



# **USING REST TO ACHIEVE FULL VISIBILITY AND CONTROL ACROSS THE INTERNET OF THINGS: INSIDE THE DATA CENTER ECOSYSTEM WITH TRUE CLOSED-LOOP CONTROL**

Vertiv™, with Lenovo  
and OSIsoft

## Executive Summary

The data center industry's evolution toward software-based management will be enabled by increased use of open technologies and automation. However, the complex mix of legacy technologies that exists in most data centers creates challenges in capturing, analyzing and using data from disparate systems to support this evolution. Most solutions struggle to aggregate this vast amount of data and cannot provide a complete picture of operational integrity.

The true potential of an operationally efficient data center will be realized with the integration of information technology (IT) and operational technology (OT) in a software-defined ecosystem. By eliminating the barriers between OT and IT, data center managers can increase efficiency and availability while continuing to scale economically. This is not only important for large cloud deployments, but also for edge computing, branch and broader IoT applications that create and aggregate large amounts of data that must be analyzed individually and in aggregate.

The industry took a significant step in addressing this challenge through the development of the REST-based DMTF Redfish specification. It's been two years since Vertiv™ and its industry partners announced the creation of Redfish to simplify server management, and one year since the DMTF (Distributed Management Task Force) released Redfish 1.0 as a specification. Now with DMTF Redfish gaining acceptance, Vertiv, Lenovo and OSISOFT have collaborated to integrate their technologies in a proof-of-concept unified data center ecosystem built on Redfish that enables operational efficiency for more than just servers.

*This paper "lifts the hood" on that ecosystem.*

## Core Technologies

DMTF Redfish was developed to address the limitations of the IPMI specification through a purposeful REST- and JSON-based design that is open, lightweight, scalable, and easy to maintain and automate. Because it is based on protocols that are already proven and accepted in cloud ecosystems and web APIs, Redfish empowers administrators to implement a modern, simplified and scalable software-defined approach to data center management.

While developed to address out-of-band server management, Redfish's simplicity and versatility naturally extends to the critical infrastructure systems that must be managed in concert with servers. This creates the potential for a single specification across all data center systems—the holy grail of data center management. Because it will take years for Redfish to fully displace other protocols in the data center, especially in infrastructure systems that have a significantly longer lifecycle than servers, Redfish must co-exist with other protocols currently in use to deliver on its potential.

Vertiv™ and Lenovo have partnered to make DMTF Redfish a reality on IT infrastructure. Vertiv is also driving Redfish support into power and cooling infrastructure. OSIssoft has partnered with Vertiv to demonstrate the unique management capabilities of REST-based connectivity across systems. In combination with the OSIssoft PI System and its new Redfish connector.

At the heart of these initiatives is the Vertiv Connectivity Engine. Packaged as a bolt-on application and delivered as a software development kit (SDK), the engine enables management solutions with RESTful APIs like Redfish.

