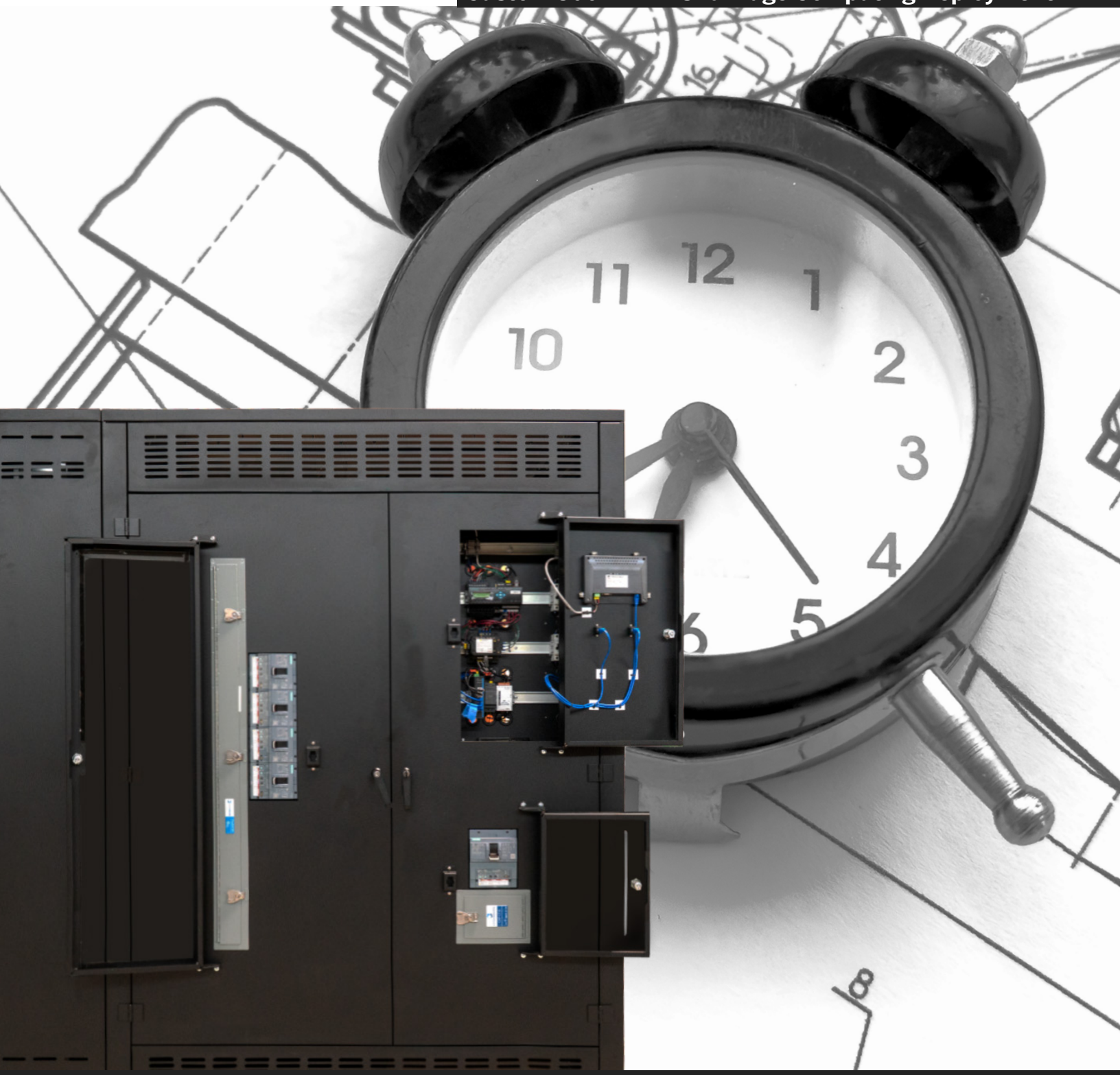
VOLTZ
POWER DISTRIBUTION PRODUCTS
by Raptor Power

Case Study: Engineering Against the Clock

Custom 300kVA PDU for **Edge Computing Deployment**



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In the high-stakes world of edge computing **infrastructure**, **speed**, **precision**, and **adaptability**

A Top 3 U.S. telecom provider approached our team with a critical and highly constrained request: design, engineer, fabricate, test, and deliver a fully custom 300kVA Power Distribution Unit (PDU) in under 10 weeks – a timeline less than one-quarter of the industry standard.

