Document Number: DSP1097

Date: 2012-06-21

Version: 1.1.0

Virtual Ethernet Switch Profile

Document Type: Specification

Document Status: DMTF Standard

Document Language: en-US

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Foreword

This profile — the *Virtual Ethernet Switch Profile* (DSP1097) — was prepared by the System Virtualization, Partitioning and Clustering Working Group of the DMTF.

DMTF is a not-for-profit association of industry members dedicated to promoting enterprise and systems management and interoperability. For information about the DMTF, see http://www.dmtf.org.

Acknowledgments

The DMTF acknowledges the following individuals for their contributions to this document:

- (Editor) John Parchem – Microsoft
- Gareth Bestor – IBM
- Khasnabish Bhumip –ZTE Corporation
- John Crandall – Brocade Communications Systems
- Uri Elzur –Broadcom Corporation
- Jim Fehlig – Novell
- Kevin Fox –Huawei
- Kevin Fox – Sun Microsystems, Inc.
- Ilango Ganga – Intel Corporation
- Shravan Gaonkar –NetApp
- Ron Goering – IBM
- Steve Hand – Symantec
- Mark Hapner – Sun Microsystems, Inc
- Daniel Hiltgen – VMware
- Michael Johanssen – IBM
- Naveen Joy, Cisco
- Vivek Kashyap – IBM
- Mike Krause –HP
- Larry Lamers – VMware
- Fred Maciel – Hitachi
- Andreas Maier – IBM
- Aaron Merkin – IBM
- Shishir Pardikar – Citrix
- Murali Rajagopal –QLogic
- Hemal Shah – Broadcom Corporation
- Nihar Shah – Microsoft
- David Simpson – IBM
- Pat Thaler – Broadcom Corporation
- Eric Wells –Hitachi, LTD
- Jeff Wheeler –Huawei

Introduction

The information in this specification should be sufficient for a provider or consumer of this data to identify unambiguously the classes, properties, methods, and values that shall be instantiated and manipulated to represent and manage the components described in this document. The target audience for this specification is implementers who are writing CIM-based providers or consumers of management interfaces that represent the components described in this document.

Document conventions

Typographical conventions

The following typographical conventions are used in this document:

- Document titles are marked in *italics*.
- Important terms that are used for the first time are marked in *italics*.

Virtual Ethernet Switch Profile

1 Scope

This profile — the *Virtual Ethernet Switch Profile* — is an autonomous DMTF management profile that defines the minimum object model needed to provide for the inspection of a virtualization system's internal Ethernet switch and its components.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated or versioned references, only the edition cited (including any corrigenda or DMTF update versions) applies. For references without a date or version, the latest published edition of the referenced document (including any corrigenda or DMTF update versions) applies.

DMTF DSP0004, *CIM Infrastructure Specification 2.6*,
http://www.dmtf.org/standards/published_documents/DSP0004_2.6.pdf

DMTF DSP0200, *CIM Operations over HTTP 1.3*,
http://www.dmtf.org/standards/published_documents/DSP0200_1.3.pdf

DMTF DSP1001, *Management Profile Specification Usage Guide 1.0*,
http://www.dmtf.org/standards/published_documents/DSP1001_1.0.pdf

DMTF DSP1033, *Profile Registration Profile 1.0*,
http://www.dmtf.org/standards/published_documents/DSP1033_1.0.pdf

DMTF DSP1041, *Resource Allocation Profile 1.1*,
http://www.dmtf.org/standards/published_documents/DSP1041_1.1.pdf

DMTF DSP1042 *System Virtualization Profile 1.0*,
http://www.dmtf.org/standards/published_documents/DSP1042_1.0.pdf

DMTF DSP1043, *Allocation Capabilities Profile 1.0*,
http://www.dmtf.org/standards/published_documents/DSP1043_1.0.pdf

DMTF DSP1050, *Ethernet Port Resource Virtualization Profile 1.1*
http://www.dmtf.org/standards/published_documents/DSP1050_1.1.pdf

DMTF DSP1052, *Computer System Profile 1.0*,
http://www.dmtf.org/standards/published_documents/DSP1052_1.0.pdf

DMTF DSP1057, *Virtual System Profile 1.0*,
http://www.dmtf.org/standards/published_documents/DSP1057_1.0.pdf

DMTF DSP8049*, Network Port Profile Schema,*
http://schemas.dmtf.org/ovf/networkportprofile/1/dsp8049_1.0.0.xsd

IEEE 802.1Qbg - *Virtual Bridged Local Area Networks - Amendment XX: Edge Virtual Bridging*
http://www.ieee802.org/

ISO/IEC Directives, Part 2, *Rules for the structure and drafting of International Standards*
http://isotc.iso.org/livelink/livelink.exe?func=ll&objId=4230456&objAction=browse&sort=subtype

3 Terms and definitions

In this document, some terms have a specific meaning beyond the normal English meaning. Those terms are defined in this clause.

