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<th>Revision</th>
<th>Description</th>
<th>Date</th>
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<tr>
<td>001</td>
<td>Initial release</td>
<td>December 19, 2017</td>
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Introduction

1 Introduction

1.1 Scope

The *Intel® Rack Scale Design Conformance and Software Reference Kit Getting Started Guide* covers implementing the required functions of the *Intel® RSD* reference architecture, including hardware, software, system setup, and standards-based APIs.

1.2 Intended audience

This guide is the starting point for developers planning to work with *Intel® RSD* software and conformance testing. Intel recommends reading the entire guide before starting.

1.3 Background and prerequisite information

The guide provides background and prerequisite information for the *Intel® RSD* documentation and the *Intel® RSD* conformance process. This information ensures that the process goes smoothly and efficiently. Keep in mind that the *Intel® RSD* code is reference software only. Developers are expected to modify the reference software and make it their own. Additional releases are forthcoming. The following steps outline a summary of all available *Intel® RSD* materials:

1. Read *Intel® Rack Scale Design Architecture Specification* (refer to Table 2) to gain an understanding of the hardware and components, and learn how *Intel® Rack Scale Design* software works with these components.
2. Read *Intel® Rack Scale Design Pod Manager User Guide* and *Intel® Rack Scale Design PSME User Guide* (refer to Table 2). These resources describe the core components and setup processes for the hardware and software components.
3. Read *Intel® Rack Scale Design Conformance Getting Started Guide* (this document, starting in Section 2) to start your design while keeping conformance testing in mind. This document covers design and test prerequisites to ensure smooth and efficient testing at the end of the development and validation processes.
4. Plan the configuration of the *Intel® Rack Scale Design* software components across your hardware. Decide which servers in your rack configurations will run which PSME and Pod Manager (PODM) components (also known as agents). For example:
   - Dedicate an Ubuntu® 14 server with a BMC (for example, 1U on any rack) to run the PSME compute and core rest interface modules. For example, Dell PowerEdge® and HP ProLiant® have this capability.
   - Dedicate a 10 GbE TOR (or other) switch to run the PSME core and networking modules.
   - Dedicate another storage server (disk controller) to run the PSME core rest APIs and storage agents/modules. This could potentially be the same dedicated server (with BMC) above for compute, as the server could also have a storage controller and additional disks.
5. Contact an *Intel® RSD* account representative or visit the *Intel® RSD* website (refer to Table 2) to acquire the required code.
6. Read *Intel® Rack Scale Design GAMI API Specification*, *Intel® Rack Scale Design Pod Manager API Specification*, *Intel® Rack Scale Design PSME API Specification*, and *Intel® Rack Scale Design Rack Management Module (RMM) API Specification* (refer to Table 2). These references will enable you to understand and work with the functional code provided, including:
   - *Intel® RSD* Pod Manager Reference code includes a fully functional northbound interface exposing Redfish*-aligned APIs along with code to discover, compose, and manage *Intel® RSD* resources.
   - *Intel® RSD* PSME/RMM reference code provides fully functional implementation to communicate with Pod Manager, northbound RESTful interface exposing Redfish*-aligned APIs, manage and report power/thermal data to the Pod Manager, and RMM implementations. It also includes stubs for the PSME network, compute, and chassis agents.
7. Build, install, and modify the PSME components on the hardware configuration (refer to the Intel® Rack Scale Design PSME User Guide, listed in Table 2). Modify the GAMI agents to interface with the hardware configuration.

8. Build, install, and modify the PODM components to talk with the PSME agents and manage the racks (refer to the Intel® Rack Scale Design Pod Manager User Guide, listed in Table 2).

9. Connect to an outside orchestration layer if one is used (for example, OpenStack*).


Note: Contact an Intel® RSD account representative or visit the Intel® RSD website (refer to Table 2) if you run into issues, have questions, or want to provide general feedback.

