aren’t executives can breathe a sigh of relief—and try to remember not to stand too close to any executives in 2016. I’m not sure it takes all that much insight or expertise to predict that something bad that’s been virtually unchecked for years will get worse in the coming year. A hint or two about what we should do about it would’ve been nice.

“Extinction of the IT specialist …”

That’s a pretty gutsy prediction to make—especially by a storage product vendor. I think they’re predicting that their customers will go the way of the dinosaurs. (I have this picture of IT specialists clinging to their beloved tape libraries, and together being hauled out of data centers and dumped into museums.) But there was a serious part of this prediction that
describes a world where everyone in the data center is a generalist, and everything has to be simple and manageable through a single pane of glass. So it’s not really about extinction, but rather about IT utopia.

March, ‘Vendors offer speed, space but overlook reliability’

When you buy a data storage system, what do you expect? Let me put that another way: Your company just shelled out hundreds of thousands (millions?) of dollars for a new array—what now? That, of course, depends on how you measure your needs and how well that new big chunk of iron meets those needs—or seems to.

A few recent surveys—a couple sponsored by data storage vendors so their results are taken with the requisite grain of salt—suggest that storage buyers not only have pretty diverse purchasing motivations, but also equally diverse criteria for determining how well a system meets their needs. Call it “survey convergence” if you like, but comparing bits from this survey and that—along with our own research—starts to tell a pretty interesting story about data storage purchases.

Separating serious from self-serving surveys

The survey from Condusiv, a data storage vendor that sells an I/O hop-up kit called V-locity, endeavors to demonstrate that storage buyers are prowling the aisles with their shopping carts because their current storage systems are performance-challenged. Self-serving? Of course, but no less interesting when you get past some of the sillier questions and look at some of the more interesting details.
For example, this survey says that 51% of respondents bought a new SAN to help improve performance due to the stresses that virtual environments put on storage. If a performance lift was all that was needed, buying a whole new rig is a fairly radical reaction. Some of the less surprising options were related to solid-state storage, such as adding flash to existing data storage systems (27%), putting flash into servers (17%) and purchasing PCIe-based flash cards, which presumably would also go into servers.

The second survey that caught my eye was fielded by Western Digital and queried CIOs and other “IT decision makers.” There was some fluffy stuff in WD’s survey, too—like citing the 85% of respondents who said they “recognize the positive impact data can have on their bottom line”—I guess the remaining 15% just said, “Data, shmata…” And given their line of business, it doesn’t shock us that WD reports that 55% of their survey audience aren’t yet storing all the data they need for that positive impact to happen. Other numbers from the survey support the capacity angle for motivating data storage buyers—89% of respondents think all data has value.

For me, the most interesting data point in the WD survey is that 39% of their respondents said reliability is the most important consideration when buying storage systems, compared to 25% who said cost. In the dozen-plus years that we’ve fielded our own Storage Purchasing Intentions survey, we’ve seen that cost is diminishing as a key factor when buying an array.

Money’s always important, but it’s not the most important thing on storage managers’ minds when they evaluate data storage vendors’ trinkets.
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WD’s capacity angle holds up vs. our home-grown data, too. This month’s Snapshot bears that out—70% said capacity was the main motivator for their considering to purchase a new unified array. I’m sure that number is a bit high because it specifically relates to those combo unified systems that mix block and file in one box, but even if you chisel off a few points, the capacity consideration was still miles ahead of the next most popular reason to buy—performance (46%).

Hmm… so even though those two surveys come from data storage vendors with pretty obvious objectives in mind, they do seem bolster the notion that storage buyers are looking for capacity and performance—maybe not in that order, but both are definitely in the picture.

Service, reliability matter

WD’s reliability data point is less compelling. We’ve conducted our Quality Awards surveys for 10 years now, querying real users about the service and reliability of their enterprise and midrange arrays, and their NAS boxes.

All of the Quality Awards surveys include a section that specifically addresses reliability. In all three of the storage systems categories that we survey, users’ ratings for reliability have gone down, down, down over the years. In our most recent survey for enterprise arrays, for example, our users gave those systems the lowest reliability ratings we’ve seen in eight years. In the midrange category, you have to go back six years to find a lower set of reliability scores than what was recorded in the most recent survey. The latest NAS survey findings were even grimmer: the lowest reliability scores ever—and that’s in 10 years of getting user feedback.
It looks like data storage vendors have the answers to the capacity and performance issues. With big disks growing to 8 TB and 10 TB and beyond, there should be ample capacity to handle big data, archives and any other capacity-gobbling app. Performance, too, appears to be addressed with solid-state gizmos shooting data down the express lanes in hybrid and all-flash arrays or in servers.