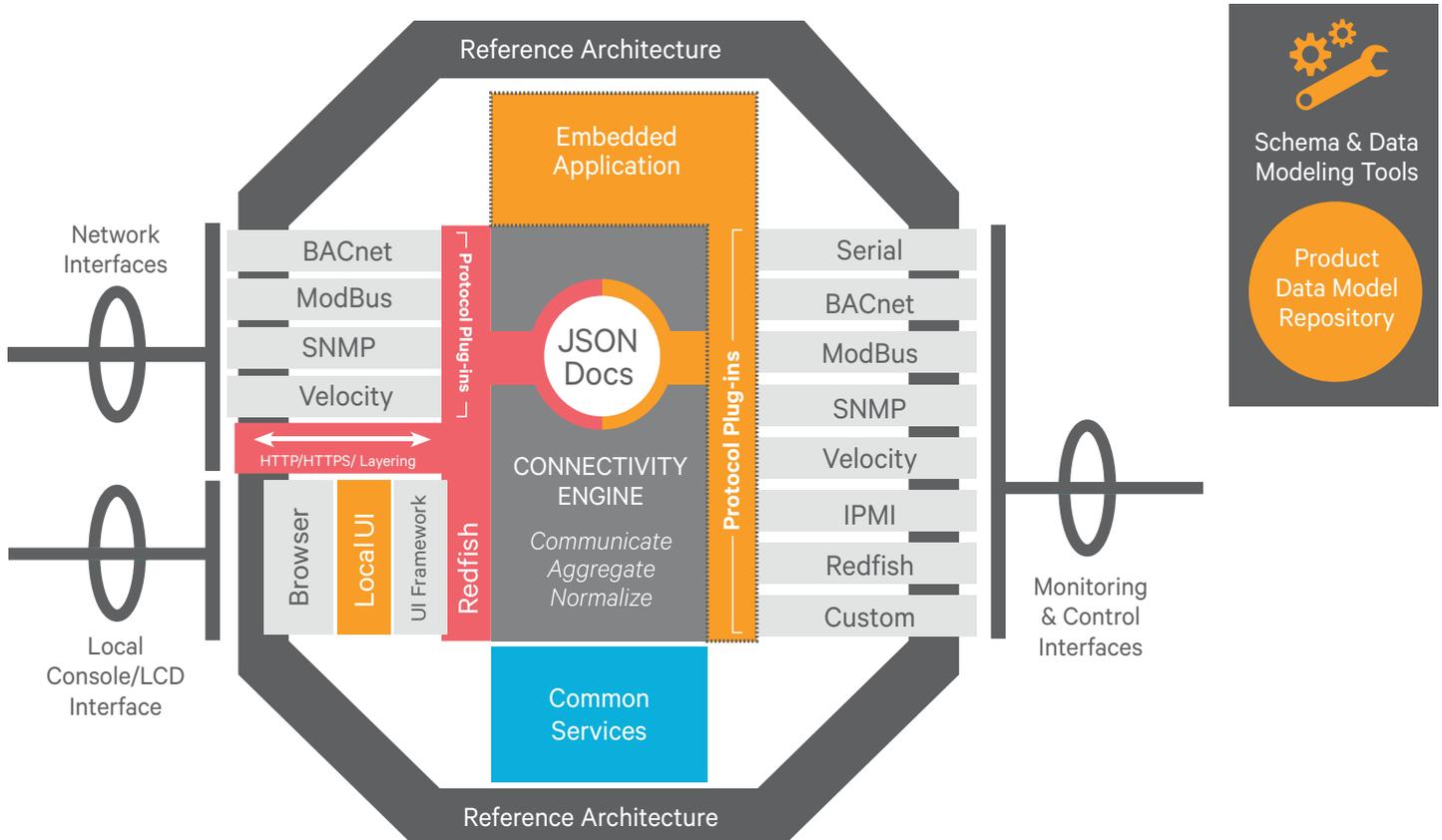


Figure 1: The Connectivity Engine provides an easy-to-deploy solution for communicating, aggregating and normalizing device data.

## Creating a Manageable Data Center Ecosystem

Vertiv™, Lenovo and OSISoft have collaborated to create a simple but powerful end-to-end framework built from the ground-up on REST APIs to collect, store, analyze and visualize data, and enable automated action when needed. Following is a summary of the key components within the system:

- **Integrated Enclosure:** To simplify design and integration, the integrated ecosystem uses Vertiv's SmartCabinet™ for Branches as a turnkey IT support system. For the proof-of-concept system, the SmartCabinet is configured with a UPS and maintenance bypass, power distribution unit, temperature and door ajar sensor, and a network switch.
- **Management Gateway:** The ecosystem uses a prototype of a compact IOT gateway, powered by the Vertiv Connectivity Engine, to provide the system dashboard, overall system management and aggregation of data from servers, thermal and power equipment, sensors and security apparatus such as video cameras, door locks and environmental protection. A core principal of the gateway architecture is to drive decision making, control-loops and data enrichment as close to the managed elements as possible. This is especially critical for edge computing and IoT solutions where the controller excels at managing many intelligent endpoints.
- **Rack-mounted UPS and Power Distribution Unit:** Vertiv's Liebert® GXT4™ true online UPS and the MPH2™ rack PDU offer protection against power anomalies, branch monitoring, outlet level monitoring and control. These products support industry standard protocols, like SNMP, and will be enabled with the Connectivity Engine in the near future.
- **Servers:** The proof-of-concept features two Lenovo System x3550 M5 servers. The Lenovo x3550 is a 1U, two-socket, Intel Xeon-based server with true DDR4 memory and industry-leading security and reliability. Lenovo's Integrated Management Module II (IMM2) is the second-generation baseboard management controller hardware enabled with the Vertiv Connectivity Engine. It combines service processor functions, video controller, remote presence, and Redfish 1.0 Restful API interface function in a single chip.

Through the integration of Redfish-enabled subsystems, the management gateway and the OSISoft PI system, the proof-of-concept ecosystem delivers simplified management and control by

- Aggregating critical data from disparate systems, such as power, temperature and CPU workloads.
- Correlating and visualizing measurements, trends and analytics into actionable KPIs.
- Enabling closed-loop control that supports decision making, simplifies critical alarm response, and automates remote administrative actions, including power control and balancing power against cooling based on the IT workload.



*Figure 2: Vertiv's SmartCabinet for Branches provides a turnkey IT support system that speeds deployment and supports standardization.*

## Edge-of-Network Management

The proof-of-concept system showcased at IDF 2016 provides an ideal solution for edge applications. Operational efficiency is particularly important at the edge where banking, manufacturing, healthcare and retail operators are challenged to enable connectivity and continuity of services across multiple sites not designed to host IT infrastructure. With a fully integrated system, personnel responsible for managing and maintaining remote facilities have a single window into alerts and system KPIs to optimize performance and availability and immediately remedy potential problems.

This allows the ecosystem to deliver the following benefits:

- **Increased security:** DMTF Redfish supports TLS encryption through HTTPS to ensure the secure transmission of data between remote facilities and the centralized management system.
- **Enhanced availability:** Consolidating and prioritizing alerts across all systems eliminates one of the biggest challenges in remote system management—dealing with the volume of alerts generated by multiple systems. The dashboard provides a single view of prioritized alerts.
- **Faster deployment:** The use of the pre-integrated SmartCabinet™ allows remote systems to be deployed faster with minimal setup and installation time and in standardized configurations.
- **Lower cost of ownership:** The operational efficiencies, higher availability and enhanced management enabled by the unified approach reduce overall ownership costs.

## A Scalable Approach to IoT and SDDC

The single-rack data center ecosystem showcased at IDF 2016 demonstrates the viability of using a Connectivity Engine to resolve protocol differences between IT and OT systems and contextualize data across these systems to deliver actionable KPIs and enable closed-loop control. When integrated through a Redfish-based management gateway to a scalable real-time data of record, the value of DMTF Redfish is unleashed across the data center and the ability to manage the data center as an IoT becomes a reality.

For organizations eager to move forward with software-defined management within cloud-based environments or at the edge, the Vertiv™ Connectivity Engine provides a powerful tool for accelerating their Redfish adoption plans and enabling the visibility and control the specification was developed to support.