1.4 Terminology

Table 1 Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>ACL</td>
<td>Access Control List</td>
</tr>
<tr>
<td>BMC</td>
<td>Baseboard Management Controller</td>
</tr>
<tr>
<td>CA</td>
<td>Certificate Authority</td>
</tr>
<tr>
<td>CTS</td>
<td>Conformance Test Suite</td>
</tr>
<tr>
<td>GAMI</td>
<td>Generic Assets Management Interface</td>
</tr>
<tr>
<td>iSCSI</td>
<td>Internet Small Computer System Interface</td>
</tr>
<tr>
<td>ISV</td>
<td>Independent Software Vendor</td>
</tr>
<tr>
<td>LAG</td>
<td>Link Aggregation Group</td>
</tr>
<tr>
<td>PODM</td>
<td>Pod Manager</td>
</tr>
<tr>
<td>PSME</td>
<td>Pooled System Management Engine</td>
</tr>
<tr>
<td>RMM</td>
<td>Rack Management Module</td>
</tr>
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<td>RSD</td>
<td>Rack Scale Design</td>
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1.5 Reference documents and resources

Table 2 Reference documents and resources

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<tr>
<td>336858</td>
<td>Intel® Rack Scale Design Rack Management Module (RMM) API Specification, Software v2.2, Revision 001</td>
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# Introduction

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<td>336861</td>
<td>Intel® Rack Scale Design Architecture Specification, Software v2.2, Revision 001</td>
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<td>336862</td>
<td>Intel® RSD v2.2 Solid State Drive (SSD) Technical Advisory</td>
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<td>RFC2119</td>
<td>Key words for use in RFCs to Indicate Requirement Levels, March 1997</td>
<td><a href="https://www.ietf.org/rfc/rfc2119.txt">https://www.ietf.org/rfc/rfc2119.txt</a></td>
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Intel® Rack Scale Design (RSD) Conformance covers implementing the required functions of the Intel® RSD Reference Architecture, including hardware, software, system setup, and standards-based APIs. Conformance drives alignment to industry standards (driving those standards into the market), builds the Intel® RSD Ecosystem, builds end customer assurance, and reduces product development costs by improving time to market of new technologies.

Engagement with the Intel® RSD Ecosystem, illustrated in Figure 1, involves the following:

- Releasing the feature complete “beta” Intel® RSD software to the open source community.
- Supporting OEM Partners to complete development of the Intel® RSD software (PSME/RMM and Pod Manager) with OEM hardware-specific code and optional OEM features.
- Supporting partners through conformance testing, which includes an automated Conformance Test Suite (CTS) tool, with manual checks.
- Working with third-party ISVs to enable orchestration solutions to work with the Intel® RSD software.

Figure 1. Intel® RSD co-development process and conformance process flow

![Diagram showing Intel® RSD Design Criteria, PSME/RMM Reference Code, OEM Specific Code, POD Manager Reference Code, OEM Specific Code, Run Conformance Test Suite, Submit Test Results to Intel, Pass, Redo]

The Intel® RSD CTS tool verifies the northbound API schema conformance of the PSME/RMM and Pod Manager through automated techniques. The tool can also test some hardware and software parameters. Intel recommends completing the full conformance testing process with a manual review of the remaining system and hardware parameters. In addition, validate the rack architecture to confirm the hardware implementation is completed, as described in the Intel® RSD Platform Design Guide (refer to Table 2).

When discussing Intel® RSD conformance, many questions arise regarding how Intel® RSD APIs align with Redfish* APIs. Intel® RSD is mapped to the schema and models standardized by specific Redfish* versions. Figure 2 shows how Intel® RSD contributes to the Redfish* community and aligns with Redfish* releases.
Figure 2  Intel® RSD mapping to Redfish® releases

- Redfish provides the schemas (general architecture)
- RSD provides a specific implementation of that architecture, i.e. a set of profiles that map to the Redfish schemas
Along with alignment to Redfish* schemas, Intel provides fully functional Intel® RSD reference code for the following items:

- Intel® RSD Pod Manager:
  - Northbound RESTful interface to expose Redfish*-aligned APIs
  - Discover, compose, and manage Intel® RSD resources

- Intel® RSD Pooled System Management Engine (PSME)/Rack Management Module (RMM):
  - PSME implementation to communicate with the Intel® RSD Pod Manager
  - Northbound RESTful interface to expose Redfish-aligned APIs
  - Manage and report the power and thermal matrix to the Pod Manager
  - RMM Implementations
  - Firmware (FW) extensions (conversion of IPMI to Redfish)

- Intel® RSD PSME Storage Service:
  - Remote storage service implementation with northbound RESTful APIs
  - Create initial iSCSI targets upon service initiation

- Intel® RSD Reference code provides stubs for PSME Network, Compute, and Chassis agents

**Note:** The Intel® RSD Reference code does NOT include all required Intel® RSD elements noted in the Intel® RSD Platform Architecture specification. Contact your Intel account representative with questions regarding the Intel® RSD reference code and architecture requirements.
This section reviews information to keep in mind at the start of the Intel® RSD product design process. This information is designed to help ensure smooth conformance testing at the end of the development cycle. Hardware, software, and API design prerequisites are covered.