The terms "shall" ("required"), "shall not," "should" ("recommended"), "should not" ("not recommended"), "may," "need not" ("not required"), "can" and "cannot" in this document are to be interpreted as described in ISO/IEC Directives, Part 2, Annex H. The terms in parenthesis are alternatives for the preceding term, for use in exceptional cases when the preceding term cannot be used for linguistic reasons. Note that ISO/IEC Directives, Part 2, Annex H specifies additional alternatives. Occurrences of such additional alternatives shall be interpreted in their normal English meaning.

The terms "clause," "subclause," "paragraph," and "annex" in this document are to be interpreted as described in ISO/IEC Directives, Part 2, Clause 5.

The terms "normative" and "informative" in this document are to be interpreted as described in ISO/IEC Directives, Part 2, Clause 3. In this document, clauses, subclauses, or annexes labeled "(informative)" do not contain normative content. Notes and examples are always informative elements.

The terms defined in DSP0004, DSP0200, and DSP1001 apply to this document. The following additional terms are used in this document.

3.1
client
an application that exploits facilities specified by this profile

3.2
direct I/O
a virtual system is directly connected to a non-virtualized host

3.3
edge virtual bridging (EVB)
a set of bridging capabilities for supporting multiple virtual computer systems with Virtual Station Interfaces (VSIs), modeled as Ethernet ports. These capabilities reside in virtual Ethernet switches and adjacent bridges. EVB environments differ from other 802.1Q bridge environments in that virtual Network Interface Controller (vNIC) configuration information is available to the virtual Ethernet switch that is not normally available to an 802.1Q bridge.

3.4
embedded switch (eSwitch)
a virtual Ethernet switch that is embedded in a hardware Ethernet adapter that implements either the VEB or VEPA function

3.5
implementation
a set of CIM providers that realize the classes specified by this profile

3.6
network interface controller (NIC)
a NIC is a component that connects a computer system or virtual computer system to a network. It is also referred to as a network adapter or adapter or Ethernet adapter in this specification.

3.7
network port profile
a DSP8049 compliant document that describes a set of networking attributes that can be applied to Ethernet ports and virtual Ethernet switches.

3.8

virtual Ethernet bridge (VEB)

a frame relay service that supports local bridging between multiple VSIs and (optionally) the adjacent bridging environment. A VEB may be implemented in software as a vSwitch or as an eSwitch within a NIC. VEBs have access to vNIC configuration information that normally is not available to an 802.1Q bridge.

3.9

virtual Ethernet port aggregator (VEPA)

a virtual Ethernet port aggregator is a capability within a computer system that collaborates with an adjacent, external bridge to provide bridging support between multiple virtual computer systems and external networks. The VEPA collaborates by forwarding all computer system-originated frames to the adjacent bridge for frame processing and frame relay (including reflective relay forwarding) and by steering and replicating frames received from the VEPA uplink to the appropriate destinations. A VEPA may be implemented in software as a vSwitch or an eSwitch within a NIC. As in the case of VEBs, VEPAs have access to vNIC configuration information that normally is not available to an 802.1Q bridge

3.10

virtual Ethernet switch

an Ethernet switch that provides internal and external network connectivity to the virtual computer systems attached to it. A virtual Ethernet switch implements either the VEB or VEPA function.

3.11

virtual network interface controller (vNIC)

an entity that performs the Media Access Control (MAC), Link Level Control (LLC), management and control functions needed to attach a VM to a network.

3.12

virtual station interface (VSI)

an entity that comprises a vNIC (modeled as an Ethernet port), its internal point-to-point Ethernet connection to a virtual Ethernet switch, and the Ethernet port of the virtual Ethernet switch that is connected to the vNIC. Each VSI carries a single MAC service instance.

3.13

virtual switch

a software emulated virtual Ethernet switch typically implemented within the virtualization infrastructure (e.g. a Hypervisor).

