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Keep it Clean

Could 'dirty power' be causing you computer problems?

By Drew Robb

When people think of preventing data loss due to power supply problems, they typically consider an uninterruptible power supply (UPS) or a surge suppressor. Recent studies by Bell Laboratories, however, indicate that less that 4 percent of power-related problems would be addressed by such devices. Thus even networks and computer systems that are well protected by UPS and surge protectors are at serious risk.

Studying the problem

Downtime causes millions of dollars in damage annually to computer networks around the globe. In many cases, people attempting to troubleshoot the cause of downtime waste hours addressing the wrong problem. They blame the software, the network, viruses, spyware, and a host of other causes. Sometimes they are correct. Often, however, they are correcting the wrong problem. Power-related issues, it turns out, are frequently the cause of time-outs, unexplained downtime and other commonplace system or networking glitches.

Recent studies by Bell Labs and IBM agreed that around 80 to 90 percent of the time, electronic equipment is being affected by tiny surges as opposed to lightning flashes or blackouts. To make matters worse, these little spikes wreak havoc in the form of logic confusion, system errors, and frozen screens.

"Everyone has had their computer lock up on them," says Anthony Loguidice, assistant vice president of service for Sharp Electronics of Canada Ltd. "If there's spikes and surges on the line it can cause quality issues and a lot of odd problems."

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The reason this situation has remained largely under the radar screen perhaps lies in the fact that there are actually two distinct types of spikes and surges. Most people protect themselves against one (occurring in what is known as normal mode) but fail to pay any attention to the other (occurring in common mode).

Most electrical wiring inside any building has three wires: Two wires that carry the power are called hot and neutral; and a third typically green wire which is for safety and a logic reference point called the ground. Normal-mode power noise occurs between the hot wire and the neutral wire, causing damage to power supplies, PC board blowouts, and other catastrophic issues. Common-mode noise, on the other hand, occurs between the hot or neutral wire and the ground wire, causing logic confusion, data loss, system errors, blue screens, or mysterious service calls that end without an actual problem being located.

Relating this back to the two studies above, blackouts and large surges account for less than 5 percent of all power problems and happen in normal mode. As these events are catastrophic, most people who have experienced one tend to deploy protection technology to guard against further normal mode hazards. Yet, 80 to 90 percent of all problems actually happen in common mode. While these events are usually not disastrous, they generate all kinds of mischief, consume end-user time, result in data loss, and generate a torrent of help-desk traffic.

Why? Microprocessors normally work with 5 volts DC (some of the newer models work with 2.7 volts DC, which makes them even more sensitive to small power anomalies). In effect, they act as high-speed switches being turned on and off millions of times per second. The off-state (zero volts) equates to the binary "0" and the on state (5 volts) equates to "1." This gives you the foundation of the binary language by which computing functions.

"Any spike greater than 1 volt confuses the logic-the microprocessor being read as a 1 rather than a 0," says Bahram Mechanic, CEO of SmartPower Systems Inc. of Houston, Tex., a maker of power protection and conditioning equipment.. "The result is screen lock-ups, timeouts, or delays."

But in this day and age, surely electrical wiring is such a precise science that such issues are minimized,

right? Not so. Apart from the fact that the power coming in from the average utility is dirty-way below the level of stability required to safely run electronic equipment-many big cities suffer from decidedly poor wiring.

Protection options

What should be done, then, to better protect computer systems and networks? Let's take a look at the pros and cons of the various options available on the market.

Surge protectors, or surge suppressors, are devices that protect equipment from excessive voltage (spikes and power surges) in the power line. They divert power from the incoming hot line to the neutral and/or ground wires. Alternatively, they can absorb the energy within the unit. Surge protectors are relatively inexpensive and offer excellent protection against catastrophic high-voltage spikes in normal mode. However, they fail to handle the relatively small over and under-voltages that occur in Common Mode which momentarily disrupt computer networks. As large scale Normal Mode surges account for only about 2 percent of all power problems, they are an incomplete solution.

An uninterruptible power supply (UPS) is a backup power supply used when the main electrical feed has failed or drops to an unacceptable voltage level. Small UPS systems provide battery power for a few minutes. This gives IT enough time to power down critical servers without suffering data loss - otherwise anything stored in RAM is lost during a blackout. More sophisticated systems are tied to electrical generators so power is available for several days. UPS systems can also include a surge suppressor.

UPS should clearly be part of any power protection strategy. But it has to be understood that blackouts make up around one percent of power quality situations. Even if you include large sags, you are still leaving over 80 percent of the power quality concerns untouched.

Isolation transformers (also known as line conditioners) have gained popularity in recent years. A transformer changes one voltage to another and is made from two coils of wire close to each other (or wrapped around an metal core). Power is fed into one coil to create a magnetic field. The magnetic field

causes current to flow in the other coil. An isolation transformer uses this technology to prevent current from flowing directly from one side of a circuit to the other. These devices are an excellent way to filter out Normal Mode voltage spikes (down to less than 10 volts) and Common Mode spikes (down to less than 0.5 volts). On the downside, they are heavier and more expensive than more modern alternatives - costing about $1000 for a unit with adequate server protection.

Recent technological advancements in the field of power conditioning have now yielded devices that provide "computer grade" power at the same price as limited-function surge protectors and a fraction of the price, weight and size of isolation transformers. Known as transformer based filtering (TBF) devices, the latest circuits include transistors, thyristors, capacitors, and relays to handle power conditioning duties in tandem with a small transformer. This intelligent digital circuitry provides greater functionality than a traditional line conditioner/isolation transformer.

TBF units provide basic protection against massive spikes up to 6000 volts as well as small Common Mode spikes and surges. In addition, they constantly monitor the line power. If voltage goes too high for more than 5 cycles (80 milliseconds), for instance, the motherboard could blow out. The TBF cuts the power off to prevent damage to the machine.

Further, new TBF technology can identify miswired outlets. If a ground wire is loose, or the polarity between neutral and hot is reversed, the device will not let the power reach the protected machine. Prolonged over-voltage protection (POVP) is another feature built in to the device. The loss of the neutral wire, for example, can lead the voltage to increase to the 160 to 200 volt range for an extended period of time.

A TBF unit disconnects the output to keep mission-critical systems safe. SmartPower Systems' TBF, for example, compresses all this functionality into a 17-ounce package the size of handheld cassette tape recorder.

Blackouts and line sags make it essential to protect servers, workstations and networking gear from electrical harm. UPS and surge suppressors offer safeguards against catastrophic events such as

burned-out motherboards, and keep computers operating at least long enough to prevent data loss.

But these methods are not enough in a dirty-power environment as they fail to address power enemy number one-low voltage spikes. That's why isolation transformers or TBF units can help cleanse the power coming along the utility line and take care of other low voltage factors.

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