



## End-to-End Interoperable Management: The Standards Requirement for Modern IT

### EXECUTIVE OVERVIEW

Today's data centers have very little in common with the designs of just a few years ago. Rapid innovation has led to the widespread adoption of cloud- and web-based infrastructures, ushering in a new era of converged, hybrid IT. The current model, delivering unprecedented levels of scalability, enables improved IT and business strategy alignment with unmatched speed, power and agility.

While software defined and hyperconverged data centers offer measurable benefits, this progress has also brought with it new challenges for the effective management of these systems. Vastly different from the centralized enterprise environments of the past, today massive quantities of servers (both single- and multi-node) and hybrid infrastructures perform tasks in a distributed fashion.

In the heterogeneous environments of modern data centers, the key to consistent management is requiring support for end-to-end interoperable industry standards. With the complexities of the digital era, open IT standards that meet scalability requirements in multi-vendor deployments are a must.

Three standards from DMTF® are serving as the IT industry's foundation for standards-based management today. Developed using a uniquely holistic approach, DMTF's Redfish®, SMBIOS, and the suite of standards from DMTF's PMCI Working Group (see *Table 1*) are helping enable end-to-end interoperability by addressing everything from management clients to servers to individual system components.



## A Break from the Past

In the past, legacy IT standards (such as IPMI) often used a “least common denominator” approach with limited functionality. In this environment, vendors built proprietary management extensions that were not common across all platforms, thereby reducing interoperability. As a result, many users resorted to developing their own custom tools with vendor-specific code for tighter integration, which led to increased vendor dependence and higher costs.

In addition, formerly separate and distinct methods for managing different components in the data center resulted in widespread inefficiency. Multiple incompatible standards, protocols, and tools required significant expertise to use and were unable to scale for modern environments. Even a seemingly simple firmware update required careful planning and numerous error-prone tasks for execution – all too often a minor bug fix could go awry and turn into expensive downtime.

Attempting to use these outdated approaches today limits innovation and interoperability, while increasing overhead and the likelihood of vendor lock-in. Without integrated standards for multi-vendor interoperability, an adaptation layer may be required for each implementation, client, and component – a costly challenge that increases exponentially with every new vendor or component that is added. As the complexity of data centers continues to grow, improving the simplicity and scalability of management infrastructure is essential.

With new and updated IT standards reducing this complexity, and the enormous cost burdens and inefficiencies that result, decision makers can architect an environment that is more flexible, stable and extensible, with a lower barrier of entry for new technical advancements.

## End-To-End Standards-Based Management

DMTF, a top provider of internationally recognized IT management standards for nearly three decades, is aggressively addressing the evolving needs of the industry. The organization’s innovative, integrated approach to the development of Redfish, SMBIOS, and its PMCI Working Group’s standards ensures alignment and consistency throughout the data center, meaning interoperable management is covered from all angles.

From a system point of view, these end-to-end management standards are both internal-facing and external-facing; inside-the-box and outside-the-box – from the device to the operating system to the out-of-band (OOB) manager. In practice, DMTF is providing a continuum of interoperability that simplifies management at each point of the product lifecycle – from provisioning and deployment to operations, support issue maintenance, de-provisioning, and de-commissioning.

## Redfish

First released in 2015, DMTF's Redfish has been purpose-built for managing today's software-defined hybrid IT environments. As the management of platforms and devices continues to overlap and converge, Redfish enables the management of compute, network, storage and facilities equipment using the same simple interface.

Redfish is a well-defined standard that takes advantage of already accepted, developer-friendly standards (HTTP, REST, JSON, etc.) – with output readable not just by machines, but also by humans. The initial release of Redfish focused on servers, providing a secure, multi-node capable replacement for IPMI-over-LAN. Subsequent Redfish releases have added the management of network interfaces, switching, local storage, memory, telemetry, and more. The standard also provides capabilities for firmware and standardized push-style software updates, eventing, and privileges mapping for security.

Not limited to platform hardware management, Redfish also addresses data center infrastructure management (DCIM) power and cooling, as well as the Ethernet domain (via a mapping to the commonly used YANG model). In addition, DMTF's open approach to Redfish and broad collaboration with other organizations has resulted in numerous open source and open standard extensions to Redfish. For example, the Storage Networking Industry Association (SNIA) Swordfish™ standard is building on Redfish's local storage management capabilities to address enterprise storage services.

