Post-Modern Power Anxiety:
Designing powered telecom cabinets for a new era

By George Thompson

Those who thought the North American power blackout in August of 2003[1] was a fluke likely changed their minds when much of Greece suffered a similar fate right before this year's Summer Olympics. In fact, power outages are the norm, not the exception. Last year, 80 percent of small businesses experienced at least one electrical power outage.[2] Of those, nearly 30 percent went without power for over eight hours, and one in five suffered in the dark for more than 16 hours. How various telecommunication companies weather the inevitable depends largely upon how well they've planned around and protected their equipment.

What's at stake?

The media traditionally gloms onto images of city dwellers trapped by heat, sleeping on sidewalks, and generally unable to go about their daily lives, which have become inexorably enmeshed with the steady hum of electricity. But physical comfort (or rather, discomfort) is only one facet of ubiquitous power. The reliability of electricity has thrust progress throughout the modern world into hyper speed.

T.V., radio, cell phones, cable, computers—just how much critical information at any given second is hurtling through copper and fiberoptic cable, over air and under ground, by way of wires or waves? As a benchmark, know that in the whole history of mankind science has managed to produce 12 exabytes of data. An extabyte is 1,000,000,000,000,000,000 bytes, or one billion gigabytes. Need a frame of reference? Just one exabyte can hold the same amount of data contained within 50,000 times the volume of the U.S. Library of Congress.

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1. U.S.-Canada Power System Outage Task Force Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations. "On August 14, 2003, large portions of the Midwest and Northeast United States and Ontario, Canada, experienced an electric power blackout. The outage affected an area with an estimated 50 million people and 61,800 megawatts (MW) of electric load in the states of Ohio, Michigan, Pennsylvania, New York, Vermont, Massachusetts, Connecticut, New Jersey and the Canadian province of Ontario. The blackout began a few minutes after 4:00 pm Eastern Daylight Time (16:00 EDT), and power was not restored for 4 days in some parts of the United States. Parts of Ontario suffered rolling blackouts for more than a week before full power was restored. Estimates of total costs in the United States range between $4 billion and $10 billion (U.S. dollars)." Id. at 1.
2. The 2004 Small Business Power Poll is an independent survey of more than 400 U.S. small businesses. It was conducted online in January 2004 by Decision Analyst Inc., and commissioned by Emerson. The sampling error associated with this research is no more than plus or minus five percentage points.

And in the next two and a half years the world will produce another 12 exabytes of data, most of it digital.[3]

Imagine what is lost in one minute of downtime. Information technology grows exponentially, each piece begetting the next two pieces, and with every new advance, the stakes get higher. Accordingly, our marriage to the power that drives that information is an irrevocable commitment.

Time equals money

"The power that is offered through the utility grid is only 99.9 percent reliable, which means during the year you have nine hours of down time in any form," said Farah Saeed, who studies power supply solutions for the San Antonio-based market research firm Frost & Sullivan.

The loss of revenue, data, and customer goodwill from even a moment's interruption is immense, making reliable backup power an imperative.

Consider that a cell phone company charges 10 cents for each minute of use. Suppose that this service provider happens to have 1,000 customers accessing calls from a specific tower. During peak hours, the power goes out, but only for a minute. If only half of those customers unsuccessfully tried to use their handsets or became disconnected, the company would still lose $50 in billable minutes. But now suppose that half of those 500 customers were over the maximum time allotted on their plans, so their rates increase to 50 cents a minute. Now you have $125 lost for the latter group, and $25 for the former, equaling a total loss of $150 in billable minutes. But what if a regional power failure occurs and 100 cell sites go down—for just a minute? The company will lose $15,000 during the next 60 seconds. The August 14, 2003 blackout left 50 million people without electricity, up to four days in some parts.

Of course, because of the nature of their build-outs, wireline telecom providers traditionally fair better than their wireless counterparts when power goes down. Nevertheless, following the 2003 blackout, a report was authored by leading experts throughout the telecommunications sector.[4] The panel determined that one of the five key

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3. From the "How Much Information?" project, a study produced by faculty and students at the School of Information Management and Systems at the University of California at Berkeley. http://www.sims.berkeley.edu/research/projects/how-much-info/summary.html.