This project involved the creation of a non-standard enclosure, the integration of four 400A panel boards, and the development of specialized metering software that could unify multiple protocols into a single, streamlined user interface. It was a first-time engagement with the client and retrofit scenario, replacing an outdated unit in a critical edge computing deployment.

Despite a compressed timeline and a set of highly specialized requirements, we not only delivered on time but exceeded expectations. The unit was delivered fully ETL listed, successfully integrated on-site, and is now serving as the baseline design for a forthcoming larger deployment from the client.

I. The Client and the Challenge

A leading U.S. telecom provider – Ranked among the top three nationally – Was expanding its edge computing infrastructure. In this case, the need was for a retrofit replacement PDU at one of its edge facilities. The legacy system had aged out and lacked the flexibility and monitoring capabilities required by today's operational and IT standards.

The request was unlike anything we had built before, and the client's specification demanded a full custom design:

- A non-standard enclosure footprint
- The integration of (4) 400A Schneider Electric NF panel boards.
- Unified metering software capable of combining multiple vendor protocols into a single interface with full visualization and data capture.

What made this even more challenging was the lead time: 8-10 weeks from start to finish. By industry standards, this is essentially a moonshot. Custom PDUs with this level of sophistication normally require 8 to 12 months to design, certify, and build. On top of that, we needed to secure an ETL listing to UL 62368-1 for a design that didn't yet exist on paper.

It was a test of our design control process, in-house engineering capability, fabrication speed, and overall ability to deliver under pressure. And with it being our first engagement with the client, the stakes were extraordinaryly high.