On the other hand, data storage vendors might want to spend a little more time and effort on the seemingly irksome reliability issue.

April, ‘Bye, bye backup – hello, real data protection’

March 31 was World Backup Day—and hopefully by now you’re rested up and recovered from all the partying and celebratory hijinks. The funny hats have been put away ‘til next year, the “backing up is easy, restoring is hard” T-shirt is back in the drawer and that hangover from toasting incrementals and synthetic fulls is just about gone.

What? You didn’t party like it’s 1999 to celebrate World Backup Day?

What a shame to miss such a momentous event. But I bet your company is still backing up its data like it’s 1999. Because, when it comes to backing up their data, that’s pretty much what most companies are doing these days—using essentially the same data backup options, processes and products to protect data that they did a couple of decades ago.

Backup is still backup

For the last few years, much of the buzz around the data center has been about transformation—virtualizing everything but the water cooler, and creating an agile environment that turns on a dime to help the company make a buck.
Technologies are evolving; software and hardware are being recalibrated to serve the new world order. But backup is still backup. Most companies are still messing around with the same data backup options; you know, the weekly fulls and daily incrementals. And backup admins’ eyes are glued to the clock as they pray that the backup will wrap up before the employees who keep regular hours punch the clock in the morning.

And it’s going to get worse. We’ve only begun to scratch the surface of the Internet of Things and big data analysis, and storage operations are already starting to get overrun with tons of new data. More and more stuff is being collected and saved and poked and prodded and analyzed. The issue isn’t just where you’re going to put all that stuff, but how are you going to protect it to make sure it’s actually there when you need it. And the data is going to get bigger and bigger …

Our storage surveys show that the average company has 1.4 petabytes of data stored on disks, flash, tape, optical, cloud—whatever. That’s the average. Larger companies have more than 4 PB of data on all those different types of media. Obviously, a lot of that is archival and may never be touched again. But if even a fraction of that data has to be backed up, it’s clear that the data backup options we use today just aren’t going to cut it for much longer.

Swapping up for a beefier backup app isn’t easy, either. Backup software has that nasty tendency to store your data in its proprietary format. So when a company brings in a new backup app, you can bet it’s the beginning of a long, long relationship.

Options aplenty, changes rare

Even if you decide it’s time for a change and are willing to migrate backed up data to a new app, or to just leave it alone and hope you never need it, the alternatives are mindboggling. Take a look at Dell’s menu of data protection software, for example. Dell’s been something of a backup app pack rat over the past few years and now offers NetVault Backup,
vRanger and Rapid Recovery (née AppAssure). And that’s pre-EMC acquisition, which will add Avamar, NetWorker, RecoverPoint and Mozy to the mix.

That’s a lot to choose from, but the truth is, few of those data backup options will likely change the way a company approaches backup. Today, the focus is largely on copy data management, the process of keeping tabs of the copies of data that backup apps produce and, more importantly, reducing the number of copies. That’s great, too, and certainly something that most data centers need.

There’s also been some buzz around flat backups or so-called backup-less backup. Flat backups use snapshots and replication to try to eliminate backups. It works okay in some cases, but you still need some way of managing and cataloging snapshots, and application awareness is sometimes an issue as well. And since snaps are local, you need to replicate them to another system—and then be able to rebuild and restore them. The bottom line is that it’s a decent alternative for some environments but—at least in its present state—isn’t likely to nudge backup apps out the door anytime soon.

**Is CDP the answer?**

So what’s really needed is a new technology that doesn’t use a batch backup app at all and that doesn’t rely on snapshots or replication. Something that is so much in the background that it becomes transparent—as in, never see it, never worry about it.

I’ll dub that new tech Instant Information Safeguarding and Retrieval—or IISR. IISR will capture every bit of data as it’s created and immediately ship it to a backup target on the other side of the data center, across town or to a cloud storage
service. It will happen instantaneously, and the data will be left in its original format, so that when it is needed again, it can be instantly retrieved and used without requiring any special software.

