GREAT LAKES CASE & CABINET

Invest in Solid Engineering

SUCCESSFUL SOLUTIONS

DATA CENTER EVOLUTION AND EXPANSION

In 2011, a Fortune 500 insurance company was prompted to reconsider its data center performance and operations after very noticeable airflow problems were identified by employees. Great Lakes Case & Cabinet Inc. was contracted to provide a comprehensive evaluation of the data center. After numerous site visits, the operational capabilities of the data center were captured in a proposal that included a computational fluid dynamics (CFD) analysis to establish baseline standards against which potential future improvements would be measured.

The data center in its original state **(Fig A)** was comprised of three areas: the server farm, the network core, and SAN equipment. Recommendations from the data center proposal were implemented in three phases, with modifications and reorganization taking place in each area of the data center. After initial completion of all three phases, upgrades continue to be made in each area of the data center, with a focus on security and airflow management to accommodate increased density.

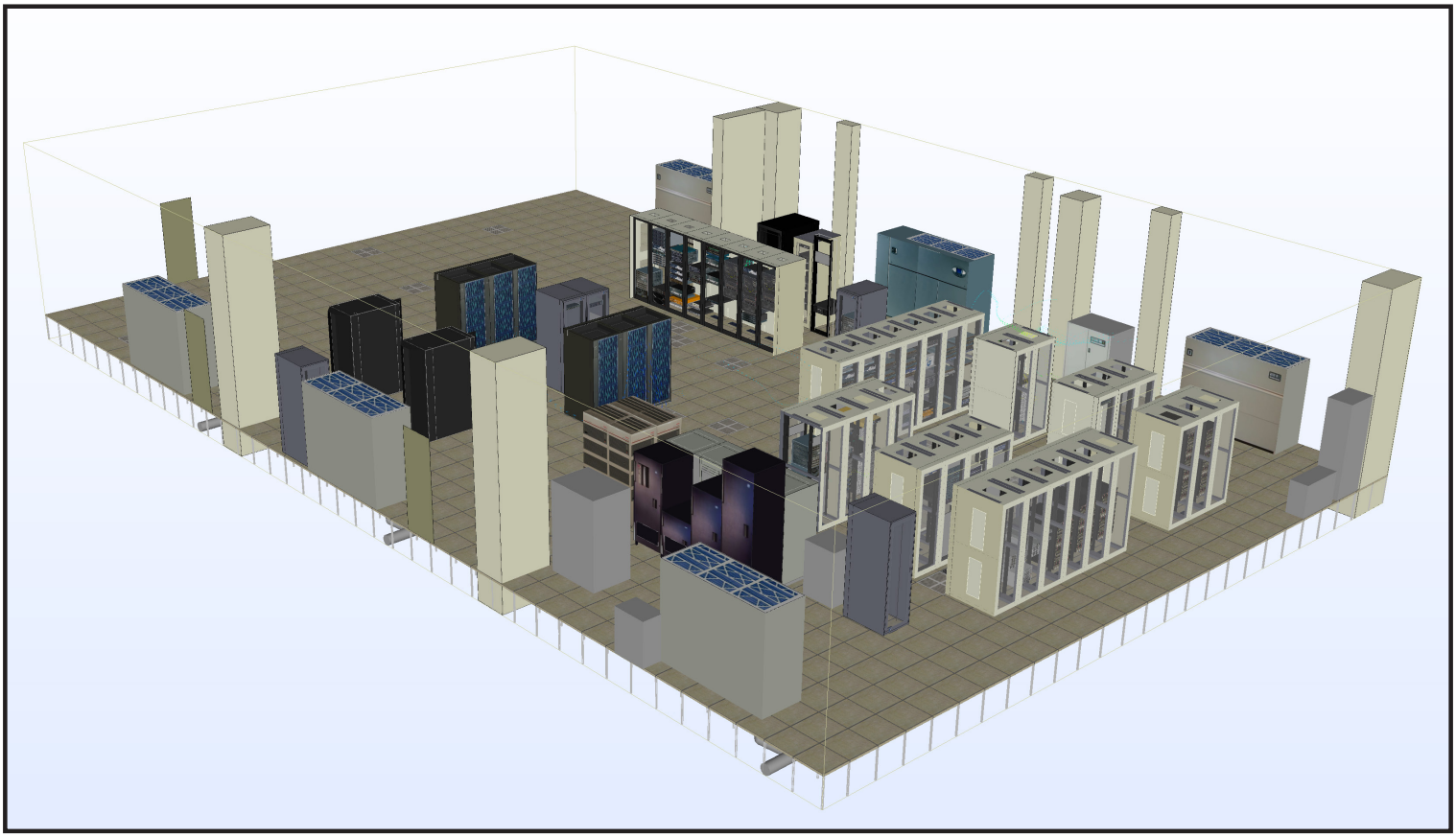

Fig. A: *Data center in its original state.*

PHASE 1: SERVER FARM

The server farm held the most enclosures with equipment, and this was where substantial temperature differentials could physically be noticed. Unfinished rows and open rack spaces inside the enclosures within the server farm increased the potential of hot air recirculation and conditioned air bypass in the data center **(Fig. B)**. Enclosure best practices were implemented in Company Z enclosures: filler panels were installed in empty RMU, brush grommet was installed along the front mounting rails, and Koldlok® floor grommets sealed floor cutouts while still allowing cable pass through. Great Lakes ES and EN enclosures were deployed alongside the existing enclosures to create complete rows so that a successful cold aisle containment strategy could be implemented **(Fig. C & D)**.

[1] Company Z references existing data center enclosures from a different manufacturer

