Overcoming Rack Power Limits with VPS Capacity Assurance and Intel® RSD

Summary

This paper describes how Virtual Power Systems* (VPS) Capacity Assurance* technology allows customers to take full advantage of Intel® Rack Scale Design (Intel® RSD) configurability, scalability and upgradeability by introducing a new level of flexibility in the data center power infrastructure.

1. Introduction to Intel® RSD

Intel® RSD is a new data center architecture that separates or “disaggregates” compute, storage and network resources into groups of components, called pools, that can be efficiently assembled or “composed” on demand to create a precise hardware configuration to match a specific software workload requirement. Intel® RSD concepts of disaggregation, pooling and composition are shown in Figure 1. In addition, Intel® RSD provides a comprehensive management architecture for all the resources in the datacenter, enabling a true software defined infrastructure.

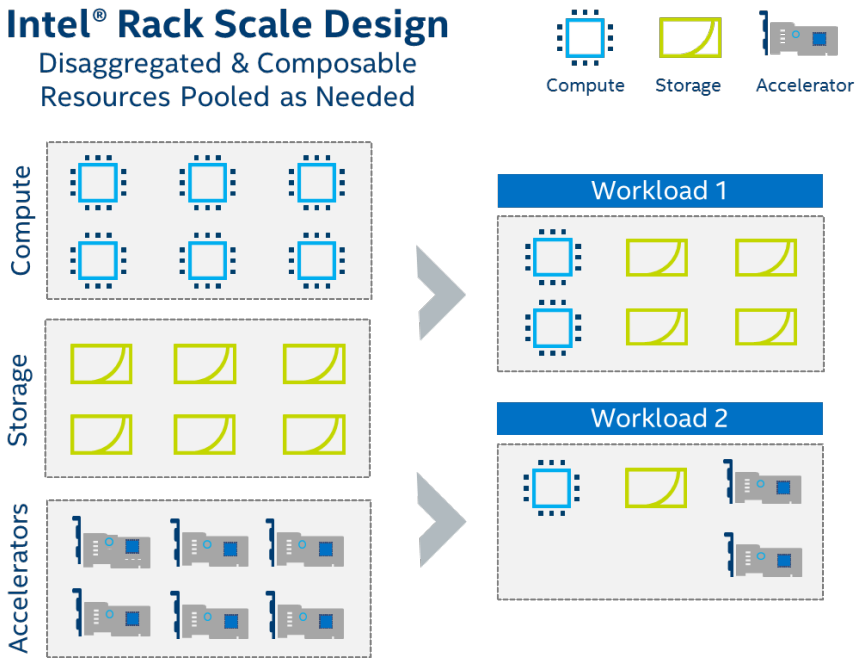

Figure 1. Intel® RSD Overview

Because resources are disaggregated and abstracted, each type of resource can be expanded, replaced, or upgraded on its own refresh cycle, ensuring that customers get the latest technology, best performance and optimum capacity without prematurely obsoleting other resources. However, with traditional rack power facilities, module expansions and upgrades can still be limited by power provisioning, resulting in energy waste and potential interruption of services in the datacenter. To provide a true hyper-scalable datacenter, rack power must be able to scale dynamically along with other resources without excessive overprovisioning or expensive and disruptive power supply upgrades.

2. Capacity Assurance

To address this need, Virtual Power Systems* (VPS), a Silicon Valley-based startup, has developed a comprehensive Software-Defined Power* (SDP) product suite designed to address a variety of electrical power-related challenges in today's and tomorrow's data centers. One of these challenges is power overprovisioning.

In traditional datacenters, overprovisioning is a response to several factors:

- Power safety margins required to compensate for the inability to accurately predict power load demands, including peak and seasonal variations
- Unpredictability is exacerbated by very high performance systems, which may drive increasingly large variations in power consumption during peak performance periods
- Power equipment is typically only available (or economical) in large increments

SDP is designed to improve the efficiency and flexibility of datacenter power distribution to reduce power overprovisioning and make it easy to adapt to dynamic power requirements. VPS calls this capability "Capacity Assurance."

