



# Prosper at the Speed of Light

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Investing in the right fiber-optic cabling infrastructure ensures that your business or property will maintain a competitive advantage in the 21st century.

#### **EXECUTIVE SUMMARY**

Case studies have made it clear: There's a pressing need today for fiber-optic networking infrastructure to future-proof commercial buildings and business ventures of all types.

Fiber-optic cabling provides the bandwidth necessary to keep up with today's burgeoning networking needs, support billions of online devices, and route Ultra High Definition (UHD) video such as emerging 4K and 8K standards.

The right fiber-optic cable solution is more durable than Category cable, easier to install and terminate, does not require extensive staff training, and eliminates services calls.

These benefits and others make the business case clear: This form of signal transmission is required now, and investing in an advanced fiber-optic infrastructure will save installation and maintenance costs well into the future.

This eguide presents case studies that show how one of the safest investments today is in a communications infrastructure that not only sends data at the speed of light but also allows you to grow and prosper.



Video accounted for an estimated **73%** of Internet traffic last year and is set to grow to **82%** of all net traffic by 2021.

### **LIKE YOUR DATA CHUNKY?**

If you've walked through a large Las Vegas casino, you know there are video monitors everywhere. These monitors direct you to your destination, lure you to other destinations, and send information. And in the case of high-definition video, they send a lot of information.

High-definition video takes up huge chunks of a network's bandwidth—and a lot of video takes up a lot of huge chunks.

Picture a hotel/casino with a 24,000-square-foot space, replete with video monitors, audio system capability, and networking infrastructure. And that's adjacent to one of the world's biggest conference centers, with multiple halls and miles of exhibit space. Hundreds of thousands of people walk through this complex daily.

Behind the scenes, the network for the hotel, conference center, and casino routes all of this chunky video and data and must remain robust 24/7/365.

### **BANDWIDTH-HUNGRY TECHNOLOGIES**

Needs like this aren't limited to large hotels and casinos. Millions of commercial buildings all over the world have serious AV and networking needs—and these needs are growing every day and with each guest or employee. Ultra High Definition (UHD) 4K HDR video is already here and available in four times the resolution of Full HD 1080p. That multiplies the data being sent over already taxed networks. Concerned about video as a bandwidth hog now? Oink. Oink. Right behind it is 8K.

Video is now the predominant mode of traffic on the Internet. Video accounted for an estimated 73 percent of Internet traffic last year and is set to grow to 82 percent of all net traffic by 2021.

But let's not forget an even greedier consumer of bandwidth: The Internet of Things (IoT), also known as the Internet of Everything. Gartner Research predicts there will be between 20 and 30 billion of these connected devices by 2020. Yes, everything with an Internet address ad nauseum and infinitum and so on—eating up your bandwidth, 24/7/365. Add bandwidth-hungry emerging technologies like virtual reality and augmented reality—which are quickly becoming realities—and you get the very big picture.

Where's all this data going? It's going on the network. Your network.

### **SMOOTH MEANS ROBUST**

"Everything connects to the network in the world of IoT, and we need a much more robust network," says Robert D'Addario, president and managing director of Cleerline Technology Group, a maker of fiber-optic cabling. He's not just talking about a building's exterior telecommunications network. "We need a stable, internal network that's exponentially larger in bandwidth to what's outside a building."

It makes sense to have an internal network capable of handling the fire hose of data coursing through it—while filtering it for security, of course. And you should reserve



## THE FINE LINE OF 4k TRANSMISSION

Old, Current or Future	Resolution	Frame Rate (FPS)	Compression	Deep Color Bit Depth	HDR	Wide Color Gamut (BT2020)	HDMI Version	Data Rate
OLD	1920x1080	24	4:2:0	8 BIT	NO	NO	1.4	2.23 GBPS
OLD	1920x1080	60	4:2:0	8 BIT	NO	NO	1.4	4.45 GBPS
OLD	1920x1080	60	4:4:4	8 BIT	NO	NO	1.4	4.45 GBPS
OLD	3840x2160	24	4:2:0	8 BIT	NO	NO	1.4	8.91 GBPS
OLD	3840x2160	24	4:4:4	8 BIT	NO	NO	1.4	8.91 GBPS
OLD	4096x2160	24	4:4:4	8 BIT	NO	NO	1.4	8.91 GBPS
OLD	3840x2106	60	4:2:0	8 BIT	NO	NO	1.4/2.0	8.91 GBPS