3.14

virtualization platform

the virtualizing infrastructure provided by a host system that enables the deployment of virtual systems

4 Symbols and abbreviated terms

The abbreviations defined in DSP0004, DSP0200, and DSP1001 apply to this document. The following additional abbreviations are used in this document.

4.1

CIM

Common Information Model

4.2

CIMOM

CIM object manager

4.3
EASD
CIM_EthernetPortAllocationSettingData

4.4
EVB
edge virtual bridging

4.5
RASD
CIM_ResourceAllocationSettingData

4.6
SLP
service location protocol

4.7
VESSD
CIM_VirtualEthernetPortSettingData

4.8
VS
virtual system

4.9
VSSD
CIM_VirtualSystemSettingData

4.10
VEB
virtual Ethernet bridge

4.11
VEPA
virtual Ethernet port aggregator

4.12
vNIC
virtual network interface controller

4.13
VSI
virtual station interface

5 Synopsis

Profile Name: *Virtual Ethernet Switch*

Version: 1.1.0

Organization: DMTF

CIM Schema Version: 2.30

Central Class: CIM_ComputerSystem

Scoping Class: CIM_ComputerSystem

This profile is an autonomous profile that defines the minimum object model needed to provide for the inspection of a virtual Ethernet Switch and its components.

The instance of the CIM_ComputerSystem class representing a virtual Ethernet switch shall be the central instance and the scoping instance of this profile.

Table 1 lists DMTF management profiles on which this profile depends.

Table 1 – Related profiles

Profile Name	Organization	Version	Relationship	Description
Profile Registration	DMTF	1.0	Mandatory	The profile that specifies registered profiles
Virtual System	DMTF	1.0	Specializes	The autonomous profile that specifies the minimum object model needed to define a virtual system

6 Description

This profile specializes the autonomous DSP1057. This profile defines the minimum top-level object model needed to define a virtualization system's internal Ethernet switch (vSwitch) or a hardware embedded Ethernet switch (eSwitch). The primary design objective applied by this profile is that a virtual Ethernet switch and its components appear to a client as a hosted virtual system with dedicated switch functionality. Typical management tasks such as enumerating, analyzing, controlling, or configuring an Ethernet switch should be enabled without requiring the client to understand specific aspects of an Ethernet switch.

6.1 DMTF management profile relationships

This profile is complementary to the DSP1057, which it specializes, and to the DSP1042:

- The *Virtual Ethernet Switch Profile* focuses on specializing the use of the components specified in the DSP1057 to model the internal Ethernet Switches that are typically used to provide Ethernet connectivity within and outside of the virtualization platform.
- The DSP1057 focuses on virtualization aspects that relate to virtual systems and their virtual resources, such as modeling the *structure* of virtual systems and their resources. The profile introduces the concept of virtual system configurations allowing the inspection of virtual system configuration and state information.
- The DSP1042 focuses on virtualization aspects that relate to host systems and their resources, such as modeling the *relationships* between host resources and virtual resources. Further, it addresses virtualization-specific tasks such as the creation or modification of virtual Ethernet switches and their configurations.

Figure 1 shows a structure of DMTF management profiles. For example, an implementation that instruments a virtualization platform may implement some of the following DMTF management profiles:

- The *Virtual Ethernet Switch Profile* enables the inspection and basic operations on a virtual Ethernet Switch.
- The DSP1057 enables the inspection of and basic operations on virtual systems.
- The DSP1042 enables the inspection of host systems, their capabilities, and their services for creation and manipulation of virtual systems, including virtual Ethernet switches.

- Resource-type-specific profiles enable the inspection and operation of resources for one particular resource type. They apply to both virtual and host resources; they do not cover virtualization-specific aspects of resources. A client may exploit resource-type-specific management profiles for the inspection and manipulation of virtual and host resources in a similar manner.
- The DSP1050 is a specific resource allocation profile that enables the inspection and operation of resources for the two virtualization-specific uses of the CIM_EthernetPort class and the simple resource allocation used for the connection between an Ethernet adapter and an Ethernet switch port. This profile specializes the abstract DSP1041 and the abstract DSP1043 and is scoped by the DSP1042. A client may exploit this resource allocation profile to inspect all of the following:
  - the allocation of virtual Ethernet adapters and virtual Ethernet switch ports
  - the connection of an Ethernet adapter (virtual or physical) to a virtual Ethernet switch port
  - the connection of a virtual Ethernet switch to a embedded Ethernet switch
  - the allocation dependencies that the virtual resources have on host resources and resource pools
  - the capabilities describing possible values for the resource allocations
  - the capabilities describing the mutability of the resource allocations