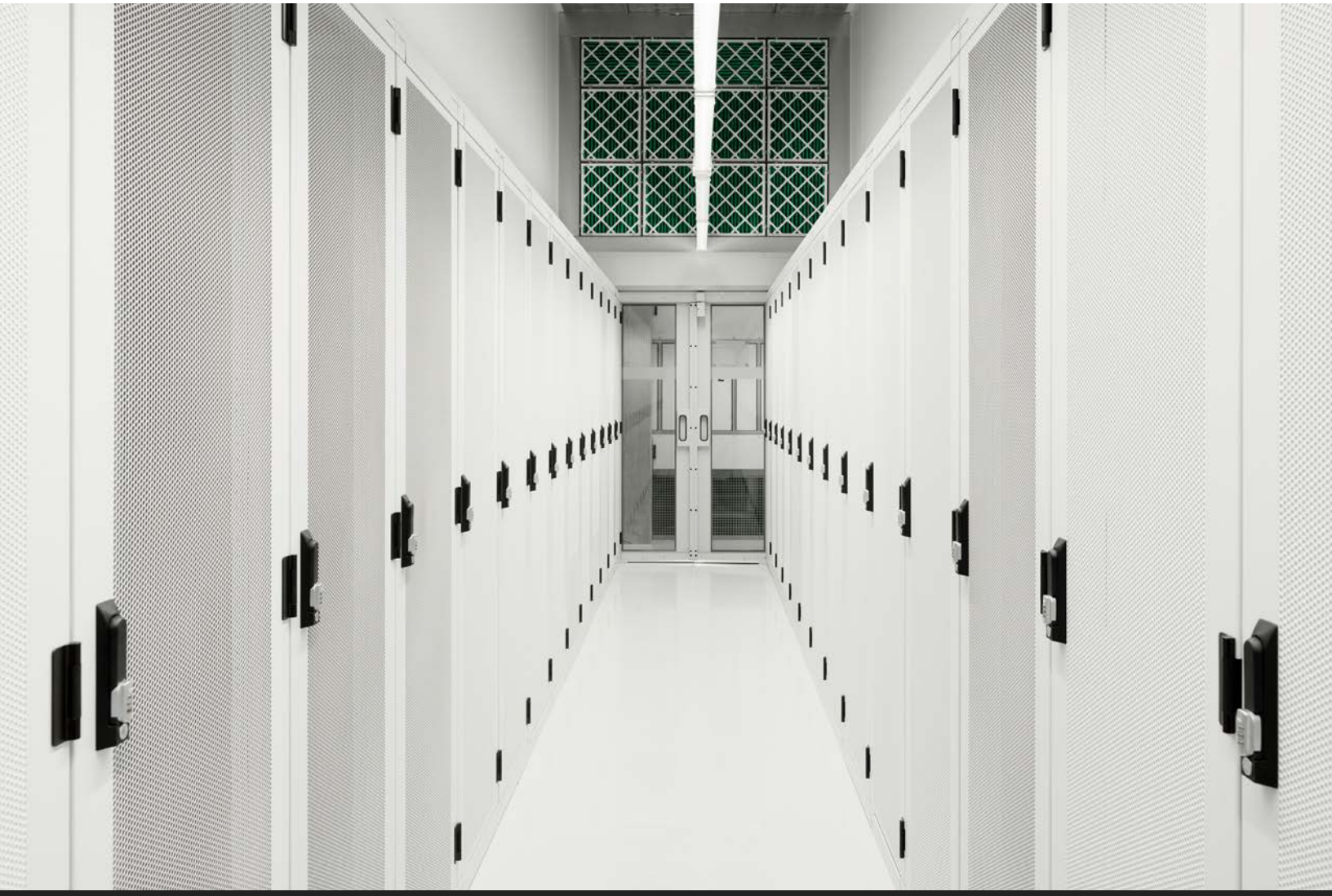
II. Use Case: Edge Computing, Retrofit Environment

The deployment was intended for an edge computing site - an environment where latency, uptime, and space efficiency are mission-critical.

Unlike hyperscale data centers, edge sites are compact and housed in tight mechanical spaces, which adds significant constraints to equipment design.

Because this was a retrofit application, we had to work within an existing physical envelope and electrical service configuration.

The client needed the unit to drop into place with minimal rework of site infrastructure while still delivering a dramatically upgraded feature set.



III. Engineering a Custom Solution on an 8-Week Timeline

1. ENCLOSURE DESIGN

The custom enclosure was one of the first major hurdles. The required footprint - 88″ high by 60″ wide by 48″ deep - demanded a full ground-up design effort. No existing product in our library came close to matching the required layout or performance profile.
This design had to meet or exceed several key standards:

- **UL 62368-1:** Ensuring safety for information and communication technology equipment.
- **ISO 9001:** Full design control documentation and traceability.
- **NEMA standards:** For mechanical protection and environmental sealing.
- **Internal requirements:** including bus access, serviceability, airflow, and thermal dissipation.

Because of the aggressive schedule, we bypassed the typical iterative design process. Instead we deployed SolidWorks for full 3D modeling, backed by AutoCAD Electrical for circuit and layout planning. Every part, down to the final mounting screws, was digitally modeled and validated.The completed design was submitted to fabrication within days of initial concept approval - something only possible due to our tightly integrated design and manufacturing workflow.

2. PANEL BOARD INTEGRATION

The PDU needed to support (4) 400A Schneider Electric NF panel boards, providing ample branch circuit distribution capacity for downstream IT and mechanical loads. This configuration presented several challenges:

Bussing constraints: We had to route conductors and bus bars compactly within the enclosure while maintaining clearances for safety and cooling.

IR scanning access: Panel terminations had to remain visible and accessible for periodic thermographic inspection.

Serviceability: Technicians needed the ability to access breakers, metering tap-offs, and cable terminations without full unit shutdown.