4. Entitled, "Review of Power Blackout on Telecom," presented by P.J. Aduskeicz, NRSC; Kathryn Condello, CTIA; and Capt. Katharine Burton, NCS/NCC. The report can be found at

areas for improving best practices in the industry was "assessing risk for need to enhancing back-up power at cell towers, cable networks, and CLECs." Furthermore, the same report analyzed power related outage data gathered by the Network Reliability and Interoperability Council from January through July of 2003 and found that back-up generator failure, failed equipment power supplies, and configuration of uninterruptible power supplies were leading causes for wireline downtime.[5]

Give the people what they want

Based on tribal knowledge—and common sense—we know that what matters most to the customers of wireless, wireline, and cable providers is the delivery of services. Network uptime is mission-critical from the end user's point of view. While a company can insure itself against damaged equipment, it can't obtain coverage for lost customers.

Tamra Burgwardt, president of TJB Telecom Consultants, Inc., says the number one customer demand is "reliability." "The basics apply here: reliability, consistency, and meeting needs," she noted. "Many customers happily pay a premium for products and services if the features and services they are seeking are met to their satisfaction better. If it were only about price, there would be only one supplier per industry since customers would only buy from the supplier with the lowest price. There are many more issues than price when customers seek new suppliers."

Protect your equipment

A $200,000 wireless radio warrants more than a ventilated rain catcher around it. Historically, original equipment manufacturers of radios (OEMs) built cabinets as simple "product housing." The equipment inside was key, the protection for it secondary. With the downturn in the market, OEMs were forced to shift their energies back to what they do best and abandoned their cabinetry products. This opened the market for innovation, with each equipment enclosure manufacturer topping their competitors' latest technology. Now it's a buyer's market. Enterprises are no longer forced to rely on OEMs; there are specialty cabinetry products being built by firms who are eager to support and protect would-be customers' networks from the elements.

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http://www.nric.org/meetings/docs/meeting_20030915/NRIC_Combined_Power_Outage_Brief_ver2_15-SEP-03.ppt Review of Power Blackout on Telecom P. J. Aduskevicz, NRSC Kathryn Condello, CTIA Capt. Katharine Burton, NCS/NCC

5. Id.

Apart from internal temperature control, reduced footprint, and easy on-site installation, cabinetry solutions also must ensure that the equipment is up, running and generating services—today, this minute, this instant and the next. "Downtime could last five seconds or so but would have an immense effect on your equipment," added Saeed."[6] Thus, power lies at the crux of any consideration.

Power is king

Having a reliable support structure in place is as important for telecommunications equipment as it is for companies. The equipment housed in outdoor enclosures, protected from the elements, climate controlled, surge protected, backup powered, and constantly monitored is the most vital service component. As service providers address heavy competition with new technologies and services, more equipment is deployed to deliver them, and more support power demanded with each potential power outage. Power is the bloodstream of every network—a flow which cannot be interrupted. Surge suppressors and power protection systems can now regulate spikes and fluctuations, and power equipment can effectively route backup power when required, but there's more needed than just batteries and power modules in a box.

Beyond providing surge suppression, backup power, an uninterruptible power supply system, and equipment housing, cabinets should be "smart." For example, some companies have developed software that allows for continuous power and equipment management. "Having the right power protection equipment is critical," stated Rob Woolner, president of a company that has designed such a software. "But in order to ensure the most effective protection and equipment maintenance, critical systems require monitoring and vigilant management to keep systems up and running smoothly. Advancements in power management software systems allow continuous monitoring of the state of the utility power, batteries, and power sources, together with the condition of the UPS's internal electronics, providing an enterprise-wide view of all key equipment."[7] Imagine being able to monitor and then correct potential trouble from your computer desk. A remote alarming system, in addition to notifying service providers when service

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6. From "Outages push small businesses to invest in backup power," by Joe Milicia, Associated Press; St. Louis Dispatch, April 24, 2004.
7. From "America's Network," August 3, 2004; http://www.americasnetwork.com/americasnetwork/article/articleDetail.jsp?id=109038.

is down, should also be able to determine and signal when a door has been opened or equipment altered.

"Additionally, when unexpected power outages extend beyond the limits of backup systems, software systems can permit a smooth shutdown of critical systems. UPS software can direct a selective, sequential shut-down of loads, so that the most critical functions receive the best protection," added Woolner.[8]

Designing a powered cabinet solution

With vanguard cabinetmakers having returned to Old World manufacturing—where the conveyor belt and assembly line have been replaced with the engineer's CAD station—service providers can and should expect individualized engineering. "Despite catering to individualized requirements and custom solutions, the turn around time can be fast," said Paul O'Brien, vice president of engineering with a leading manufacturer of integrated outside plant enclosures. O'Brien, who holds several patents for telecommunications equipment enclosures, explained, "This is what we do; we don't make radios, we don't make batteries, and we don't make cable. We build and outfit cabinets for individual customers' unique needs. We stay with our core competency."