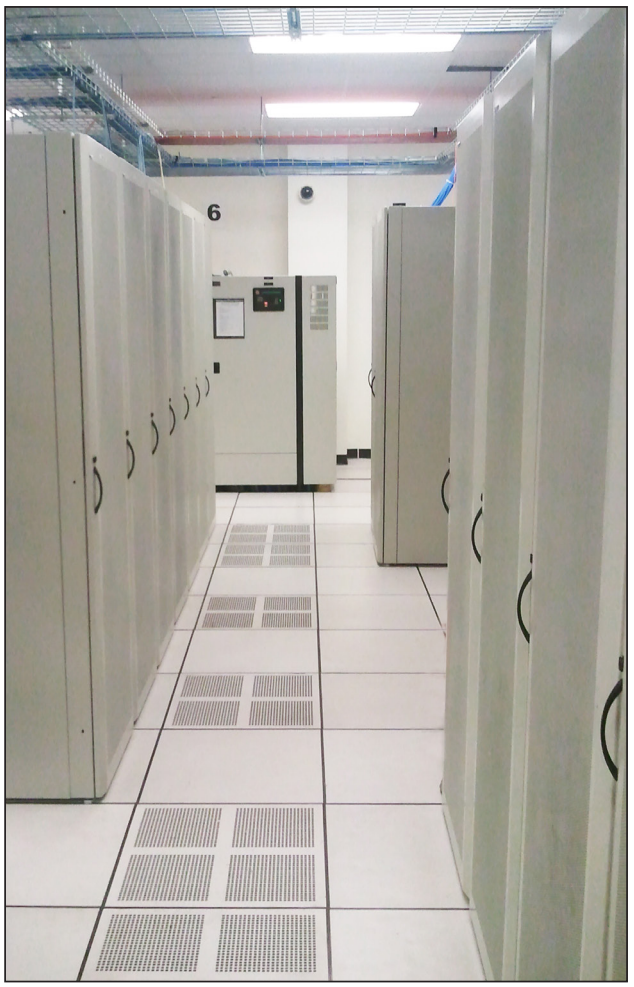

Fig. B: *Unfinished rows in the original server farm*

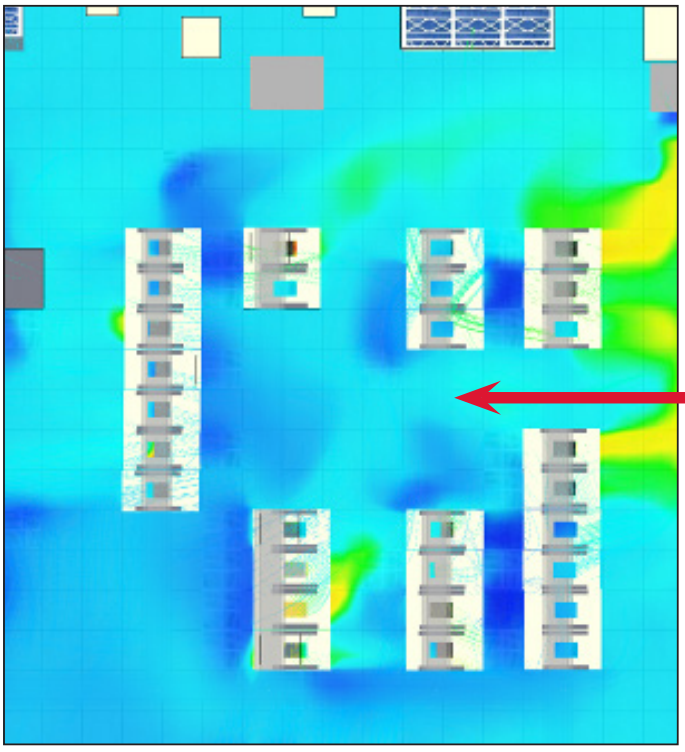

Fig. C: *Unfinished rows with open rack spaces*

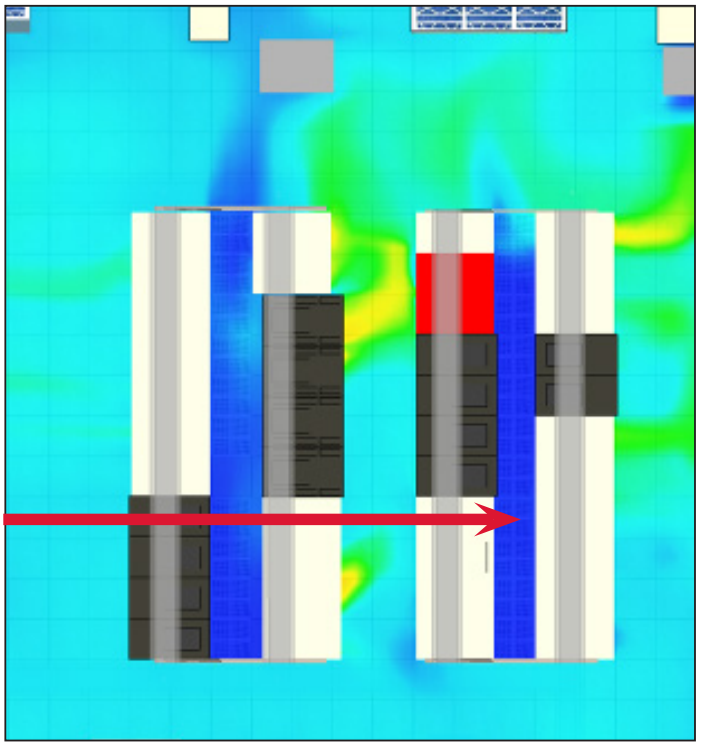

Fig. D: *Additional enclosures to complete rows and segregate hot and conditioned air; CFD comparison shows a 10.9°F difference*

Floor tiles from other areas of the data center were migrated to the now complete rows so that conditioned air could be delivered to all enclosures in the server farm **(Fig. E)**. Once enclosures and tiles were in place, custom Great Lakes aisle containment doors enclosed the row ends so that two cold aisles were created **(Fig. F)**. Due to the height difference between Company Z and Great Lakes enclosures, a support bar was designed to create a level surface so that overhead containment panels could properly be mounted across the aisle **(Fig. G)**.

Fig. E: *Cold aisle containment implemented with single aisle doors, overhead containment panels, and a mixture of standard perforated floor tiles and high flow tiles*

Fig. F: *Custom support bar to create a level surface so overhead containment panels could properly be mounted*