Hold it.

I think I just described continuous data protection—or CDP. What we need is here already—and it even comes with its own cool acronym. And it’s really a pretty old tech, after all.

Given the shortcomings and frustrations related to traditional data backup options, it’s puzzling why we haven’t seen more products that do true CDP. It could be built into storage systems, server OSes, array OSes, applications and hypervisors—just about anywhere that data passes through or where there’s an API that can be tapped.

So maybe it’s time to dust off CDP and give it another try. And maybe when World Backup Day 2017 rolls around, we’ll really have something to celebrate.

May, ‘Data storage growing faster than capacity’

Just about a year ago, I got all jazzed about a new discovery that could turn DNA into a storage medium. That was pretty cool—the stuff of life getting turned into the equivalent of a 21st century floppy disk, but with a lot more capacity and even more intriguing scenarios. Scientists speculated that a mere gram of DNA could potentially hold 2 TB of data. Not bad for a medium that until now only handled mundane tasks like determining the color of our eyes and whether or not we were going to lose our hair eventually.
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Now the lab coat set has come up with another ingenious alternative to boring old magnetic data storage media or stolid solid state. In news reported by a number of sources, including Research and Markets, the arrival of “quartz coin data storage” has been widely heralded.

Not to be confused with bitcoins, each of these coins (developed at the University of Southampton in the UK) is said to be capable of holding 360 TB of data on a disk that appears to be only a bit larger than a quarter. That’s a lot of data in a small space, and it makes that 32 GB USB flash drive on your keychain seem pretty puny.

According to the Research and Markets press release, here’s how they did it:

“The femtosecond laser encodes information in five dimensions. The first three dimensions of X, Y and Z denote the nano-grating’s location within the coin, while the 4th and 5th dimension exist on the birefringence patterns of the nano-gratings.”

Well, sure, if you’re going to resort to using birefringence patterns and nanogratings, then that kind of capacity in that small of a space is no surprise. (Confession: I have no idea what birefringence patterns and nanogratings are.)

All those terabytes on a small coin are pretty impressive, but what’s even more staggering is the predicted life expectancy of this form of data storage media: 13.8 billion years. That’s about the current age of the universe! Sure, that number is theoretical, but even if it’s only a measly one billion years, I’m impressed. I just hope I’m around to check on the accuracy of that forecast.
If you’re starting to think about reconfiguring your data center to house a lot of little quartz coins, you might want to slow down a bit. I don’t expect WD or Seagate are likely to be stamping out quartz coin drives any time soon. But maybe you don’t really need all that extra capacity anyway.

**HDD capacities on the decline**

Some market research firms have reported that the total hard disk capacity recently sold is down from previous periods. For example, TrendFocus noted that total HDD capacity shipped declined sharply from about mid-2014 to the middle of 2015. If you think that cloud and flash are responsible for that dip and are filling the gap, that doesn’t appear to be entirely true.

What’s more likely is that storage managers are finally trying to get the upper hand in the struggle to control data storage media capacity. And with new capacity requirements looming with big data analytics and IoT apps, it’s kind of a now-or-never proposition: Take control or take cover.

Our storage purchasing surveys reveal that storage buyers have been better at planning ahead over the past six or seven years by buying bigger arrays and then filling in with additional drives as needed. Similarly, while flash is likely taking up all the slack of slumping hard disk drive (HDD) sales, it’s also likely that solid state is affecting storage buying habits. In the past, to squeeze out required performance, a storage array might’ve been configured with dozens of short-stroked 15K rpm disks, but now the same—or better—performance can be achieved with far fewer flash devices. So the net-net there is better performance and a smaller capacity purchase.
Tape—you know, that type of data storage media that’s been declared dead umpteen times in the past decade—could also be making a difference due to its generous storage capacities absorbing some of the capacity previously destined for disk.

**Clear out rotten storage**

Veritas’ recent (and oddly named) Global Databerg Report declared that only 15% of the data a typical company has stashed away on its storage systems is business-critical stuff. And the report called 52% of the stored information “dark data” because its value was unknown. The rest of the data (33%) is described as “redundant, obsolete or trivial,” or ROT—definitely one of the best acronyms I’ve seen in some time.