Designed from its inception to provide interoperable management for converging infrastructures, Redfish takes advantage of commonly used data center technologies, integrating with modern tool chains for simple and secure management in Internet and web services environments. With its cohesive approach to open source tools and software as well as open industry standards, Redfish is at the center of a broad ecosystem of industry collaboration, helping reduce vendor lock-in and increase the productivity of system administrators.

## SMBIOS

DMTF's SMBIOS is one of the most widely used IT standards in the world, simplifying the management of more than two billion client and server systems since its release in 1995. The premier standard for hardware inventory – implemented on nearly all server, client, and mobile platforms used in the data center – SMBIOS is the provider of product information any time a user looks up a system's model, serial number, etc.

In the broader data center environment, SMBIOS' standard format for presenting information about system hardware delivers consistency that is critical for effective management. By extending the system firmware interface, SMBIOS can be used with both internal- and external-facing management technologies to eliminate the

need for error-prone operations, such as probing system hardware for presence detection.

### **Platform Management Communications Infrastructure (PMCI)**

PMCI refers to the Working Group that produces a suite of standards to address “inside the box” management, where internal components communicate. These specifications enable the monitoring and control of systems independent of the Operating System (OS) state, including when the OS is not available (for example, when a system is booting, before the OS has loaded, or when the OS is inoperable).

PMCI’s internal-facing standards and technologies can be used by implementations of external-facing standards, including Redfish, for improved interoperability. For example, PMCI standards are used to greatly simplify the firmware inventory and update process, accelerating delivery.

PMCI’s multiple standards for these communications are detailed in separate specifications, to deliver maximum flexibility in implementation (*see Table 1*). Together, they provide a comprehensive, common architecture for platform management subsystem communication, which is an essential component for an interoperable end-to-end management solution.

### **Integration**

As DMTF continues to develop and synchronize these modern standards in lock step, the organization regularly identifies and provides supportive technologies for even tighter integration.

Some examples of this tight integration include the PLDM for Redfish Device Enablement specification, which can be used for Redfish-conformant management of input/output (I/O) adapters in a server, without needing code for each adapter family/vendor/model. Another example is the PLDM for Firmware Update specification, which can be used in conjunction with the Redfish Firmware Update Service for a seamless approach to end-to-end firmware payload delivery to internal devices within a server. These advancements, along with other technologies from the DMTF, greatly enhance productivity and management effectiveness.

### **Summary and Conclusion**

Modern IT requires an entirely new approach to achieve effective and efficient management in today’s hybrid environments. Serving as the industry’s foundation for standards-based management today, DMTF’s Redfish, SMBIOS, and the suite of standards from DMTF’s PMCI Working Group are being developed in a uniquely synchronized, holistic fashion under the umbrella of a single organization. In combination, the whole of these innovative standards is greater than the sum of

the parts – enabling flexible and scalable end-to-end interoperability for converged, hybrid IT.

## TABLE 1: MODERN IT STANDARDS TO SPECIFY/SUPPORT

### Redfish

Redfish is a standard that takes advantage of accepted, developer-friendly standards (HTTP, REST, JSON, etc.) to enable the management of compute, network, storage and facilities equipment using the same simple interface.

### Platform Management Communications Infrastructure (PMCI)

This Working Group produces a suite of standards that addresses “inside the box” communication interfaces between the components of the platform management subsystem. These standards include:

- **Platform Level Data Model (PLDM)**  
PLDM defines how platform level management functions, such as inventory, monitoring, control, eventing, and data transfer are abstracted and accessed.
- **Management Component Transport Protocol (MCTP)**  
MCTP is used to move management data between hardware components. This provides a common protocol across different interconnects and interfaces, and delivers monitoring and control functions inside a managed system.
- **Network Controller Sideband Interface (NC-SI)**  
In out-of-band management environments, the interface between the out-of-band Management Controller and the Network Controller is critical. NC-SI is responsible for supporting communication between the Management Controller and external management applications.

### Security Protocol and Data Model (SPDM)

SPDM provides message exchange, sequence diagrams, message formats, and other relevant semantics for authentication, firmware measurement, and certificate retrieval.

### SMBIOS

SMBIOS is the premier standard for delivering management information via system firmware.

### FOR ADDITIONAL INFORMATION:

- DMTF – <https://www.dmtf.org>
- Redfish - <https://www.dmtf.org/standards/redfish>
- PMCI - <https://www.dmtf.org/standards/pmci>
- SPDM - <https://www.dmtf.org/standards/spdm>
- SMBIOS - <https://www.dmtf.org/standards/smbios>