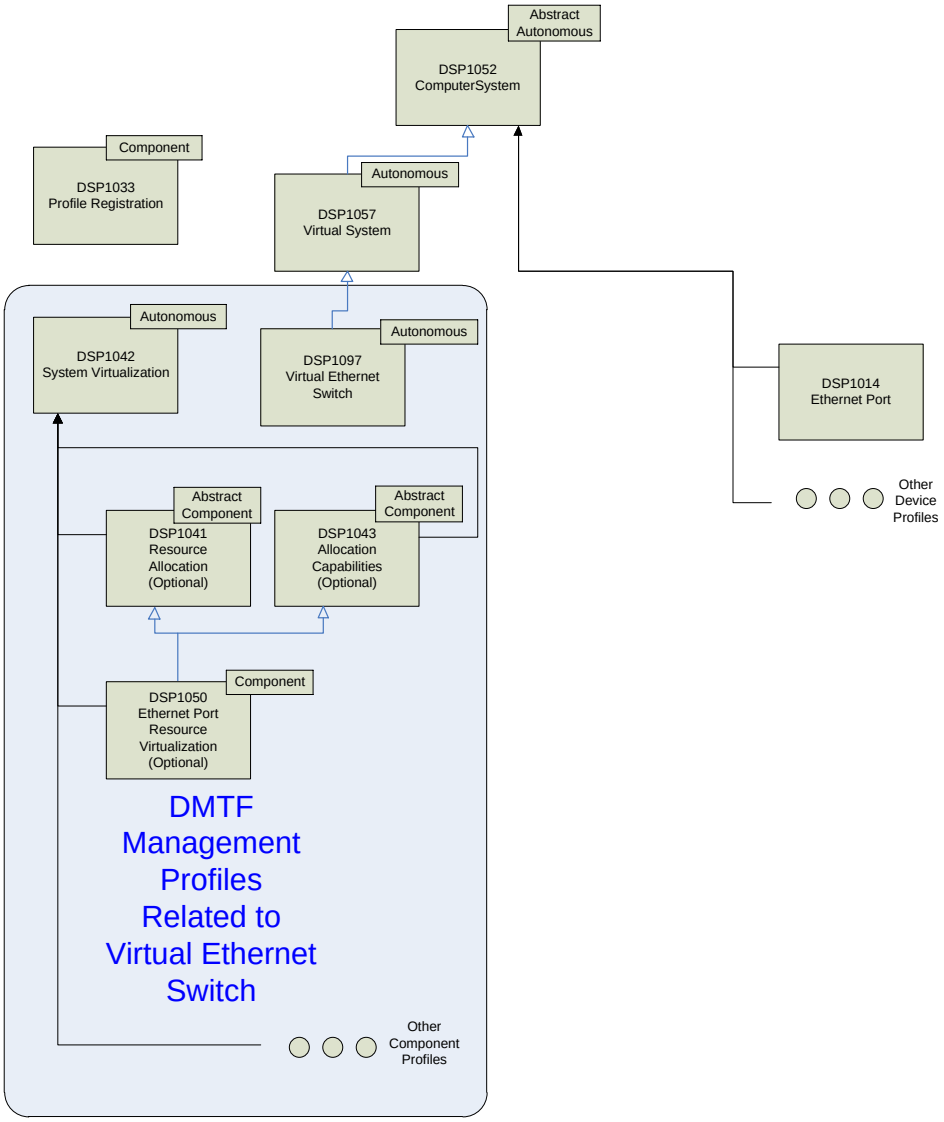


Figure 1 – DMTF Management profiles related to the virtual Ethernet switch

6.2 Virtual Ethernet switch class schema

Figure 2 shows the class schema of this profile. It outlines the elements that are owned or specialized by this profile, as well as the dependency relationships between elements of this profile and other profiles. For simplicity in diagrams, the *CIM_* prefix has been removed from class and association names.

The *Computer System Profile* (DSP1052) and the *Virtual System Profile* (DSP1057) reference additional classes in the class diagram that outline relationships with certain resources, services, and protocol endpoints. The *Virtual Ethernet Switch Profile* provides no specialization of these dependencies. For that reason they are not shown in the class diagram. For details, refer to the *Computer System Profile* (DSP1052) and to the component profiles referenced there.

