Internet Topics: Modular Eco-Data Center Proof-of-Concept Tests

IIJ currently operates 15 data centers nationwide as locations for installing the equipment for running our services and hosting customer IT systems. These data centers are housed in secure buildings featuring power and air conditioning systems with high capacity and high reliability for the stable operation of servers, storage, and routers. In the past, it was common for IT systems to be operated in environments like this with facilities that are more than sufficient. However, in recent years a new attitude towards the operation of IT systems has been gaining momentum. Behind this is a new perspective that calls for cost reductions and ecology for IT systems.

Beyond development and construction costs, data center usage fees and daily operating costs also account for a large percentage of the cost of IT systems. Reducing these costs is an important component in lowering the TCO (total cost of ownership) for IT systems as a whole. This trend is particularly evident for the recent hot topic of cloud computing. For cloud computing, there is no need for IT system users to be conscious of facilities such as data centers. However, data centers still play a crucial role as the infrastructure for supporting cloud computing. Software and server costs are reduced as services move to the cloud, so the relative cost ratio of data centers is mounting.

Due to a growing awareness of environmental problems at present, there is a need for IT systems to take ecology into consideration. Conventional data centers consumed large amounts of power for cooling systems, such as air conditioning to cool the high performance and high-heat-generating equipment. According to a survey conducted by "The Green Grid," an organization working to improve data center efficiency, close to 1.3 times the power consumed by server equipment is consumed by equipment such as air conditioning and lighting that is not directly related to IT systems. This demonstrates that of the power consumed at data centers, less that half is utilized for its primary purpose. If we can reduce the power used for non-primary elements such as these, we can make significant headway with regard to energy savings and the reduction of CO2 emissions. Additionally, reducing the power used by data centers lowers the maintenance costs associated with IT systems. More efficient power usage at data centers is needed from this point of view as well.

Given these circumstances, IIJ is working on the following two new technologies for next-generation data centers. The first is modular data center construction that enables additional equipment to be deployed quickly in response to an increase in demand. This is made possible by installing data center equipment inside a transportable container instead of the secure buildings that are currently used. Another technology is the introduction of an outside-air-cooling method for cooling IT equipment such as servers. Outside-air-cooling can be operated using far less electricity than existing forced cooling methods such as air conditioning, making it a trump card for energy savings.

However, to take advantage of the merits of these technologies, there is a need to rethink existing operating methods. Data centers constructed inside a container are more limited in the types of equipment that can be installed compared with conventional building-type data centers. Additionally, when a device fails it may be more efficient to simply exchange container units rather than repairing individual devices. The outside-air-cooling method conserves energy, but its cooling ability is affected by the climate and weather of the surrounding area. To use this technology in Japan, which has four seasons that bring dramatic changes, advanced control technology is required. These operating methods and technologies are not yet fully established anywhere in the world.

For this reason, IIJ is carrying out proof-of-concept tests to establish this technology and gain experience with it before beginning full-fledged construction of next-generation data centers. For these tests, we will be constructing an operational IT module (a container-based data center) with actual servers installed and a cooling module for taking in outside air, and operating them over an extended period of time. We plan to carry out tests over the period of a year, actually cooling with outside air throughout the four seasons and observing how much we can reduce power consumption, while building up knowledge regarding IT/cooling module designs that can stand up to real-world operation.

We have already built the equipment for these proof-of-concept tests, and we began operation from February 2010. We have gathered a variety of data since February, as the weather gets steadily warmer. We have identified a number of unexpected problems and design issues, and we are applying this feedback to our commercial equipment design. There is no doubt that these tests will play a significant role in establishing this new technology. In the next IIR volume we plan to report on the progress of these proof-of-concept tests and development towards a commercial service.

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