Like a Swiss watchmaker who refuses to be seduced by the allure of fast money through cheap knockoffs, any cabinet manufacturer worth its cost is willing to work over an enclosure solution until it's deemed perfect for that customer. This isn't innovation for innovation's sake; it is a quest for improvement that legitimizes the expenditure in effort and engineering. So, when choosing an outdoor enclosure for telecommunication equipment, make sure the manufacturer is able to provide a tailored fit that can accommodate specified needs.

Ask about interoperability. Can the cabinet take various suppliers' parts and have them operating harmoniously together? Can they integrate any power equipment and have it operate seamlessly with the other cabinet functions like alarming, monitoring, and battery power? Can they integrate network equipment from multiple vendors ? Can the manufacturer design a solution to accommodate any power equipment, any electronics, and even future technologies? Different installers and repair service providers prefer different equipment brands. "Usually, the customer has already committed their build-out

8. Id.

budget to the purchase of certain brands. Our job is to draft a solution that will accept those parts and that can still be built and deployed into the field quickly," explained O'Brien. This is why, before approaching the cabinet manufacturer, it's a good idea for a telecommunication service provider to sketch out exactly what it needs and/or wants.

After power protection and interoperability comes modularity. Modularity should be the telco provider's mantra. Can the outdoor cabinetry be expanded to accommodate additional strings of backup batteries? What about deploying additional DLCs, fiber optic transport systems, or wireless radios for a growing service provider? Scrapping and rebuilding a site every time there's an upswing in business or need for upgrades can dig into profits. Along those lines, insist on enclosures that offer both front *and* rear access for easier installation and maintenance. Not surprisingly, one of the products to turn heads at the recent tradeshows was a modular wireline telco cabinet that boasts provisions for line termination, protection, and cross connections; front and rear access, a power module option equipped with load center, transfer switch, and—of course—a generator receptacle and surge protection. Most importantly, it could be expanded with modular components as needed by the service provider, minimizing initial costs.

Considerations should also include size; is the manufacturer willing to scale down a design to fit existing or limited lease spaces or easements? Is it flexible enough to be deployed on a pad, wall, H-frame, or pole-mounted site?

Spotting the phonies

But be wary of what can best be termed the Cubic Zirconium effect; there are plenty of mass producers imitating the new generation of artisan cabinet builders. The difference is beneath the surface, in the details. For instance on the wireless side, the cabinet may feature a radio frequency cabling management system with punch out holes for expansion, which would allow for the side-to-side placement of additional cabinets, but can the air conditioner or heat exchange system also be upgraded on-site if more equipment is added? What good is room for additional radios and batteries if the cabinet can't control the added heat in a similarly modular fashion?

Also many manufacturers brag that their cabinets are "Zone 4 Compliant." This must be differentiated from "Zone 4 Certified." Compliance is an empty promise; certification denotes the passage of extremely rigorous independent tests, proving that the

valuable equipment and components therein will be protected against the harshest earthquakes as defined in Telcordia's GR-487-Core standard: Generic Requirements for Electronic Equipment Cabinets.

Ultimately, these qualities are captured within what are referred to as the "NEBS" certification. The rigorous Network Equipment Building Systems criteria have become a universal measure of network product excellence. Originally developed by Bell Telephone Laboratories in the 1970s and expanded by Bellcore in 1985, NEBS covers a large range of requirements including criteria for personnel safety, protection of property, and operational continuity. The Bellcore documents cover both physical requirements including space planning, temperature, humidity, fire, earthquake, vibration, transportation, acoustical, air quality and illumination; and electrical criteria including electrostatic discharge (ESD), electromagnetic interference (EMI), lightning and AC power fault, steady state power induction, corrosion, DC potential difference, electrical safety and bonding and grounding.

Power is the air we breathe, and it isn't until it fails that we realize just how tenuous our hold over it really is. Telecommunication service providers today can take simple steps at the onset of the design process to ensure their equipment is protected and their network is running 24/7 when the inevitable happens. Business depends upon it, and customers count on it.

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