



# CASE STUDY

HOW PRECISION TIME PROTOCOL SAVED A DATA CENTER FROM  
FREQUENT POWER LOSSES



## **THE CUSTOMER**

For over 20 years, a data center in the southwestern United States has supported clients in more than 40 countries, delivering a comprehensive range of IT services — from colocation and disaster recovery to network solutions and cloud computing. Yet, despite their commitment to reliability, they faced persistent power failures that disrupted their services, challenged their ability to meet clients' Service Level Agreements, and created additional and significant difficulties for their clients.

With four electrical equipment rooms and thousands of feet of cable powering the data center's operations, pinpointing the root cause of these frequent outages proved to be almost impossible. Each incident — whether triggered by an electrical anomaly, a brief power loss, an overloaded circuit, or a complete outage — came at a high cost to both their clients and the data center itself. Circuit breakers sometimes malfunctioned, UPS systems occasionally failed to engage, and a variety of internal and external factors threatened the stability of the data center's electrical distribution system. Without a precise, real-time record of events, investigating and resolving the source of each power failure was both frustrating and time-consuming... leaving the data center manager and operations team searching for a more effective solution.

Recognizing the urgent need to resolve these recurring power failures, the data center sought a solution that would provide clear, actionable insights into every electrical event across their facility. They needed a way to quickly identify the root cause of each incident and prevent future disruptions. Trusting Trystar's expertise in power monitoring and event recording technology, the data center partnered with Trystar to gain real-time visibility into its electrical power system and restore their clients' confidence in the data center's ability to deliver uninterrupted service. After a comprehensive assessment of the data center's electrical infrastructure, Trystar recommended a custom-tailored solution which integrated Sequence of Events Recorders (SER's) with Precision Time Protocol (PTP) synchronization.

## **THE CHALLENGE**

As Trystar began implementing a Sequence of Events Recorder (SER) system to synchronize the clocks of all Intelligent Electronic Devices (IED's) and precisely monitor the status of every circuit breaker, the team quickly encountered significant challenges within the data center's electrical infrastructure... including keeping a consistent time synched to all connected devices.

The first obstacle emerged with the master clock — a critical component which delivers an accurate time source to all connected devices. Trystar discovered that the time signal's voltage was 80% lower than required, undermining the reliability of synchronization efforts. To resolve this, the data center installed a solid-state relay to boost the signal to the necessary voltage. Unfortunately, this effort introduced excessive electrical noise, further degrading the signal quality.

A second major challenge involved the physical layout of the data center. The electrical rooms were separated by considerable distances, with several cable runs extending over 2,000 feet. This layout made it extremely difficult to maintain a consistent and reliable time signal across all areas of the data center, complicating the efforts to achieve precise, facility-wide synchronization.

## **THE SOLUTION**

To resolve the issue of an unreliable time source, Trystar recommended its STR-100 Satellite Time Reference to function as the new “master clock”. The STR-100 leverages advanced GPS technology to deliver highly accurate time and date signals, ensuring precise synchronization across all power system devices. By providing the required voltage directly to all connected devices, the STR-100 eliminated the need for a relay, which in turn removed the electrical noise that had previously degraded the signal quality.

The STR-100 is a microprocessor-based device that accepts GPS time signals from a smart antenna or receiver and outputs synchronization signals using DCF77, 1per10, or IRIG-B protocols. This flexibility allowed the synchronization of up to 32 devices, with an accuracy of  $\pm 50$  microseconds... providing new confidence in the reliability of the critical data center environment.

With the time source issue resolved, Trystar then proposed how to eliminate intermittent time synchronization from the STR-100 to all downstream devices. The complexity of the wiring scheme connecting devices across the four electrical rooms, the intricate layout, and the long cable runs posed a significant challenge... but Trystar recommended implementing Precision Time Protocol (PTP) for time synchronization. Defined by IEEE 1588, PTP is native to the design of the Trystar Sequence of Events Recorders and enables devices to synchronize over Ethernet with sub-microsecond accuracy. This approach eliminated the need for dedicated wiring between SER's, switchgear, and separate electrical rooms.



### **What is PTP Protocol?**

**Precision Time Protocol (PTP) is a network protocol used to synchronize clocks throughout a computer network with high precision, achieving accuracy within sub-microseconds. It is particularly useful in applications requiring precise timing.**

Since the data center's 30-plus Sequence of Events Recorders were to be integrated into an Ethernet network, leveraging PTP allowed the existing Ethernet infrastructure to distribute precise timing signals to every SER. This approach would not only simplify the system design architecture, but also ensure reliable, high-precision synchronization across all critical equipment, regardless of physical distance within the data center.

Additionally, Trystar recommended that power meters and all other IED's, be connected directly to the Sequence of Events Recorders using Trystar's "PTP Legacy Interface (PLX)" modules, rather than routing connections through the terminal blocks of the original wiring scheme. This final step would eliminate the need for thousands of feet of two-conductor cable previously used to transmit the time signal... therefore, significantly streamlining the wiring layout and reducing the overall complexity of the data center's electrical infrastructure.

## THE RESULTS

The data center accepted Trystar's proposed solution. Once the upgrade was complete, the entire electrical network was synchronized and has enabled the data center personnel to have system-level views of all the inputs... and most-importantly be able to quickly determine the source of any future power anomalies or failures. The SER's, the STR-100, and the PTP time synchronization continue to provide the required data to determine where and precisely when any faults occur in the data center's complex electrical system.

### KEY OUTCOME

**'Stable power... eliminating outages while adding the ability to test, troubleshoot and view more precise data on all connected devices.'**