Green data center infrastructure in the cloud era

By Huang Wenxiong & Ye Lijun

Global IT spending is expected to reach USD1.6 trillion in 2011, a 5.7 percent increase from 2010, according to IDC. However, spending on cloud computing is growing at a much higher clip, with a thirty percent increase expected over the same period.

The cloud computing boom will require the building of a large number of Data Center (DC) equipment rooms, but these will be of a somewhat different order than those used before; their architecture will be more modular and external.

The industry is focused on building cloud computing equipment rooms that feature optimal application fulfillment, deployment suitability, and TCO.

Cloud equipment room construction challenges

High-capacity power distribution & cooling

Network architecture is evolving, while the performance of certain network elements (blade servers) is increasing rapidly; both trends have pushed power consumption per rack up from the two-to-three to the ten-to-forty kilowatt range. This poses infrastructural challenges in terms of both capacity and cooling that, if not addressed, will lead to equipment breakdown. Other cooling-related issues include ventilation difficulties, a lack of blind plating, and disordered cabling; all will reduce equipment efficiency and drive up power consumption.

Lowering operating costs

Operating costs are also trending
Green data center infrastructure in the cloud era

upwards. The aforementioned power and cooling issues are certainly involved, with the costs of both increasing eight times faster than those for hardware. This is unacceptable in the cloud era, which means that the industry must grow beyond its traditions.

Deployment planning

Traditional DC equipment rooms are highly integrated with the buildings that encompass them and are thus burdened with the same drawbacks such as overplanning and poor short-term utilization.

Power supply and distribution systems typically are designed and built to meet expected medium- and long-term business needs, which means that they may not be fully utilized for years. This situation puts start-ups at a disadvantage, which is certainly unworthy of the utopian ideals that the supporters of cloud computing are espousing.

Satisfying the needs of all scenarios

Huawei is fully prepared for the aforementioned challenges; it offers a comprehensive series of cloud computing equipment room solutions that encompass virtually any scenario.

IDS1000 series

The IDS1000 series currently features two entries; a container-borne, distributed DC solution (separate containers for primary equipment, cooling, and power distribution); and an all-in-one container-borne DC equipment room. Both efficiently isolate hot and cool air flows and are suitable for outdoor scenarios. Both also enable easy access to the necessary resources, as long as sufficient electricity and water are available.

A firm may simply select an equipment room site, build a concrete foundation platform, and lay pipe and cable before the primary equipment, cooling system, and distribution systems are delivered. A crane will also be needed for container placement. After the three containers are installed and fixed, the cable and pipe must be connected before final commissioning. The room is ready to use in eight to twelve weeks, which is a significant improvement over traditional DC equipment room construction scenarios.

With full-service configuration, a single, container-borne, distributed equipment room will feature the service capacity of a 300-square-meter traditional equipment room. Ten of these containers can be deployed in a stacked application mode to equal the workload of a 3,000 square meter room.

Power consumption per rack for this scenario is thirty kilowatts, thanks to its high-density cooling and power supply systems. Energy is saved thanks to its highly-efficient aisle-sealing and cool/hot air flow isolation technologies. Power usage effectiveness (PUE) is approximately 1.2, which far exceeds the mean 2.5 for a traditional equipment room, leading to forty percent reductions in OPEX and fifty-two percent reductions in CAPEX.

The air cooling for Huawei’s all-in-one container-borne solution supports a power density of up to ten kilowatts per rack, while the solution’s form factor enables convenient movement and transportation, making it ideal for scenarios such as disaster relief, military deployment, and oil exploration.

IDS2000 series

Huawei’s IDS2000 series is modular and categorized according to the ventilation involved. The series can employ subfloor or horizontal ventilation, of either cool air or hot air, through sealed aisles. All of these options enable efficient isolation of cold/hot air flows. They are ideal for the building and/or modernization of DC equipment rooms. Traditional DC rooms usually require several pieces of high-powered equipment (greater than or equal to 10kW/rack) with a low power density (3kW/rack) to satisfy the needs of cloud service development. However, the new equipment often negatively impacts the reliability of existing equipment due to inefficiencies in both the heat dissipation and power distribution infrastructure.

Huawei’s horizontally-ventilated, sealed-aisle IDS2000 series addresses this problem. These solutions seal high-density racks into a separate module and enhance heat dissipation and power distribution capabilities within it, which guarantees reliability and eliminates any negative impacts on existing equipment.

Thanks to their modular and scalable nature, IDS2000 solutions are also suitable for equipment rooms designed with cloud computing in mind, which tend to be more flexible and phase-oriented than traditional designs.

Increases in service capacity merely require a proper increase in the number of air-conditioning and power-distribution modules, without the need to change the existing layout. IDS2000 also features a PUE of about 1.5, which is a fifty percent improvement over traditional equipment rooms.

In addition to sealed-aisle ventilation, precision ventilation also addresses the aforementioned challenges. Precision ventilation refers to the sending of cool air directly to the hardware air intakes through pipes or static pressure boxes.

It also features ‘cooling on demand,’ where an intelligent monitoring system (which also simplifies maintenance) enables automatic cool air quantity adjustment, based on temperature spikes in rack-mounted equipment. Precision ventilation enables nearly forty percent energy savings for air conditioning equipment, when compared with traditional equipment rooms.

Cloud computing equipment rooms may also use free outdoor cooling sources to reduce energy consumption. Compressors stop operating automatically when the outdoor temperature dips to
5°C. At this time, the air-conditioning system makes direct use of natural outdoor cooling through its condensers.

Real-world cases have shown that, compared with traditional cooling solutions, precision ventilation solutions eliminate local hot spots and make airflow more structured, which prevents cascaded heat in equipment rooms.

China Mobile (Inner Mongolia) deployed Huawei’s precision subfloor solutions in 2010 and has enjoyed an annual savings of 5,100,000kWh (a 41 percent reduction) since that time. Its equipment room space utilization has also decreased to 2.8 square meters per cabinet, which is a significant improvement from the 3.5 square meter industry average.

**End-to-end design & delivery capabilities**

To guarantee efficient DC equipment room construction, Huawei has built an end-to-end design and delivery system that covers eight L1 subsystems (power supply, cooling, integrated cabling, integrated management, fire protection, lightning protection, cabinet, and remodeling/Decoration). Huawei provides services ranging from consulting/planning to solution design to project delivery to maintenance. Consulting and planning comprise equipment room location selection, civil engineering, and business development planning.

Solution design includes detailed design of the eight subsystems and the drawings and configuration lists that guide engineering. As for project delivery, Huawei installs components and integrates system commissioning for testing and acceptance.

With its comprehensive cloud equipment room lineup, Huawei is capable and confident that it can meet the needs of industry leaders, both today and tomorrow.

**Editor: Li Xuefeng** xuefengli@huawei.com