

Optimizing the modern data center with energy-efficient solutions

Chunghwa Telecom reduces power consumption of its data center cooling equipment by 30 percent with Intel® Datacenter Manager (Intel® DCM) and power thermal-aware solution (PTAS) technologies, improving overall data center operating efficiency



Established in Taipei in 1996 by the Ministry of Transportation and Communications, Chunghwa Telecom is Taiwan's leading telecom service provider, offering residential and business customers telecommunications and information-related services such as city and long-distance calls, GSM, data and satellite communication, Internet, broadband, intelligent network, and mobile data.

Challenges

- **Reduce power consumption and energy costs.** Raise power density of data center racks to meet business growth while reducing operational costs.
- **Adopt intelligent and efficient solutions to cool equipment.** Tailor data center cooling needs on a server/rack/row basis to reduce long-term energy usage.

Solutions

- **Deploy servers based on energy efficient Intel® Xeon® processor E5 family.** Optimize the data center to combine greater energy efficiency with business agility.
- **Adopt Intel® Datacenter Manager (Intel® DCM).** Enhance the power management system by dynamically managing the data center's cooling infrastructure with real-time energy usage monitoring.
- **Utilize Chunghwa Telecom's Intelligent Energy Network* (IEN*) service.** Combine power thermal-aware solution (PTAS) technologies from Intel with the iEN data center solution to decrease power usage while increasing operational efficiency.

Technology Results

- **Improved data center efficiency.** Real-time power and thermal monitoring and management improved dynamic workload placement and increased operational efficiency.

Business Value

- **Achieved up to 30 percent energy savings.** Decreased energy consumption by reducing overcooling, while achieving 1.52 in power usage effectiveness (PUE) to meet the LEED standard for green data center operation.
- **Increased reliability of data center operation.** Utilizing Intel platform telemetry data, metrics, and analytics solution enables real-time thermal and energy management for data center administrators.

With the rising demand for cloud services, businesses today require more compute capability from their data centers. It drives up long-term energy consumption and data center reliability issues if not managed effectively.

This is a challenge Chunghwa Telecom wanted to address when it embarked on a plan to develop a data center efficiency management platform. Chin-Chou Chen, director at Chunghwa Telecom, explains, "We had lots of power-saving devices, but we could not really control the real CPU power consumption. As a result, our data center suffered on efficiency and performance issues. Saving on power will not only ensure data center efficiency but will also allow us to continue with our commitment of going green."

Monitoring energy consumption with power benchmarking

Before Chunghwa could reduce its data center's energy consumption, it had to benchmark its power consumption to compare the power needed to run business-critical equipment with the power needed

to maintain that equipment. Using PUE and data center infrastructure efficiency (DCIE) as benchmarking standards, Chunghwa Telecom was able to measure its data center's power usage for actual computing functions. The company would need to operate at 1.5 PUE or lower to increase data center efficiency.

953,680 sqft.
cloud computing data center



1.52 PUE
Green data center operation

30%
Energy saving



100% RCI
Effective Rack Cooling

"Combining Intel® DCM and PTAS technologies with our power management solution allowed us to save on power consumption while optimizing the performance of our data center. This enabled us to continue with our goal of delivering exceptional telecom and information-related services while keeping our commitment to preserving the environment."

– Chin-Chou Chen,
Director,
Chunghwa Telecom



Intel® Xeon® processor E5 family-based servers, Intel® DCM and Chunghwa Telecom iEN* reduce data center energy consumption with real-time power management capabilities

Chunghwa Telecom deployed a server platform based on the Intel Xeon processor E5 family and built with PTAS technology, which could identify where power is lost by measuring PUE continuously throughout the day, including data from power distribution units (PDUs) and uninterruptible power supplies (UPSs). PTAS provides thermal indicators that allow the matching of cooling supply and demand inside the data center. Chunghwa Telecom was able to see inefficiencies at the rack level, and eventually address all of its data center efficiency needs. This solution enabled the company to reduce power consumption and related energy costs—in both operation and capital expenses—thereby extending the life of its data center.

Addressing downtime issues by cooling the data center

Rack Cooling Index* (RCI*) is a common monitoring metric to ensure the air temperature at the equipment intakes conform to recommended values. To reduce the power to cool its data centers, Chunghwa Telecom needed to achieve a RCI value of 100 percent consistently, to avoid any thermal damage to equipment or operational interruption. A real-time monitoring and control system was needed to optimize power and temperature at the rack and equipment level to avoid hot spots and overheating.

With integrated platform telemetry and analytics, Intel DCM and the Intel Xeon processor E5 family together enables server-level power monitoring. Intel DCM gathers PTAS-related information from monitored servers in the Chunghwa Telecom data center. Intel DCM sends this data in real time through an application programming interface (API) to the iEN-Box. If a server is running hot, the iEN-Box, through its controlling devices,

could increase the cooling of the server's rack, keeping RCI at 100 percent. The iEN-Box can also build thermal maps and efficiency metrics from data gathered from Intel DCM. As a result, Chunghwa Telecom could identify unused or idle servers for consolidation, avoid potential failures, and run the data center more efficiently.

Achieving efficient power consumption

After conducting a proof of concept on its 953,680-square-foot cloud computing data center, Chunghwa Telecom found the power consumption of its data center cooling equipment reduced by up to 30 percent, improving overall data center operating efficiency.

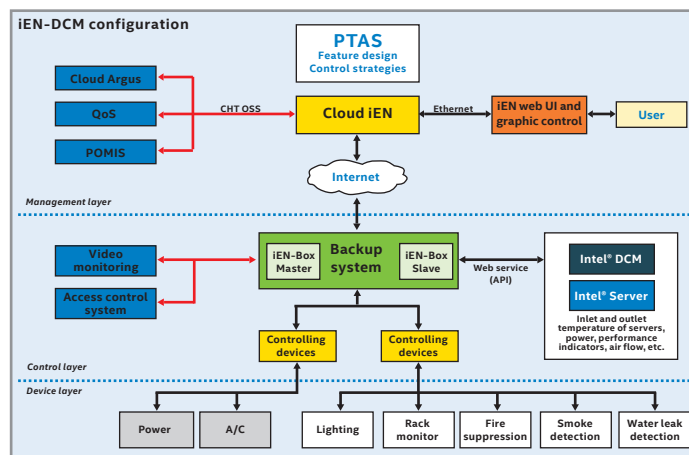
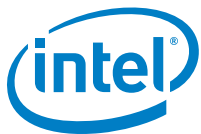
Chunghwa Telecom's next step is to show the feasibility of integrating real-time server data with a building energy management system (BEMS) to manage cooling infrastructure dynamically, and compare the performance of different cooling algorithms developed for computer room air-conditioning unit (CRAC/ACU) components. It also hopes to demonstrate the integration of compute data, measured using compute units per second (CUPS), with the iEN data center solution, and

Lessons Learned

- To lower data center power consumption, first identify the component in the data center that creates the biggest energy impact.
- Identify the scope of your data center energy-efficiency plan and initially go for a simple monitoring procedure to test-drive your data center management platform.
- Use Intel® technologies and know-how in data center efficiency management to optimize your data center according to power saving and performance needs.

use that data—along with thermal metrics—in balancing the compute load to correct thermal events in the data center.

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Proof of concept developed by Chunghwa Telecom and Intel to improve data center efficiency

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All performance tests were performed and are being reported by Chunghwa Telecom. Please contact Chunghwa Telecom for more information on any performance test reported here.

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