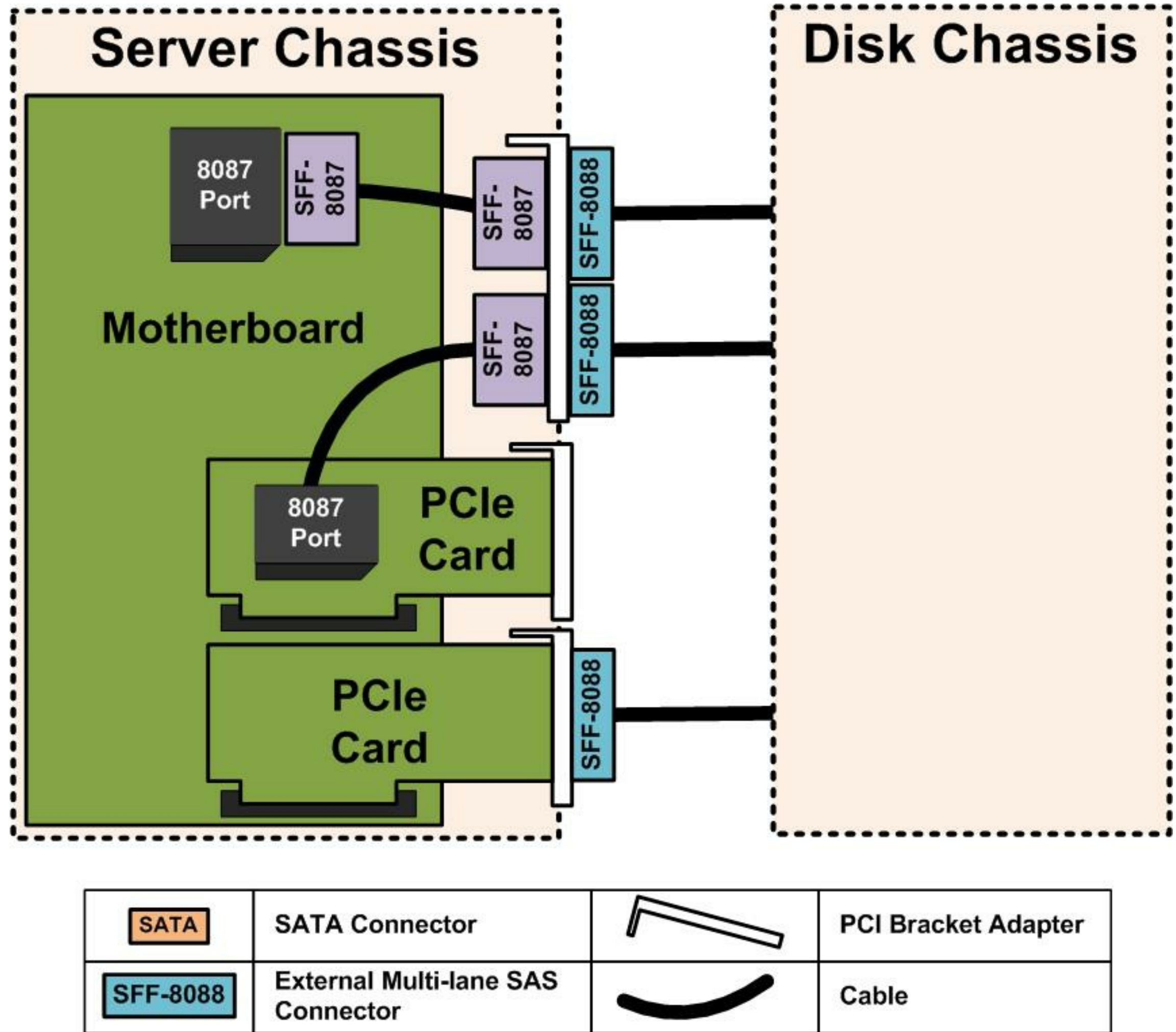


External SAS/SATA Disk Chassis Wiring – Part 1

By [Jeff Shukis](#) - December 10, 2012



	SATA Connector		PCI Bracket Adapter
	External Multi-lane SAS Connector		Cable
	Internal Multi-lane SAS Connector		

Completed Server Wiring

You've decided to build your own external hard drive chassis. You bought your drives and a bare chassis to house them. You've read Patrick's [first](#) and [second](#) build articles plus my article on the [Supermicro power board](#). Now you are figuring out which disk cables and adapters you need to wire it all together – and it's starting to get a bit complex. If that describes you, then you have stumbled upon the right article. Let's make it simple again. In this article we'll talk about wiring your server for use with an external disk chassis. In part two we'll dive into wiring the disk chassis itself.