SDP delivers Capacity Assurance by monitoring power consumed by IT loads at sub-second intervals using strategically located power sensors. This increased visibility of immediate power requirements is coupled with active energy storage in the form of batteries at key locations within the data center topology that can be used to meet peak demand without overloading the overall power infrastructure (see Figure 2). SDP delivers power Capacity Assurance by increasing the effective capacity of the power infrastructure smoothly and economically, avoiding expensive upgrades.

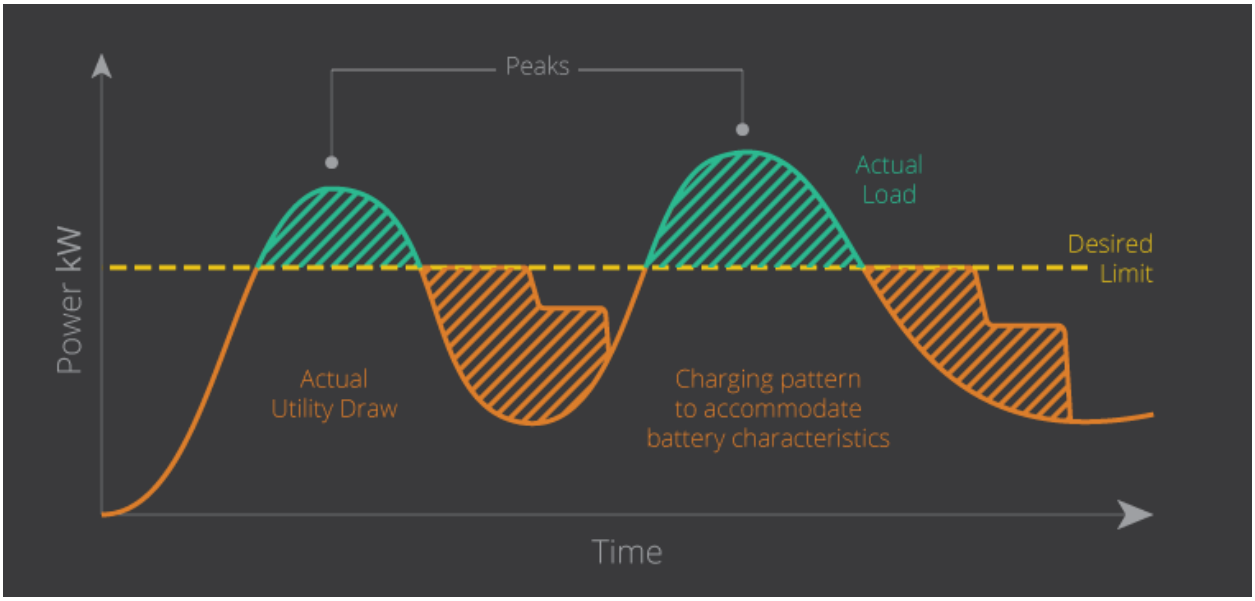

Figure 2 VPS SDP® Peak Shaving Mechanism

But what about peaks that last longer than a few seconds? To address sustained load demands that tend to drain the batteries, SDP employs an innovative optimization algorithm that dynamically controls the mix of utility power and local battery power consumed at different points in the data center topology. By adjusting the mix every few seconds, SDP controls which batteries are charging and which are discharging at any moment, creating a form of "power-sharing" among all the batteries. The result is a more dynamic power capacity that can be "moved around" in the datacenter where and when it is needed. The impact is shown in Figure 3, which compares the total power supply load over time with and without the load leveling effects of SDP.