**COPPER CABLING IS AT OR NEAR ITS LIMITS AND NOT CAPABLE OF MEETING THE IP AND HD VIDEO REQUIREMENTS OF THE FUTURE.**

CURRENT	3840x2160	24	4:2:2	10 BIT	YES	YES	2.0(a/b)	8.91 GBPS
CURRENT	3840x2160	24	4:4:4	10 BIT	YES	YES	2.0(a/b)	11.14 GBPS
CURRENT	3840x2160	60	4:2:0	10 BIT	YES	YES	2.0(a/b)	11.14 GBPS
CURRENT	3840x2160	24	4:4:4	12 BIT	YES	YES	2.0(a/b)	13.37 GBPS
CURRENT	3840x2160	60	4:2:0	12 BIT	OPTIONAL	YES	2.0(a/b)	13.37 GBPS
CURRENT	3840x2160	60	4:2:2	12 BIT	OPTIONAL	YES	2.0(a/b)	17.82 GBPS
CURRENT	3840x2160	60	4:4:4	8 BIT	OPTIONAL	YES	2.0(a/b)	17.82 GBPS

**THESE FORMATS ARE ALL IN USE TODAY.**

Graphic courtesy of Murideo © AVPro Global Holdings 2016

enough of that bandwidth for your own security and surveillance needs, if you're not hosting it on a dedicated network. It's a sane strategy for future-proofing—ensuring smooth operation for the next year and the next decade.

### THE BOTTOM LINE ON CATEGORY CABLING

Here's what was happening in the huge Las Vegas hotel: The huge hotel/casino/conference center/neighbor of a colossal convention center with thousands of trade-show attendees constantly trodding about had to send all of that video and other data to dozens of displays while also handling corporate network needs and security—all on an Ethernet-based network requiring all sorts of techno-geek transmissions from video over HDBase-T using Ethernet cable to media devices to

HDMI audio/video cable to the display screens. The separate device decoders for each display filled IP closets. Oh—and they also sent data up hundreds of feet to the giant marquee on the roadside.

It all worked—barely.

Most commercial buildings today are equipped with an aging infrastructure of structured wiring, including copper-based Category Ethernet cabling. Higher-rated cables such as Category 6 and 6a provide gigabit networking and bandwidths of up to 10Gbps (gigabits per second) with distance limitations as short as 180 feet. Yet no matter how advanced Category cabling becomes at transmitting video, voice, and data, it is limited by its copper core and the distance you can send those signals.

The new HDMI 2.1 standard required for transmitting high-definition video will have the capacity of up to 48Gbps, enough to handle Ultra High Definition uncompressed 4K and 8K video. Uncompressed 4K video can take up to 18Gbps already beyond the capabilities of category copper while 8K video will up the ante to 48Gbps. The demands on our networking infrastructures increase daily, in some cases hourly, and HDMI copper cabling is good for only short distances that will become limited to distances as short as 15 feet with this new specification.

Bottom line: Category Ethernet cable and HDMI are simply not capable of supporting the burgeoning needs of high-definition and Ultra High Definition video, audio, networking, security, and Internet of Everything devices without problems like slow transmission speeds that simply aren't tolerated in today's fast-paced, always-connected world.

### SPEED IS EVERYTHING

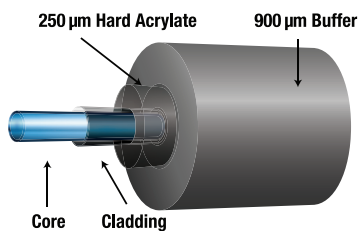
Network speed is a feature that many now won't live without—and with good reason. The world runs on high speed. If you're not on an advanced high-speed network, you're behind

the second your workday begins—and even before that. “Everything we’re seeing in our lives is about speed. We want the higher-resolution TV and more data going down the network,” says Cleerline Technology Group managing partner Rick Sant.

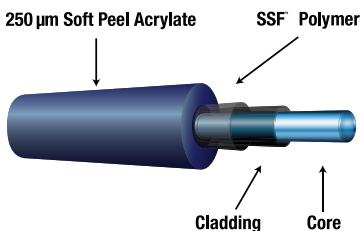
The only cabling infrastructure that can address both today’s and tomorrow’s ever-increasing high-speed, high-bandwidth needs is fiber-optic cabling, which contains glass strands that transmit data in light—at the speed of light and with virtually unlimited bandwidth.

In 2017, an estimated 280 million kilometers of fiber-optic cabling were sold around the world. That’s nearly a trillion feet of fiber. Fiber optics are now the de facto standard for connecting the world—not just through undersea cables and fiber-to-the-curb and fiber-to-premises services, but also inside commercial buildings where networks must be as robust and even more nimble than exterior wiring to transmit our vast amounts of data, voice, and video with reliability and ease.

“We’re at the intersection of the changeover from copper to light,” says Sant. “Today’s 4K video demands and data network requirements are driving this, and we’re seeing all of this convergence. Integrators are realizing we can’t avoid this any longer.”



## Traditional Fiber



## SSF™ Fiber

### THE CLEAR CASE FOR FIBER

Dan Sano and his IT staff at the Westgate Las Vegas Hotel knew their facility needed a fiber-optic network upgrade to route video and data to all their video monitors and the roadside marquee, in addition to supporting the needs of the conference center, parking facilities, security and surveillance, and the corporate network.

