White Paper

Power and Its Connection to Network Reliability

ALPHA TECHNOLOGIES

[Power]

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Reliability continues to be the driving force in communication system design. Industry changes, as well as heightened customer expectations, have had a significant impact on communication service providers' deployment plans – in some instances greatly accelerating and in other cases completely changing the direction of those plans.

These issues are especially relevant in the high-growth wireless market, where the rapid rate of network deployment is a key, strategic initiative.

Because of the criticality of the powering component of the delivery network, and its close connection to overall system reliability, powering has become a common topic of network planning. The active elements that form the communications network share a common need for clean, reliable, uninterrupted power. Without power, these components simply do not function.

Utility deregulation, widespread overloading of transmission grids, and reduced capital investment, are all conditions contributing to the declining quality of unprotected utility power. As a result, power interruptions, brownouts, and other damaging power anomalies are becoming more common. Direct, unprotected use of utility power can produce costly network component damage, data stream degradation and/or loss, as well as a wide array of unscheduled, and unwelcomed, system maintenance issues.

Today's communication service customer cares little whether a power anomaly is caused by a voltage or current spike due to lightning, a transient harmonic brought on by utility switching, or a sag resulting from increased single-point utility demand. It simply doesn't matter to the consumer if the problems can be traced to the utility provider, the environment, or the end-users themselves. What does matter to the consumer, however, is the reliability of their service.

The result is interrupted service to the customer caused by what may have been a very brief and very avoidable power disturbance to the outside plant. The service provider may get a nasty call from an angry customer – or worse yet – may never hear about the problem and simply lose the customer altogether. With this in mind, the responsibility of establishing a reliable source of clean, uninterrupted power shifts from the utility to the service provider – who in turn looks to network power experts for solutions.

Communication Powering Trends

Within the communication industry, power protection plays a critical role. The link between reliable power and overall system reliability has already been discussed. Several powering trends, however, are worthy of mention.

More Power: As traditional voice, video and/or data carriers work to "bundle" communication services, power requirements for a given network increase. This increase is usually discussed on a "per subscriber" basis. For example, a network providing basic voice or video service only, may have had a historical network power requirement of 2-3 watts per subscriber. As a result of adding services, however, the network power requirement may climb to 6-8 watts or more per subscriber. This need for additional power requires increasing (in some cases more than doubling) network power density.

At the same time, other factors have quite a different affect on network design. In some of the more recent wireless applications, for example, the trend is toward the deployment of a greater number of smaller cell sites and repeater stations. These sites cover smaller geographic areas, but are deployed in significantly greater numbers, providing enhanced coverage for cellular, PCS and other wireless communication services. Although the net power requirement has increased, it is dispersed or distributed throughout the overall outside plant. If the power system supports one of these smaller applications, it must be cost-effective enough to match the budgetary requirements of a greater number of sites, while maintaining the needed level of reliability.

Extended Backup Time: Another recognizable trend in outside plant communication powering is the need for extended backup time. Some power installations, because of their strategic importance or vulnerability to utility outages, will require extended backup time capabilities.

Leading power system providers have designed power systems with the ability to fully integrate either internal or remotely located engine generators. These backup generators, which run on natural gas or propane, can be deployed in addition to battery backup – providing additional system reliability during extended utility outages.

Delayed starting circuitry in these generator systems allows the batteries to provide backup power for short outages and the integrated generator to be brought fully on-line for extended outages. This feature optimizes both battery life and system reliability.

Recent advances in generator system design have allowed these engine-generators to be effectively placed in the outside plant, supplying one or more power supplies with extended backup power. Designed specifically for communication network applications, these generator systems provide the appropriate output power levels, include fully integrated status monitoring and significantly reduced audible noise levels over standard generator offerings.

The Need for Uninterruptible, UPS-Grade Power

The sophistication of today's communication networks makes UPS-grade power a necessity. Before the days of expanded video, digital signal and the integration of other more "fragile" services such as telephony and internet access, delivery systems could accommodate the transfer time typical of standby power systems of that era. With the advent of sophisticated wireless services, however, the issue of reliable, true UPS-grade power has never been more important.

In recent years it has become very clear that even brief interruptions in power can have serious consequences on digital transmission traffic such as data, internet access and life-line telephony services. Today, UPS-grade power systems with backup power capabilities are a baseline requirement for communication networks.

As discussed, the backup power component of these systems has been dramatically improved, incorporating fully integrated engine-generators, dual power grid switching, advanced status monitoring and enhanced battery management. Such improvements provide much longer backup runtime in the event of extended utility power outages, enhanced battery life and reduced maintenance requirements – all contributing to improvements in the overall reliability of the network.

Supporting Incremental Growth

The power component of the networks must meet the changing needs of the system. For example, if the initial deployment supports limited service but includes the addition of enhanced services at a later date, the "scalability" of the power system is critical.

Scalability is a key ingredient to formulating an effective powering design – especially in an environment of rapidly evolving network technologies and architectures. The power system's flexibility should support efficient operation with a present network, while allowing the powering component of the system to grow incrementally with the addition of expanded services and increased subscriber penetration.

The power system should incorporate a "growth path" that allows it to grow as the system grows. By providing a clear upgrade path, power system purchased today are protected against premature obsolescence, and provide a planned path to add power and functionality as the delivery network develops.

Power system flexibility, however, should not be limited to power rating alone. An effective powering solution will also allow the service provider to configure a number of other features to meet the specific needs of the build. Flexibility and choice are essential. Enclosure size, configuration, mounting options (ground, pole, and underground), status monitoring and enhanced reliability options should all be specific to the particular needs of the application.

Appropriate Battery Selection

The critical importance of appropriate battery selection and maintenance – and their associated costs – cannot be overemphasized. Regardless of the powering topology, batteries provide the first-line defense to utility power failures, and ensure that system actives receive the necessary and appropriate power.

Too often, service providers falsely consider battery selection a "non-critical" decision, sometimes making cost or other non-performance issues the primary criteria. Gel cell batteries, designed specifically for outside plant communication applications, have been shown to provide the longest life and most reliable performance – as well as the safest application.

Maintenance Considerations

Network maintenance is an important consideration when evaluating different power systems. Even seemingly small reductions in required maintenance activity on a per-unit basis can translate into very significant dollars that can be reallocated to additional infrastructure or value-added, revenue-generating services.

Properly designed power systems can help reduce these maintenance costs. Hot swappable, modular components make replacement, repair and upgrades more cost-effective and limit disruption to the system. The ability to remove and replace these power system components without interrupting power or reducing the backup capability is a very important maintenance consideration.

Conclusion & Summary

Outside plant communication power system requirements are unique. The operating environment is harsh and the performance requirements are high.

In light of recent and on-going industry developments, clean, quality power is needed with more reliability than ever before. Where analog technology once tolerated momentary power service interruptions, the complex, vulnerable digital stream is much more susceptible to power interruptions of any length.

Knowing the demanding characteristics of these delivery networks is essential to properly evaluating proposed OSP powering solutions.

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