Let's say that your goal is to connect your server to an external disk chassis containing 24 hard drives. Your server motherboard has PCIe slots and SATA disk ports and, if you are lucky, multi-lane SAS disk ports. You need cables and adapters to connect the disk ports in your server chassis to the drives in your disk chassis, and of course you want the whole setup to be reliable and decent looking. A few minutes of Googling could easily leave you a bit overwhelmed with options. With enough research you can figure it all out, but I'd like to save you some time.

Start in the Middle – Cables Between Chassis

The cables between your server chassis and your disk chassis should be SFF-8088 cables. You'll need one cable for every four drives in your chassis, unless you intend to include a SAS expander into your disk chassis, in which case you need only one cable. You might be tempted to use something cheaper than SFF-8088, but please don't. SFF-8088 cables are shielded, tough, very high bandwidth, and they have a remarkably strong and secure latching connection. They are sold as SAS cables, but they work perfectly with SATA disks. They can be expensive when bought from server supply vendors, but you can almost always get them [cheap on eBay](#) – often \$20 but sometimes as low as \$10 each. They look like the image below and are available in lengths from .5 meter to around 10 meters.



SFF-8088 Cable

What are the other, less desirable cable options? SFF-8087 cables are multi-lane SAS/SATA cables like SFF-8088, but they lack the required shielding and are best used inside of a chassis, not externally. You may already have eSATA cables lying around, which are sold as external cables, but these are very flimsy compared to SAS cables and, even worse, you'd need tangled mess of 24 of them for your 24 disk chassis. eSATA is really only useful to connect one or two external disks to a desktop machine. Don't even think of using standard SATA cables. Can you imagine 24 non-shielded, non-latching cables run between two chassis?

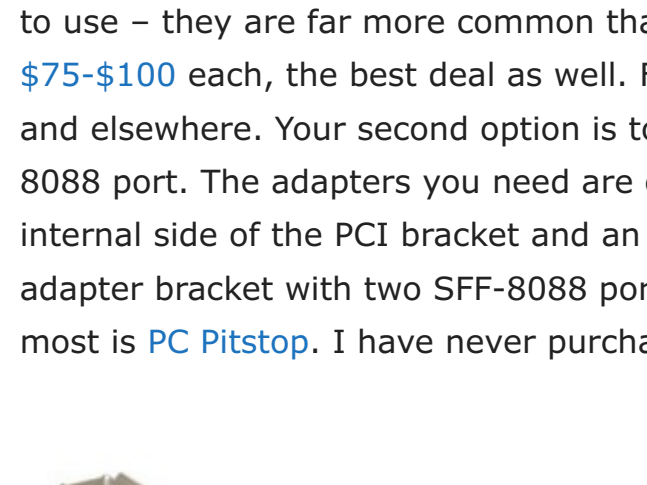
[Ed.] One quick note here is that along with the LSI 9202-16e, we will see more cards start to come with SFF-8644 connectors. These are higher-density connectors that will replace SFF-8088 over time, and you can get SFF-8644 to SFF-8088 conversion cables easily.

Server Adapters and Wiring

With your between-chassis cable strategy in place, you can move on to wiring your server. Since your inter-chassis cables have SFF-8088 male ends, you'll need SFF-8088 female ports at the back of your server. Simple enough. You have three options:

- 1) Use a RAID card or a Host Bus Adapter with SFF-8088 ports.
- 2) Use a RAID card or a Host Bus Adapter with internal SFF-8087 ports, converting them to external SFF-8088 ports.
- 3) Convert your motherboard SFF-8087 SAS ports to SFF-8088 ports.

The first, and best, option is to use a RAID card or HBA with SFF-8088 ports built in. The photo below shows a host bus adapter with two external ports – the excellent LSI 9207-8e. If you need "only" 2.5GB/Second of bandwidth, you could settle for used LSI 9200-8e cards instead – these sometimes dip as low as \$100 on eBay. If a RAID card is more your style, there are many options available, from the no-holds-barred LSI 9286CV-8eCC to a somewhat cheaper used LSI 9280-8e. These and other external-port SAS/SATA cards provide the cleanest wiring setup with the fewest cable length restrictions, and they don't use up your servers' internal disk ports, which are probably already connected to a set of internal hard drives.