Sano had been discussing a fiber-optic network upgrade with local electronics integration company Advantage Electric. “The Westgate was due for a big network upgrade. We had a lot of long-distance runs that fiber was better suited to, so we decided to upgrade for everyone,” says Sano, including security and corporate. Sano is Westgate Resorts’ senior IT operations manager for its western region.

“The biggest factor [in moving to fiber-optic cabling] is the distance,” says Evan Zucker, Advantage Electric’s low-voltage director and senior on-site technician. “You have to have less than 330 feet to run Category 6.” For many commercial buildings, a fiber-optic infrastructure solves the issue of moving data and video long distances. The Westgate property has cabling runs extending thousands of feet.

At the Westgate, Zucker and his crew from Advantage Electric ran miles of fiber-optic cabling, in a combination of 48-strand fiber. Ninety percent of this was in multimode, which is better for shorter distances. The conference center and the marquee are fed by 48 strands in single-mode, which yields better results with long-distance cable runs. The marquee needs about 20 strands, Zucker explains, so the extra strands allow it to swap to a redundant infrastructure if necessary. Some of the runs to the parking garages and lots run over 1,000 feet. That’s not unusual in larger buildings, institutions, and campuses.

You have to ask yourself: Why is your network not on fiber?

Don't forget another truism of data transmissions of any kind: "Speed is hampered by distance," Sant says. This is especially true in the case of Category Ethernet cabling. "One piece of glass can transmit so much more than Category cable which has simply reached its limits."

### **A CLEAR BUSINESS CASE**

#### ***With Fiber You're an Odds-On Champ***

Fiber-optic cabling isn't just for large facilities like the 3,000-room Westgate in Las Vegas. A 100-room hotel has video displays and networking needs and often a roadside sign as well. Other facilities—including medical, manufacturing, and many other sectors—have high-bandwidth needs as well. Remember the Internet of Everything, and 4K then 8K video?

If you're in business—almost any business today—you have high-bandwidth issues to address. To address these increasing needs, Advantage Electric is, for example, pulling fiber to video displays for directional signage for many of its clients, using \$15 HDMI connectors. While many of these facilities are presently transmitting only on Full HD 1080p video, they're set up.

Cleerline's Robert D'Addario points to a fiber-optic solution installed in one of his company's own buildings. D'Addario & Co.'s own IT staff technicians did the terminations to 130 desktops, saving thousands in initial installation costs.

At the Westgate in Las Vegas, the convenience of Cleerline's fiber-optic cabling was a bottom-line deal-breaker as well. "If it wasn't for their ability to terminate fiber in the field, the project would have run much longer," says Dan Sano, Westgate Resorts' senior IT operations manager, western region.

The Westgate isn't saying how much it saved, but a huge Las Vegas hotel and casino surely know the books. Cleerline's SSF fiber has turned out to be a very good bet. Sano reports no issues with the new Cleerline fiber-optic AV infrastructure. Do you think a Vegas casino, with one of the world's largest sportsbook screens, would wager on something like this if the numbers didn't play in their favor?

We have all of these new video technologies and the Internet of Everything, and yet many of us are still sending data around on glorified telephone wire evolved from decades ago—wire that simply can't handle the speed, distance, or demands of the times. Copper is finite. Not light.

### **NOT ALL FIBER IS THE SAME**

Some IT directors and commercial building consultants are reluctant to change their business models to include fiber-optic cabling. They're comfortable doing what they know with Category cabling, and they want any infrastructure they put in to be bulletproof. In addition, many IT staffs feel hampered by having to call certified technicians to perform new fiber terminations and connections.



## GO ON A FIBER DIET

Can't afford to rewire an entire building for fiber all at once? Start a backbone network to cover your floors and numerous points, then run wireless or wired Ethernet along branches the rest of the way. Individual workstations and other end points don't generally require fiber to the device—yet.

Build onto this fiber backbone later, and plan to upgrade from Full HD 1080p to 4K video, as the Mob Museum in Las Vegas is doing. The Westgate Las Vegas Resort may do other fiber-optic infrastructure work in the future, as business demands.

“As IT moves toward the future, we're no longer in the business of defining what's going on the

network,” says Westgate's Sano. “It's not just a data platform. It's how our operations use it, how our customers and guests use it.”

In other words, your network has to be robust and nimble enough to respond to business demands as they arise.

### WHAT'S YOUR ROI?

The ROI with fiber is going to be different for every business. It's up to each business to determine what they're going to invest in their AV and data transport systems. With fiber, you can realize savings during installation and payback in years—knowing your network is capable of handling and transporting data for the

next decade or longer.

If you want to compete in the world today, the choice is clear: It's fiber or bust.