III. Engineering a Custom Solution on an 8-Week Timeline

The engineering solution involved a layered internal architecture, where bus runs were staggered vertically with clear thermal and service zones. This design proved so effective that the bussing techniques used have since been adopted in several ongoing custom projects.

3. THERMAL CONVECTION DESIGN

Thermal performance was a serious concern. The combination of a 300kVA transformer, tight internal spacing, and four high-capacity panel boards created the potential for hot spots and thermal imbalance. Instead of relying on forced-air cooling—which adds noise, failure points, and maintenance—we designed a passive, convection-cooled enclosure.

Key strategies included:

Venting: The design incorporated double the venting required by UL standards, strategically placed to promote natural convection paths.

Thermal modeling: We ran simulation models using specialized software to verify airflow behavior and component surface temperatures.

Compartmentalization: Heat-generating components were isolated in compartments to avoid localized hotspots.

IV. Custom Metering & Unified Software Interface

SYSTEM iNTEGRATION

The client required full visibility into energy use, real-time metrics, and waveform diagnostics—all through a single Ethernet drop and IP address. This meant aggregating multiple meter types, each using different communication protocols (Modbus and BACnet), into a unified software environment.

Voltz Connect HMI Platform

Our proprietary in-house system, **Voltz Connect**, was selected as the backbone of the interface. This platform was specifically engineered to:

- Normalize data streams from multiple third-party meters
- Provide real-time visualization via a 7” HMI touchscreen.
- Log trend data for power quality analysis
- Capture ITIC waveforms and log alarm events

Developed internally, Voltz Connect gave us the control needed to build a custom interface quickly, without reliance on external software vendors or integrators.

Network Simplicity

Despite the complexity behind the scenes, the final system required only one Ethernet drop and a single IP address to the client’s upstream SCADA or BMS. This simplicity was crucial for fast field deployment and alignment with the client’s cybersecurity requirements.

V. Certification Process Under Pressure

Achieving ETL listing under UL 62368-1 is no trivial matter, especially for a new design.

This process typically takes 6–8 weeks on its own, and we had less than that from design to shipment. To make it happen, we:

- Completed full documentation packages in parallel with the design effort
- Scheduled early engagement with our NRTL partner
- Delivered a working sample for evaluation days after fabrication

The test results exceeded expectations. The unit passed without incident, and the NRTL noted that thermal performance was well within acceptable ranges—affirming the success of our passive cooling design. Network Simplicity

VI. Project Outcome

The unit shipped on time, fully tested, and field-ready.
Upon delivery and commissioning, the client reported:

- Seamless integration into the existing electrical infrastructure
- Immediate visibility into real-time power metrics
- No issues with installation, metering, or commissioning
- Outstanding satisfaction with both design quality and project execution

The client is now preparing a significantly larger follow-on project based on the success of this deployment.

Internally, we've reused the advanced bussing layouts and some of the software control logic in other custom projects—making this unit not just a one-off success, but a catalyst for broader design innovation.

VII. Key Takeaways

- **Design Control Matters:** A tightly controlled design process—guided by ISO 9001 discipline—was key to delivering a first-time-right product.Immediate visibility into real-time power metrics

- **Engineering Flexibility Wins:** Our ability to accommodate mechanical, thermal, and software challenges in-house allowed for an unmatched turnaround time.

- **Software Integration Is Now Table Stakes:**
  Metering and monitoring aren't optional anymore. Our proprietary Voltz Connect platform provided a competitive advantage that helped seal the deal.

- **Speed Is Possible—With the Right Team:** While most in the industry view custom PDU lead times in months, we proved it can be done in weeks, with zero compromise on safety, performance, or quality.

Conclusion

This project stands as a testament to what's possible when expertise, urgency, and engineering excellence intersect. In under 10 weeks, our team delivered a **fully custom**, **fully certified**, **high-performance PDU** that is now helping power one of the most demanding edge environments in the **Telecom industry**.

For clients looking to push the boundaries of speed, customization, and control—this case shows exactly what's possible.

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