Adapter Card with SFF-8088 Ports

While external-port adapter cards are the best option, they are expensive. You might already have an internal-port SAS card that you'd like to use – they are far more common than external port cards. The excellent IBM M1015 host bus adapter is the best known example, and at \$75-\$100 each, the best deal as well. For a RAID card option, the IBM M5014 is usually available used for [very reasonable prices](#) on eBay and elsewhere. Your second option is to use one of these internal port cards along with adapters to convert each SFF-8087 port to an SFF-8088 port. The adapters you need are commonly called PCI adapter brackets. These brackets have one, two, or four SFF-8087 ports on the internal side of the PCI bracket and an equal number of SFF-8088 ports on the external side. The photo shows a standard profile PCI adapter bracket with two SFF-8088 ports. These brackets are available from many sources, but one vendor who sells a broader variety than most is [PC Pitstop](#). I have never purchased from them, but they do offer the right products and I regularly use their site as a reference.



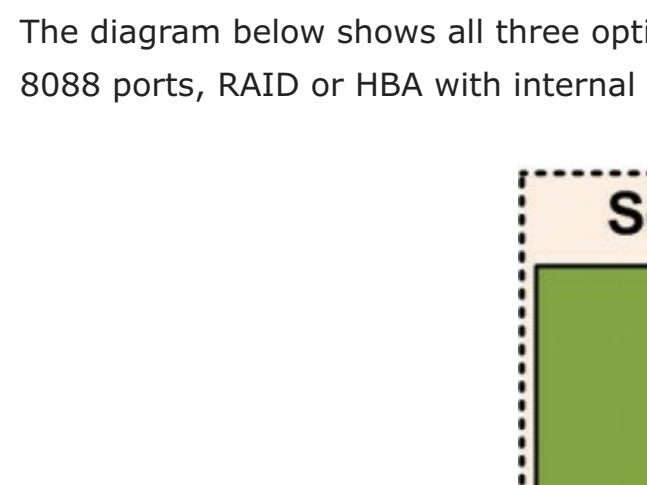
SFF-8088 to SFF-8087 PCI Adapter Bracket

In addition to the PCI adapter bracket, you'll use a SFF-8087 cable. The photo below shows such a cable plugged in to the right side of a single-port PCI adapter bracket. The free end of the SFF-8087 cable plus in to the SAS/SATA card.



PCI SAS Adapter Bracket plus SFF-8087 Cable

As an alternative to a PCI adapter bracket plus a separate cable, Supermicro offers adapter brackets with the cables wired-in. These are often the least expensive option and I like the clean look. The photo below shows Supermicro part number CBL-0168L, the standard profile dual-port version. Supermicro also offers a low profile version with part number CBL-0168L-LP and single-port versions with part numbers CBL-0167L and CBL-0167L-LP.