For Intel® RSD hardware conformance, Intel engages with partners in the following ways:

- Architects from both Intel and partners collaborate and confirm the implementation of the Intel® RSD architecture.
- The Intel PAE and partners collaborate to complete the Intel® RSD hardware checklist document. The checklist covers the required items from the Intel® RSD Platform Architecture specification. For example, Intel audits the power supply and fan numbering consistency, compute blade serviceability, node reset support, and so forth.

For Intel® RSD software setup conformance, Intel engages with partners in the following ways:

- **Software Architecture**: Architects from both Intel and partners collaborate and confirm the implementation of the Intel® RSD software architecture. Implementation details include (but are not limited to):
  - Where the PSME/RMM/BMC will reside in the rack
  - APIs the partner plans to provide in addition to the Intel® RSD APIs (needed extensions for a specific design)
- **Compute Sled Telemetry**: For partners using Intel® RSD reference code, Intel includes an SMBIOS implementation to gather the needed telemetry data required for conformance (CPU, memory, BIOS, and network). For partners not using the Intel® RSD reference code, an equivalent implementation must be developed to report this data in order to pass conformance testing.
- **Location Hierarchy**: Pod Manager requires location hierarchy between the chassis and sled resources to locate composed node resources.
- **Power and Thermal Telemetry**: Functionality to display the power and thermal matrix must be implemented for conformance. The parameters in the power and thermal matrix include active power supplies, total watts consumed, and so forth.
- **PSME Network Functionality**: PSME networking conformance depends on the implementation of the required PSME network APIs.

A number of prerequisites are required to ensure Intel® RSD API conformance. Intel® RSD v2.2 includes required functionalities across the Pod Manager and PSME/RMM. Each required functionality may include the implementation of one or more APIs. To complete Intel® RSD conformance, all required APIs are expected to be implemented for all required functionality. Table 3 covers the most common issues with Intel® RSD APIs encountered during the conformance testing process.
Table 3  Required functionalities

<table>
<thead>
<tr>
<th>Pod Manager</th>
<th>PSME</th>
<th>Compute</th>
<th>Network</th>
<th>Chassis</th>
<th>Storage</th>
<th>PNC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSME and PSME storage resources</td>
<td>TPM config</td>
<td>Switch Port config</td>
<td>PATCHING</td>
<td>Discover and report SATA-based storage volume</td>
<td>Graceful restart of the PCIe* switch</td>
<td></td>
</tr>
<tr>
<td>Discovers rack resources</td>
<td>Discover BIOS/BMC, compute, memory, network matrix</td>
<td>StaticMAC config</td>
<td>Supports reporting OOB telemetry</td>
<td>Create, delete, attach, and detach iSCSI targets</td>
<td>Triggering PCIe* switch port action</td>
<td></td>
</tr>
<tr>
<td>Node composition</td>
<td>Event subscription</td>
<td>Binding/Unbinding switch port to ACL</td>
<td>Rack-level power and thermal matrix</td>
<td>Create and patch PCIe* switch zones</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Support boot override operations</td>
<td>Associating VLAN with switch ports</td>
<td></td>
<td></td>
<td>Discovering logical system containing PCIe* devices (no CPU or memory)³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PATCHing location ID for ChassisType rack¹</td>
<td>LAG creation (static mode)</td>
<td></td>
<td></td>
<td>PATCH PCIe8 system⁴</td>
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<tr>
<td>VLAN operations with GET, POST, and DELETE methods for a node</td>
<td></td>
<td></td>
<td></td>
<td>SecureErase operation through POST method⁵</td>
<td></td>
<td></td>
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<tr>
<td>Power and thermal zone attributes</td>
<td></td>
<td></td>
<td></td>
<td>EraseOnDetach attribute through Delete method⁶</td>
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<tr>
<td>Attaching and detaching PCIe* endpoint (NVMe drives) to a composed node</td>
<td></td>
<td></td>
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</table>

¹ Refer to Section 4.6.1.3 PODM 2.2 specification.
² Refer to Section 4.8.1.3 PSME 2.2 specification.
³ Refer to Section 4.10.1.2 PSME 2.2 specification.
⁴ Refer to Section 4.10.1.4 PSME 2.2 specification.
⁵ Refer to Section 4.21.1.4 PSME 2.2 specification.
⁶ Refer to Section 4.21.1.3 PSME 2.2 specification.