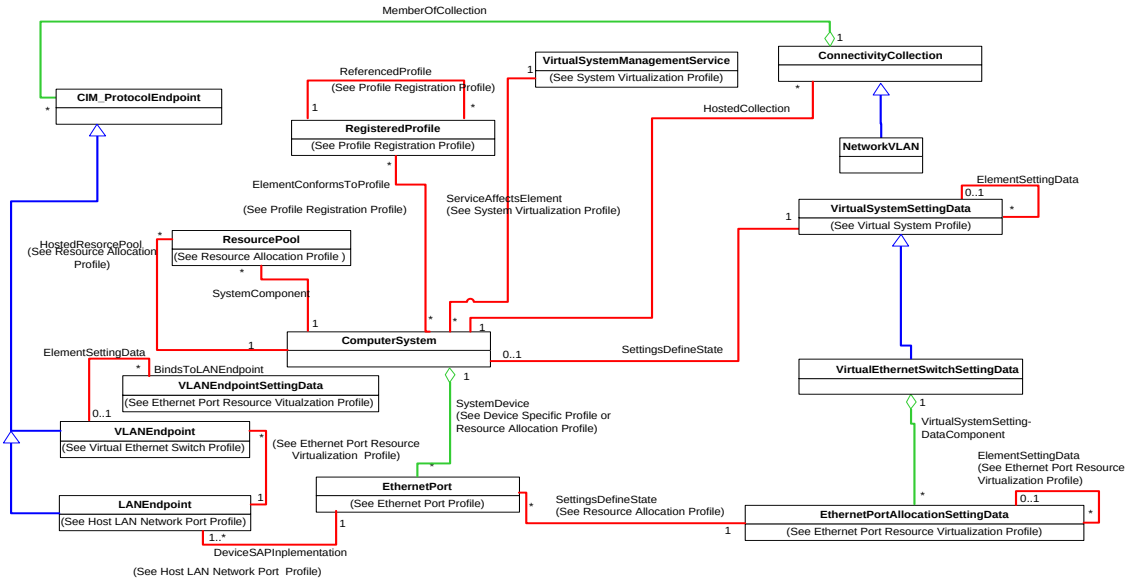


Figure 2 – Virtual Ethernet Switch Profile: Class Diagram

This profile specifies the use of the following classes and associations:

- The CIM_ComputerSystem class represents a virtual Ethernet switch or an embedded Ethernet switch.
- The CIM_RegisteredProfile class and the CIM_ElementConformsToProfile association are used to model conformance with this profile.
- The CIM_NetworkVLAN class represents a collection of VLAN endpoints that are members of the same VLAN.
- The CIM_LANEndpoint class represents the Ethernet communication endpoint of the CIM_EthernetPort that represents an Ethernet switch port.
- The CIM_VLANEndpoint class represents an endpoint on a virtual Ethernet switch that is assigned to a given VLAN or accepts traffic from one or more VLANs.
- The CIM_VLANEndPointSettingData class represents the configuration data for CIM_VLANEndpoint instances.
- The CIM_ConnectivityCollection class represents a collection of LANEndpoints that are able to communicate with each other.
- The CIM_VirtualEthernetSwitchSettingData class specializes the CIM_VirtualSystemSettingData class to add Ethernet switch-specific aspects to a virtual Ethernet switch.
    - CIM_VirtualEthernetSwitchSettingData.AssociatedResourcePool contains the list of associated resouce pools that the resource type 33 (Ethernet Connection) use for the allocation of Ethernet connections between an Ethernet Switch and a Virtual System, including another instance of an Ethernet Switch.

412 - EVBMode describes the Ethernet virtual bridge mode that this Ethernet switch is operating
413 in. The value 2 (VEB) indicates that the EVB's associated port on the adjacent bridge is not
414 configured for Reflective Relay and the value 3 (VEPA) indicates that the associated port
415 on the adjacent bridge is configured for Reflective Relay as defined in *IEEE 802.1Qbg*.

416 - VLANConnection lists the avalable or defined VLANs on this Ethernet switch.

417 • The CIM_SystemComponent association is used to model the relationship between the
418 virtualization system's host resource pool of resource type 33 (Ethernet Connection) and the
419 Virtual Ethernet Switch represented by the CIM_ComputerSystem class to which the resource
420 pool's Ethernet connections can be made. Ethernet Connection resource pools are used for the
421 allocation of a connection between an Ethernet port, that is typically part of a virtual system, and
422 an Ethernet switch port.