ENCLOSURES ALREADY INSTALLED IN THE DATA CENTER

GREAT LAKES ENCLOSURES

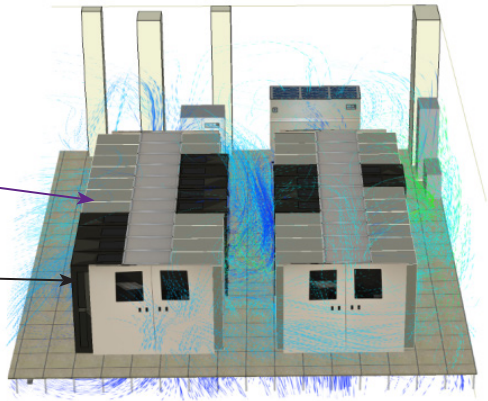

Fig. G: *GL enclosures deployed alongside Company Z enclosures; notice the handles and height difference of Company Z enclosures on the left*

PHASE 2: SAN EQUIPMENT

Company Z enclosures as well as multiple third party storage racks were located in several places throughout the data center. Again, many of the enclosures held only a few pieces of SAN equipment. Two Cisco Catalyst 6509-E core switches, which feature side-to-side airflow, were moved from Company Z enclosures to 30"W GL enclosures so that the equipment airflow could be properly accommodated. 30"W enclosures accept baffle kits that direct cool air into the right of the switch and channel exhaust out the left of the switch and into the rear of the enclosure.

Remaining third party storage racks were moved to the far left side of the data center and were oriented parallel to the server farm. Floor space was left between the enclosures so as technology and data center topology evolve, old racks could be removed and replaced with current models. Aislelok® adjustable gap panels were installed between racks to create a “complete” row; panels magnetically attach to the side of one enclosure and a retractable material stretches across the area between two racks **(Fig. H)**. Aislelok® rack top baffles were also magnetically attached to the top of racks and containment curtains were placed at each end of the row to isolate conditioned air **(Fig. I)**. The ease of installation and adjustability of the products installed in the area allow flexibility in a space that is constantly changing.

Fig. H: *Aislelok adjustable gap panels used to fill the gap between enclosures*

Fig. I: *SAN Equipment aisle with Aislelok top panels installed on enclosures and end of row containment curtains*

PHASE 3: NETWORK CORE

The original network core consisted of eight enclosures in a single row which were orientated perpendicular to the server farm **(Fig. J)**. A new cold aisle pod of Great Lakes ES enclosures and existing mainframe enclosures were deployed parallel to the server farm. This new pod consisted of six Great Lakes ES enclosures in a row, with the opposite row containing three ES enclosures and three mainframe enclosures that had previously been scattered throughout the data center. Aislelok® adjustable gap panels sealed the open area between the mainframe enclosures and the ES enclosures; mainframe enclosures would be replaced in the future, so this space also needed to be flexible to accommodate upgrades.