Businesses don't have to worry any longer about fiber being too fragile, too difficult to work with, and too expensive to terminate in the field. Cleerline's SSF fiber-optic cabling is sturdy enough to be pulled through conduits and, after some brief training, it's also easy to terminate in the field.

The calculus is simple: Those who make the investment in advanced fiber optics will prosper at the speed of light. Those who don't ... won't.

The former drawbacks of working with traditional fiber-optic cabling have been resolved by advanced manufacturing techniques that make the fiber-optic glass highly durable, bendable, and easy and safe to work with. In addition, fiber-optic cabling is not susceptible to interference from other signals—while unshielded Category cabling is.

Not all fiber-optic cabling is the same, which means that not all of it is difficult to work with, and not all of it requires the extra expense of licensed technicians to terminate the cables in the field. In fact, it can be easy to work with and pull and terminate, with very minimal training.

### A MORE DURABLE FIBER

Cleerline's SSF fiber—Stronger, Safer, and Faster—can be bent down to as little as 2.2mm radius. That would be a death crimp for any Category cabling, most of which can be bent only from about 60mm to 90mm. Other fiber, too, is susceptible to fractures when bent to extremes.

Cleerline SSF fiber has up to 10,000 times the bend capacity and up to nine times greater pull tension than Ethernet and other fiber-optic cables, shattering the assumption that fiber-optic cable is too fragile to be durable.

In tests of pull-tension, repeat bending, and elongation, Cleerline's fiber-optic cabling was found to be 200 times more durable under duress. The cable can withstand up to 225 pounds short term and 120 pounds of sustained tension, versus the 25

## FIBER MADE EASY

### MULTIMODE VS. SINGLE-MODE

Simply put, “single-mode” is generally used for long distances. Most internal fiber networks run in “multimode.”

### EASY CONNECTIONS

Consider universal SFP (small form-factor pluggable) ports on network switches in use today. SFPs convert fiber-optic light to digital data, and they can be bought in 1Gbps to 10Gbps or 25Gbps units, says Sant. The connections are easy as well. (See ‘Easy Terminations’ sidebar.) Baluns are also available to send uncompressed 4K video.

### TREAT IT LIKE CATEGORY CABLE

“A lot of the way you manage your information is similar. Buy patch cords at shorter lengths up to 10 meters and make your cables at longer lengths,” advises Cleerline’s Rick Sant.

### LOCK THE FIBER INTO THE CONNECTOR

Don’t place fiber where it can be hit by a door opening, advises Ryan Markus, director of technology for the Mob Museum in Las Vegas.

### USE A GOOD CLEAVER

Cleavers are used in the field to “score and break” the fiber-optic glass at the proper point and dispose of the discarded glass safely. Some cleavers may need to be adjusted to cleave Cleerline’s more durable SSF cabling.

### CHOOSE THE RIGHT CONNECTOR

The two most common connectors in the United States are LC- and SC-type connectors. LC, which is predominantly used for network-related devices, has a smaller form factor. ST type connectors are less common. Find out which connector is appropriate for your installation needs.

pounds a Category 6 cable can withstand. In another stress test that submerged the glass fiber in water heated to 90 degrees Celsius and bent it at 3.0mm between two metal plates, traditional 125-micron glass broke within 100 to 1,000 seconds, while Cleerline’s SSF fiber lasted 10,000 to 100,000 seconds. Cleerline’s SSF fiber therefore has a 31-year life expectancy at a 2.2mm bend radius—which is beyond the most extreme circumstances.

### EASY TERMINATIONS

Traditional fiber-optic cabling can be difficult to work with, as the cabling must be precisely cleaved and this process exposes strands of glass that can puncture human tissue. The special polymer coating on the SSF fiber ensures safety from glass punctures, and the cable can be cleaved and terminated in the field in seconds by any technician who has watched a short YouTube video. According to the company, this saves up to 80 percent in labor costs.

Think of the SSF coating like the coating on a car windshield or smartphone glass, which ensures that one rock chip doesn’t cause a crack. Because the integral polymer is part of the glass fiber, it helps prevent fracturing of the glass fiber.

One test with union-certified technicians showed that preparation and connecting times using Cleerline’s SSF cabling were 33 percent to 150 percent faster. Once cut, the outer coating of the fiber can be stripped by a finger or fingernail to prepare for cleaving and termination, and the technicians in this test quickly adopted this simple procedure. “The biggest selling point is that every single technician who can terminate Category cable can terminate SSF fiber,” says D’Addario. ■

### ABOUT THE AUTHOR

*Steven Castle has been writing about emerging technologies for 25 years. He is an award-winning writer, editor, and storyteller who also specializes in the luxury market, high-performance home systems, green technology, and healthy building. His website is [www.stevencastle.com](http://www.stevencastle.com).*