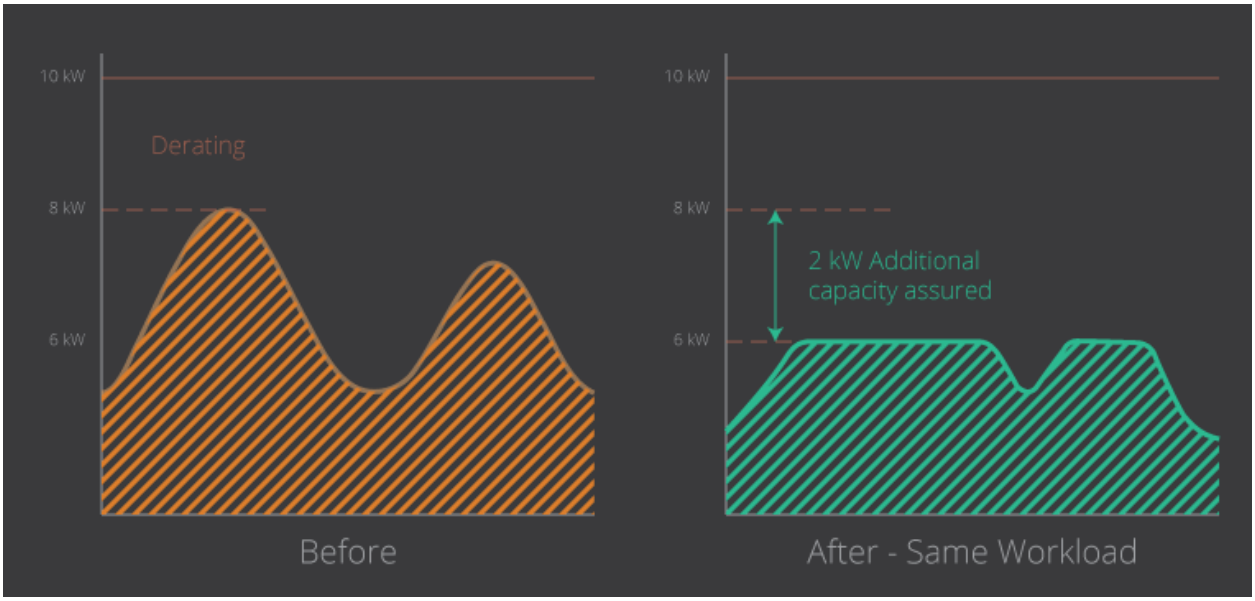

Figure 3 Capacity Assurance created by VPS Software-Defined Power

The basic technology is enhanced with learning algorithms that analyze and predict power consumption over time to automatically optimize load balancing parameters to ensure sustained power availability and marginally higher capacity. Multiple levels and complexity of optimization and intelligence, as shown in Figure 4, ensure that both short- and long-term power consumption trends are taken into account.

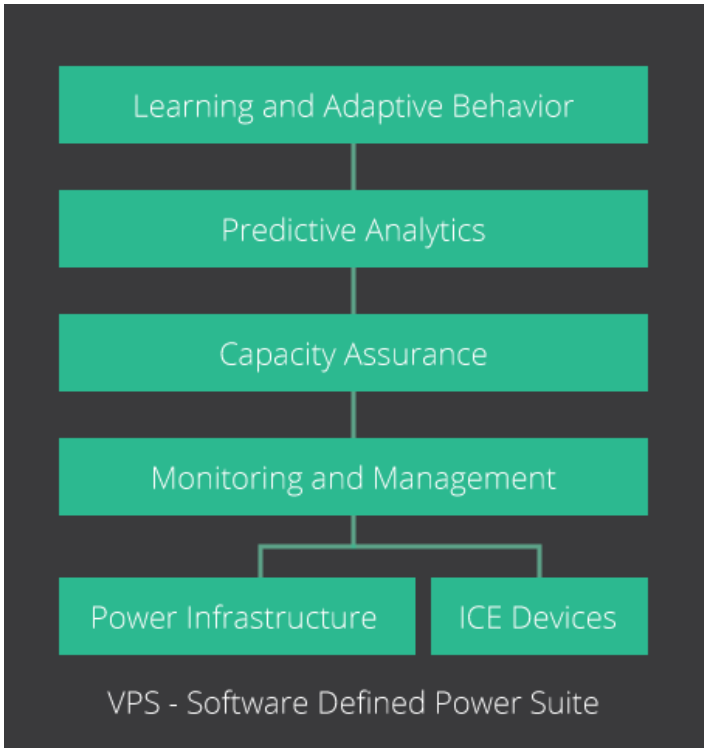

Figure 4 SDP Hierarchy of Optimization and Intelligence

VPS's Capacity Assurance technology is available for commercial use via the Software-Defined Power* product suite. A comprehensive set of APIs allows SDP products to be fully managed in an Intel® RSD environment.