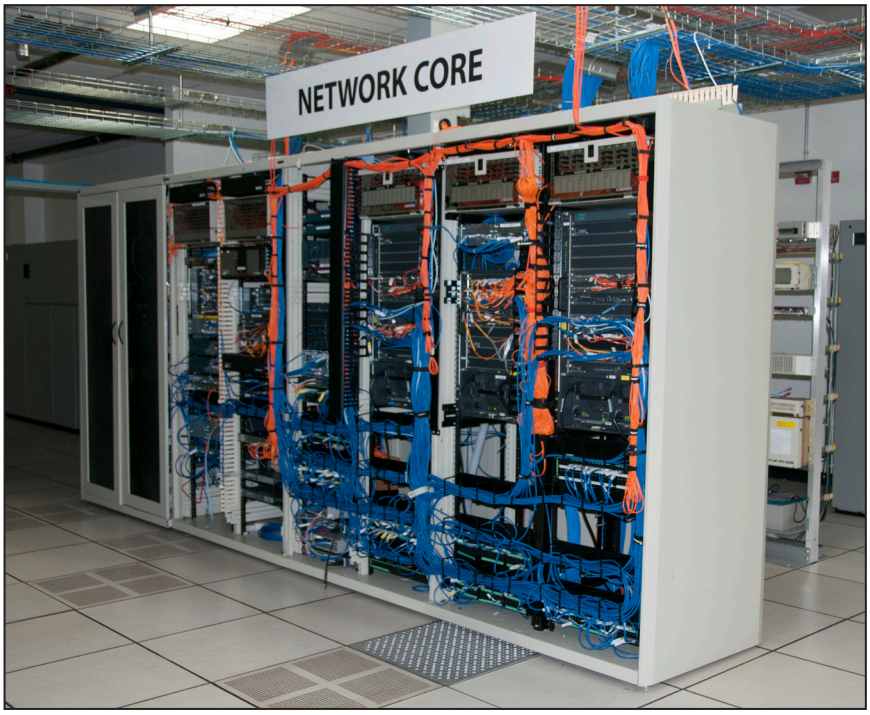

Fig. J: *Original network core*

Fig. K: *New network core; aisle doors removed for maintenance purposes*

Company Z network core enclosures remained in their original position, but as daily company operations allowed, pieces of equipment migrated to Great Lakes ES enclosures with attached external cable managers (or side cars) that allowed for improved cable infrastructure. Equipment continues to migrate from Company Z enclosures and once all enclosures are empty, they will be removed from the data center. The cold aisle created with Great Lakes and mainframe enclosures was enclosed with aisle doors and overhead containment panels will be implemented in the future **(Fig. K)**.

MODIFICATIONS AFTER REORGANIZATION

Phase one through three consisted primarily of modifying the enclosure layout in the data center and implementing airflow strategies to improve the life of mounted equipment and increase energy efficiency within the data center. Upgrades to the data center continue to be made to support current and future operational needs.

BIOMETRIC ACCESS

Great Lakes enclosures in the server farm consisted of locking swing handles while Company Z enclosures featured a simple pull handle. In order to maintain compliance with regulatory law, the risk assessment group of the insurance company proposed the use of biometric handles on all enclosures in the server farm. The handles on Great Lakes enclosures could easily be swapped for biometric handles, which utilize an industry standard handle cutout; however, Company Z enclosures did not have a cutout of any sort. Great Lakes developed a custom door frame to mount on the front and rear of Company Z enclosures so that Great Lakes doors could be hung. Not only could the biometric handles be installed, but each enclosure featured a Great Lakes “profile” which gave the row an aesthetically pleasing look **(Fig. L)**.

During handle installation, high flow floor tiles in the server farm aisles were replaced with standard perforated floor tiles to evenly distribute conditioned air to all enclosures **(Fig. M)**.

Fig. L: *Server Farm aisle with standard perforated floor tiles; all enclosures outfitted with GL doors and biometric handles*

Fig. M: *Server Farm outfitted with Great Lakes doors and biometric handles*

ENCLOSURE EXTENSIONS

In order to collect information on data center performance, active equipment in the server farm needed to be monitored through intelligent PDUs and environmental sensors. PDUs were installed in Great Lakes ES enclosures, which feature dedicated space in the rear to accommodate button mounting of PDUs. Due to space constraints of Company Z enclosures, PDUs could not initially be installed. Great Lakes developed an extension to mount on the back of the enclosure so that PDUs and cable bundles in the rear of the enclosure could be properly managed **(Fig. N)**.

Fig. N: *Rear of server farm enclosure with PDUs and cable management*

DATA CENTER SEGREGATION

An additional layer of security for the SAN equipment was requested by the company's management team. Due to the location of the equipment in the data center, it was easy to develop a "wall" composed of steel support beams, rigid mesh panels, and a sliding door to segregate the equipment from the rest of the data center **(Fig. O)**. Currently, the door is secured with an electromagnetic handle and panic button **(Fig. P)**. The electromagnetic handle will soon be replaced with a biometric handle which features two factor authentication (biometric and RFID). These same handles will also be installed on server farm enclosures—all of which will be linked to the company card access system and monitored by the company

Fig. O: *Enclosed SAN equipment area*

Fig. P: *Electromagnetic handle and panic button*

CFD ANALYSIS

As the company and data center continue to improve, potential modifications and upgrades that effect data center airflow are evaluated through additional CFD reports provided by Great Lakes. Reports have been able to portray many scenarios, including eliminating a CRAC unit, modifying existing containment products, and even how moving a piece of rack mount equipment affects airflow within the enclosure. CFD reports have also been completed to provide recommendations on the company's disaster recover site and branch offices throughout the United States.

