Dell OpenManage Power Center - Main User Interface Features for Power Management

This paper describes the main features of Dell OpenManage Power Center and illustrates how these features can effectively manage the power usage in data centers.

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Executive Summary

OpenManage Power Center provides a means for managing power consumption within environments from the data center down to the individual server within a rack. IT administrators can assess historical trends in power consumption as well as viewing real-time power and thermal data. Power Center utilizes a dashboard view which allows the monitoring of current power consumption and user-defined thresholds for certain groups of devices or even a data center. Administrators can also view the current power consumption of a particular rack and easily determine the amount of available power for efficient rack power utilization. In addition, administrators can set a power policy on an empty rack to avoid power spikes when the rack is populated with servers. In the event of a power emergency, the servers within a rack can be throttled down to a minimum power consumption level for continuous operations.

Introduction

OpenManage Power Center offers several unique features within the user interface for monitoring and managing power in a dynamically-changing energy environment. In today’s data centers, effective power utilization is critical to achieving a “greener” data center.

Power Center equips administrators with a power and thermal monitoring and management solution that ensures effective power utilization at multiple levels of the data center environment: the server rack, aisle, room, and data center levels. Through the real-time and historical monitoring of power and temperature within the data center, administrators can make accurate decisions for setting power and temperature thresholds and power policies on groups of devices or at a particular level of the data center. Power Center also allows administrators to react to emergency power events, such as power outages, through a clearly-implemented Emergency Power Reduction feature within the user interface.

Historical Trends of Power Consumption

Dell PowerEdge 12th generation servers use Intel’s Node Manager for advanced power management. Node Manager is an out of band (OOB) power management firmware embedded in the BIOS. It uses Advanced Configuration and Power Interface (ACPI) in combination with the input energy counter (Ein) from a power supply to measure the actual power consumption of the server and generate a report through the IPMI interface.

Using Intel’s Node Manager IMPI power commands, Power Center monitors and receives power management data that is aggregated to present power consumption and thermal data in the user interface. This information is used to track how much power server operations are consuming and how much power is still available. Power Center provides detailed, accurate information needed to implement strategies for optimal power consumption and to quickly respond to dynamically-changing energy conditions.

Real-Time Measurement and Trends in Power Consumption

Having accurate power utilization data and recognizing trends in power usage are essential precursors to proactively managing power consumption in the data center. Power Center provides real-time, accurate, group-level power information through highly-detailed graphs. The in-depth information that Power Center provides allows administrators to increase rack density, manage power peaks, and effectively plan the power infrastructure in the data center.
• Power consumption data can be viewed in different increments of time: every fifteen minutes, hourly, daily, weekly, monthly or yearly. This data can be reported for up to the preceding three years. Administrators can visually identify patterns in power usage and ways to improve data center energy efficiency.

• Average, maximum and minimum power consumption data may reveal trends that can help administrators manage the power peak and customize the power policy to intelligently balance workloads and to optimize energy usage.

• Examining the trends and the available power capacity, administrators can provision servers to safely respond to changing energy conditions.

**Figure 1. Power measurement displayed in user interface**

Current Power Usages and Temperature Conditions

The dashboard gives administrators a quick glance at power consumption and thermal conditions for the current time interval. Administrators can use this data in conjunction with the currently-applied threshold levels to proactively manage and mitigate events and to ultimately prevent power catastrophes. Administrators can set and configure threshold values to send alerts when the temperature or power consumption reaches cautionary or critical conditions.
Figure 2. Quick assessment of the current condition

Group-Level Power Monitoring

Power Center provides group-level power measurement by aggregating data from servers in a rack, aisle, room, or an entire data center. At a central console, administrators can monitor and control the power conditions for an entire data center.

Administrators can create device groups according to their logical features for the purpose of monitoring the groups’ power consumption. For example, administrators may want to know the trend of only the servers that provide web services.

As demonstrated in the figure below, administrators can quickly monitor the rack space, power capacity, power utilization and available capacity at the rack level.
Over-provisioning is a common issue in power management. It is also the first problem that administrators must address in order to accomplish power efficiency in a data center. An issue that contributes to over-provisioning is the over-allocation of power. Without power consumption data, administrators might base decisions for power deployment on the less accurate nameplate data. The use of power meters is also not helpful because they provide only a snapshot at a given point in time and do not reflect any trends or variations in power consumption.

**Example Scenario:** A server has a nameplate capacity at 500W and a total rack capacity of 5000W, allowing the administrator to deploy 10 servers. However, when monitored, Power Center’s power consumption graph reports the average power consumption level of each server to be 150W and the maximum power consumption level to be 200W for the duration of a week. Therefore 20 to 25 servers could actually be added to the rack. Compared to the 10 servers, the rack density is increased by
150%. The efficiency rate can be increased even higher if power consumption is monitored and adjusted over time. In many data centers, expansion is limited because the administrator does not have the actual information on how much power their operations are using and how much spare power is available.

**Note:** The example above is used to illustrate how to address over-provisioning in the rack. The numbers listed are used as examples only and the numbers will depend on the types of servers used.

Using the rack-level power monitoring and power policy, the administrator can safely deploy servers and formulate the optimal power deployment strategy. For example, the following are the power deployment steps the administrator would follow to control and to optimize the power resource in a rack:

1. First, set a power capping policy on an empty rack. Power capping can prevent power spikes from tripping the power breaker when servers are added to the rack. This feature is especially useful when the power consumption data of each server is not available. For example, setting the cap at 2000W, 10 servers (nameplates at 500W) can be safely put into a rack with a 2000W capacity.

2. Deploy the servers to the rack and start monitoring power consumption. Since the cap is set at 2000W, if the total power usage in the rack is above the cap limit, Power Center will maintain the power usage under 2000W and send an alert message.

3. Analyze the power consumption trends.

4. Mitigate and adjust the power policy as needed.

The administrator would repeat the last three steps until the optimal power usage is achieved in the rack. This process can be similarly applied for power deployment to the aisle, room or an entire data center.

**Emergency Power Management**

Emergency Power Reduction (EPR) allows administrators to set maximum throttling on a select number of servers to minimize their power consumption in case of an emergency. For example, during a critical event such as a brownout or a system cooling failure, the administrator may want to minimize the power usage of all the servers in Rack1 of the SMD_Lab. From the Power Center console, the administrator would navigate to the physical topology of Rack1 and then apply the EPR.

Figure 5 shows that the servers in Rack1 are under the EPR. The power available for these servers to consume is reduced to a minimum to decrease heat generation and to allow power resources to be redirected to higher-priority servers in the room.
Power usage is throttled down when applying EPR.

When the emergency situation returns to normal, the administrator can click the EPR button to disable this feature.

Rack1 is under EPR.
Power Events Management

Power Center provides a power monitoring system that ensures alerts are quickly transmitted to warn of potential power catastrophes.

The event messages are classified at different levels and color-coded for ease of monitoring:

- Inform (blue)
- Warning (yellow)
- Critical (red)

Administrators can forward event messages to any upstream systems management console for a unified solution.

Figure 6. Events

Conclusion

By utilizing OpenManage Power Center, IT administrators can proactively monitor and manage power consumption and thermal conditions effectively and efficiently within the environment. The granular level of power and thermal monitoring that is aggregated across devices, and presented within the user interface at multiple levels of the data center, provides IT administrators with the necessary information for making power management-related decisions quickly and accurately. Dell OpenManage Power Center provides a solution for responding to power emergencies as well as providing the correct type of data for making calculated decisions for achieving effective power utilization in the environment.