3. Increased Capacity of Intel® RSD Racks

By incorporating VPS's SDP solution, a datacenter based on Intel® RSD can be refreshed with higher performance compute and storage components to accommodate more demanding workloads with the confidence that sufficient power is available as needed.

Intel® RSD Pod Manager knows the nominal power requirements of individual components that make up a rack. In addition, SDP provides real-time Capacity Assurance information, i.e., knowledge about the capacity reserve that is available across the system. With this combined information Intel® RSD Pod Manager makes intelligent decisions that optimize the SLA of provisioned compute or storage nodes. When a node fails, and the Intel® RSD Pod Manager

has to provision a new compute or storage node, the new node can be chosen on a rack with the best available power.

Customers or IT vendors can make informed decisions to upgrade their components based on their business need, without feeling constrained by the underlying power infrastructure. In dual corded environments, the SDP capabilities can be deployed live without bringing the IT systems down, which enables existing deployments to be upgraded without downtime. Through an Intel® RSD API interface, the Intel® RSD Pod Manager can leverage these mechanisms to provide more reliable reporting and IT capacity provisioning.

As shown in in Figure 5, SDP can be fully integrated by installing the power hardware anywhere in the rack, and installing the SDP power control software on any server on the datacenter network. This allows for easy turnkey deployments.

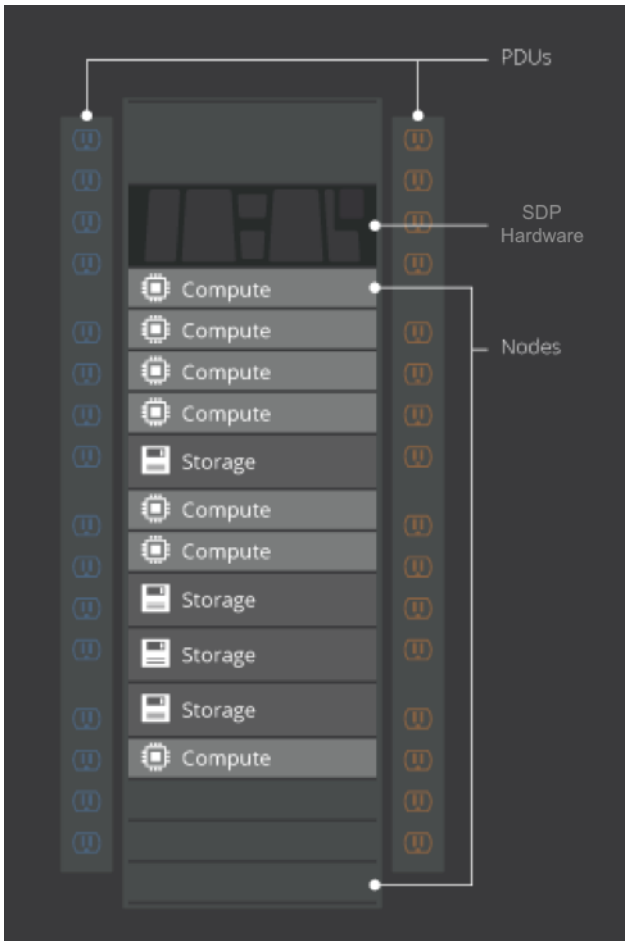

Figure 5 SDP in a Rack

4. Conclusions

Integration with VPS SDP technology increases the effectiveness of Intel® RSD implementations by giving customers the flexibility to upgrade datacenter compute and storage resources without upgrading the power infrastructure within a rack. This achieves significant cost savings as well as avoiding delays due to the need to replace power supplies, making upgrades possible with minimal disruption to the data center.

We are working with IT vendors to enhance Intel® RSD racks to be SDP-ready. With this approach, customers can purchase Intel® RSD racks with integrated SDP technology directly from these vendors and immediately realize the benefit of a fully-scalable infrastructure.

** Other names and brands may be claimed as the property of others.*