I don’t really know how accurate Veritas’ numbers are, but I bet that they’re at least in the ballpark for most companies. In our most recent purchasing survey, respondents indicated that they manage an average of 1.4 petabytes of data on all forms of data storage media, including disks, tape, flash, cloud, optical and whatever else you can lay a few bits and bytes on. If 33% of that is indeed ROT, that means companies are paying for the care and feeding of about half a petabyte of junk.

Perhaps data centers have begun to get the ROT out. Some of the newer and smarter storage systems make the chore of finding and deleting rotten data easier by providing more intelligence about the stored information. It’s also possible that tape, our favorite dead data storage media, has been resurrected for archival purposes, and both dark data and ROT have found a final resting place. The LTO Ultrium Consortium, which effectively produces the only tape game in town with its LTO format, reported that vendors shipped 78,000 PB of compressed LTO tape capacity in 2015.
In any event, when you put the ever-growing capacity demands and the apparent downturn in disk capacity sales side by side, you have to conclude that we’re all getting at least a little better at what we save and what we dump. And we’d better get used to it—it looks like selective saving will be the way of life if we want to survive the imminent big data/IoT data deluge.

June, ‘Study storage to learn about servers’

I thought I was going to learn all about servers, but I got a lesson in storage instead.

I attended the recent Open Server Summit conference down in Silicon Valley, figuring that it was a great opportunity to become a little smarter about server architectures and designs. There was no shortage of new stuff for me to try to cram into my personal nonvolatile memory (read: brain), but I was surprised that so many of the new developments in server techs were related to storage. In fact, if I closed my eyes and imagined that I was at the Open Storage Summit instead, the presentations I heard on servers and storage would’ve made just as much sense.

At first, I thought it was a little odd that so much of the talk at a server conference was about storage, but the reasons sunk in pretty quickly: convergence and solid-state. Because convergence is so tightly linked to the abstraction of controlling software from physical devices such as servers and storage, it’s ironic that that decoupling actually puts greater focus on the hardware in a number of ways. Pretty much all of the elements that make convergence work—automation, agility, low latency and so on—require some pretty sophisticated hardware underneath that convergent upper layer.
Commodity hardware has value

In the software-defined everything world, the hardware—regardless of whether it’s storage, server or networking gear—is often referred to as “commodity” stuff. Webster’s online dictionary defines commodity as: 1) “something that is bought and sold” and 2) “something or someone that is useful or valued.”

Everything gets bought and sold, so that part of the definition doesn’t shed any new light on convergence technologies, but the second one is spot on. The way “commodity” gets tossed around in convergence conversations, you might think that the label meant just the opposite—something undistinguished and pretty unimportant. I understand that some champions of converged architectures feel a need to emphasize—maybe over-emphasize—the importance of the new, more powerful software layer. So, maybe, by trivializing the hardware, they think the software will stand out even more.

Personally, I think that’s a misguided and potentially misleading approach. Not relying on proprietary hardware doesn’t mean that you don’t need a sophisticated, reliable, high-performance, scalable (and so on) assemblage of hardware products to bolster the software. You could have the greatest software in the world, but if it’s running on a creaky kit, it won’t seem all that great. Look, all IT hardware has always been software-defined; the latest wave is just another step in reducing the need for proprietary hardware tweaks.

Another reason why there was so much talk about storage—and networking for that matter—at a server conference is that as we rely more on the software than on hardware hacks, it makes it easier to bring servers and storage and networks closer and closer together. And in the world of IT, close is good. It’s getting harder and harder to talk about one of these data center pillars without also bringing the other two into the conversation.

Think hyper-converged infrastructure.
Flash storage crucial to convergence

But there is a “pure” storage technical development that—in my not-so-humble opinion—has been one of the key motivators for the software-defined data center movement: NAND flash. Solid-state storage hasn’t just accelerated storage systems; it has also enabled a variety of architectures involving servers and storage that provide the flexibility and agility to leverage software to meet the requirements of a slew of different use cases. Flash, along with multicore processors, makes it possible to build converged systems that can offer improved performance without the need to cobble together special hardware devices. Flash can take up the performance slack of general-use hardware, which makes using those “commodity” parts feasible. So what’s really happening in the software-defined realm is that the “commodity” hardware is getting more and more sophisticated and efficient, and is therefore able to do what other proprietary parts used to do. That means “proprietary” is getting shoved down stack to the component level. Once again, the beauty of software-defined is being bolstered by hardware.
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