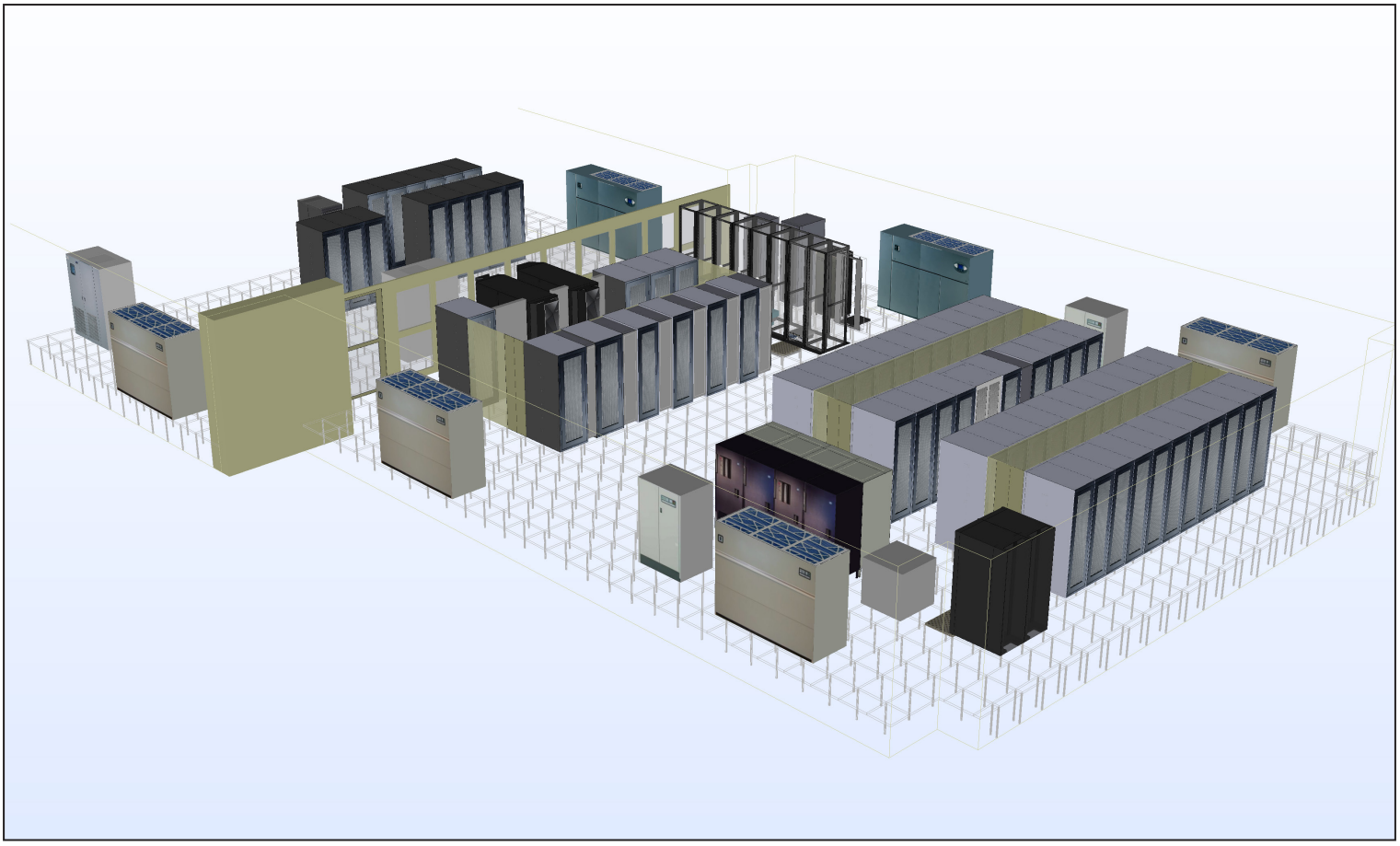

Fig. Q: *Data center in its current state*

CONTINUED GROWTH

The current state of the insurance data center **(Fig. Q)** can be viewed as an evolution of its own company growth, but also as a progression of Great Lakes products. The advancing needs of the customer—including security, cable management, and an efficient airflow strategy—have been met by improved Great Lakes products, many of which have been modified and retrofitted onsite. The relationship that Great Lakes has been able to develop with the customer has allowed the two to work closely together to develop specific, truly unique solutions for a single data center.