**Note:** The functionalities shown in Table 3 do **NOT** cover all **required** Intel® RSD functions. Please refer to the PSME/Pod Manager API specifications for details on all required, recommended, and optional functionalities.
5 Test for Intel® RSD Conformance

The next step is to test for Intel® RSD conformance. Some preparation is required before testing. To begin the process, complete the following tasks:

- Download the Intel® RSD v2.2 Conformance Test Suite (CTS) tool binary from Github* (refer to Table 2).
- Verify and validate the Intel® RSD architecture implementation in the hardware design checklist.
- Populate the rack with the required hardware and software components:
  - **Hardware**: Compute blades, storage servers, PCIe* devices, TOR (Ethernet) switch, PCIe* switch, cables, and power and thermal units.
  - **Software**: Pod Manager and PSME (network, compute, storage, RMM, PNC) agents.
- Enable Certificate Authority (CA) Authentication to establish a secure communication connection between the Pod Manager and PSME/RMM.
- Complete the Pod Manager and PSME/RMM conformance testing prerequisites described in this section.

For the CTS test to run successfully, a few setup tasks are required for both the Pod Manager and PSME/RMM prior to testing. These tasks streamline the testing and feedback processes for both partners and Intel engineers. Prior to running the CTS tool for Pod Manager, complete the following tasks:

- Create an Intel® RSD node with remote storage (iSCSI targets and NVMe drives), associated NICs, and VLAN.
- Create multiple logical nodes with the parameters defined in the Pod Manager API specification (section 6), including CPU, memory, drive (local and remote), and Ethernet type parameters. Verify they are populated.
- Ensure Resource Hierarchy by completing the following tasks. Refer to the Pod Manager and PSME API specifications for details. CTS will need to be reinitiated to achieve the actions noted:
  - Verify parent/child hierarchy (relationship in the rack).
  - Patch rack ID through the Pod Manager API, and paste the snipped to show that the RackID change is reflected in the Chassis ParentID field.
  - Create a new RSD node, and verify that the new RackID is displayed in the ParentID field.
  - Patch an existing node with an NVMe drive to verify that a new RackID is displayed in the ParentID field.
  - Reinitiate CTS to achieve all actions listed.
  - Provide CTS logs for each scenario.

- Ensure location awareness by completing the following tasks. Refer to the Pod Manager and PSME API specifications for details. CTS will need to be reinitiated to achieve the actions noted:
  - Create a new node, and verify that the node has a unique chassis ID and hierarchy.
  - Patch an existing RSD node with an NVMe drive to verify that the node has a unique chassis location ID and hierarchy.
  - Reinitiate CTS to achieve all actions listed above.
  - Provide CTS logs for each scenario.

Prior to running the CTS tool for the PSME/RMM, complete the following tasks:

- Create an Access Control List (ACL), and link the ACL rule to a switch port.
- Create an Ethernet Switch LAN, and associate an RSD logical node(s) with this VLAN.
- Create a Link Aggregation Group (LAG), and verify LAG information is visible through the Ethernet Switch APIs and on the Ethernet switch ports.
- Create a StaticMAC, and verify the StaticMAC (RSD Node MAC) is learned by the Ethernet switch port (NeighborMAC).
- Demonstrate the PSME and RMM event service subscription to the Pod Manager.
- (Optional) Support the required features for all connected switches for leaf and spine switch support, as mentioned in the PSME API, Section 4.25.
- (Optional) Implement the PSME task service APIs for Pooled NVMe functionality support.
When the tasks are competed, run the CTS tool and tests. Execute the GET, PATCH, and CRUD options with individual cmd and confirmation. Also, generate a separate log file for review through the CTS tool against the implemented Intel® RSD modules (Pod Manager, PSME, RMM). Send the data and any support questions to an Intel® RSD representative.

Intel representatives review the Intel® RSD conformance test results and provide feedback and troubleshooting guidance. If you find any errors with the CTS tool or process, contact your Intel® RSD representative for troubleshooting and technical escalation.

As an exception, Intel does have an Intel® RSD conformance waiver process. Conformance waivers can be investigated on a case-by-case basis. Work with your Intel® RSD representative for waiver questions and support.

Once all conformance tests pass (manual and automated), Intel grants Intel® RSD Conformance!