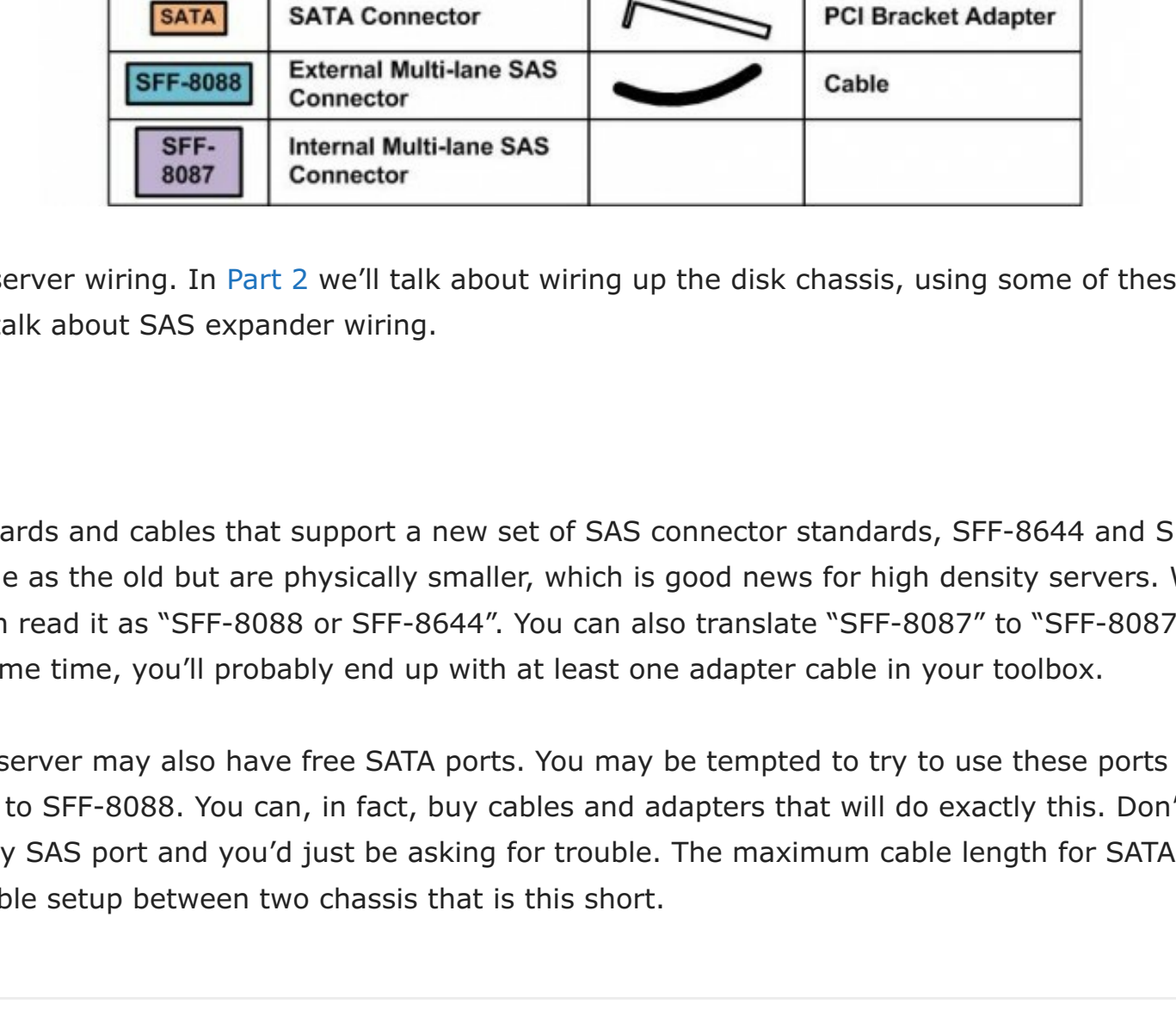


Supermicro CBL-0168L

Lastly, some server boards feature embedded SAS/SATA controllers and have SFF-8087 connectors right on the motherboard. Your third option is to convert these motherboard resident SFF-8087 ports to SFF-8088. The wiring used in this scenario is identical to the internal-port SAS card scenario: A PCI adapter bracket and a SFF-8087 cable.

Putting It All Together

The diagram below shows all three options for wiring your server for use with an external disk chassis: RAID or HBA card with external SFF-8088 ports, RAID or HBA with internal SFF-8087 ports, and motherboard with SFF-8087 ports:



	SATA Connector		PCI Bracket Adapter
	External Multi-lane SAS Connector		Cable
	Internal Multi-lane SAS Connector		

That should complete your server wiring. In [Part 2](#) we'll talk about wiring up the disk chassis, using some of these same cables and adapters plus a few more. We'll also talk about SAS expander wiring.

Additional Notes

You may soon start seeing cards and cables that support a new set of SAS connector standards, SFF-8644 and SFF-8643. The new connectors function the same as the old but are physically smaller, which is good news for high density servers. Wherever you see "SFF-8088" in this article, you can read it as "SFF-8088 or SFF-8644". You can also translate "SFF-8087" to "SFF-8087 or SFF-8643". Since the two sizes will co-exist for some time, you'll probably end up with at least one adapter cable in your toolbox.

One last bit of advice: Your server may also have free SATA ports. You may be tempted to try to use these ports instead of buying a HBA or RAID card, converting them to SFF-8088. You can, in fact, buy cables and adapters that will do exactly this. Don't. SATA ports put out a much weaker signal than any SAS port and you'd just be asking for trouble. The maximum cable length for SATA is 1 meter, and its nearly impossible to construct a cable setup between two chassis that is this short.

Jeff Shukis

Jeff is a "Software Guy" who seems to like Hardware quite a lot. Formerly VP Engineering at Oracle, formerly VP/CTO for Bridgestream (acquired by Oracle), and formerly VP Engineering and SaaS Operations for Promptu, Jeff is currently launching a new software company, [OpenData](#), focused on analytics and analytical applications for IT Security and Identity Management. Jeff sometimes posts as "Jim" on the ServerHelix.com forums.