423 • The CIM_HostedCollection association is used to model the relationship of the Virtual Ethernet
424 Switch represented by the CIM_ComputerSystem class to each CIM_NetworkVLAN instance
425 that represents a VLAN available in the switch. It is also used to model the relationship of the
426 host system represented by the CIM_ComputerSystem class to each
427 CIM_ConnectivityCollection.

428 • The CIM_VirtualSystemSettingDataComponent association is used to model the aggregation of
429 instances of the CIM_EthernetPortAllocationSettingData class to one instance of the
430 CIM_VirtualEthernetSwitchSettingData class, forming a virtual Ethernet switch configuration.

431 • The CIM_VirtualSystemManagementService class contains the set of methods used to manage
432 a virtualization environment. In the context of this profile the methods support the lifecycle and
433 configuration of an Ethernet switch.

434 • The CIM_SettingsDefineState association is used to model the relationship between an
435 instance of the CIM_ComputerSystem class representing a virtual Ethernet Switch and an
436 instance of the CIM_VirtualEthernetSwitchSettingData class representing virtualization-specific
437 aspects of that virtual Ethernet switch.

438 • The CIM_ElementSettingData association is used to model the relationship between an element
439 and configuration data applicable to the element.

440 In general, any mention of a class in this document means the class itself or its subclasses. For example,
441 a statement such as "an instance of the CIM_LogicalDevice class" implies an instance of the
442 CIM_LogicalDevice class or a subclass of the CIM_LogicalDevice class.

443 ### 6.3 Ethernet switch states and transitions

444 The *Virtual Ethernet Switch Profile* adds no specialization to the states and transitions as specified in the
445 DSP1057. Unlike the DSP1057 model's requirement to match a model of a physical system, the virtual
446 Ethernet switch model is solely intended for use in a virtualization system and may not have a defined
447 corresponding physical system model. Thus, the need for power and enabled state transitions are
448 minimal and most implementations will implement the minimum as described in the DSP1057.

449 # 7 Implementation

450 This clause details the requirements related to classes and their properties for implementations of this
451 profile. The CIM Schema descriptions for any referenced element and its subelements apply.

452 The list of all methods covered by this profile is provided in clause 8. The list of all properties covered by
453 this profile is provided in clause 10.

454 In references to CIM Schema properties that enumerate values, the numeric value is normative and the
455 descriptive text following it in parenthesis is informational. For example, in the statement "If an instance of
456 the CIM_VirtualSystemManagementCapabilities class contains the value 3 (DestroySystemSupported) in

an element of the SynchronousMethodsSupported[ ] array property", the "value 3" is normative text and "(DestroySystemSupported)" is descriptive text.

Unless explicitly described, the text in this clause does not relax any of the implementation details described in clause 7 of the DSP1057.

7.1 CIM_ComputerSystem

The CIM_ComputerSystem class shall be used to represent virtual Ethernet switches. One instance of the CIM_ComputerSystem class shall exist for each Ethernet switch that is conformant to this profile, regardless of its state.

This subclause and all secondary subclauses apply to instances of the CIM_ComputerSystem class that represent Ethernet switches in this profile and the virtual system in the DSP1057.

7.1.1 CIM_ComputerSystem.Dedicated property

The Dedicated property shall be supported and set to match the value 38 (Ethernet Switch).

7.2 CIM_VirtualEthernetSwitchSettingData

There shall be exactly one instance of CIM_VirtualEthernetSwitchSettingData that represents the "state" virtual system configuration as specified in DSP1057. This subclause and all secondary subclauses apply to instances of the CIM_ VirtualEthernetSwitchSettingData class that represent the "state" virtual system configuration in this profile as specified in DSP1057.

7.2.1 CIM_VirtualEthernetSwitchSettingData.VirtualSystemType

The VirtualSystemType property shall be supported and contain the value "DMTF:VirtualEthernet Switch".

7.2.2 CIM_VirtualEthernetSwitchSettingData.AssociatedResourcePool

The AssociatedResourcePool property shall be supported if VirtualEthernetSwitchSettingData is used as an instance in a virtual system configuration as specified in this profile. The property shall contain the list of host resource pools that are associated with an Ethernet Switch for the purpose of the allocation of Ethernet connections between a virtual machine and an Ethernet switch.

7.2.3 CIM_VirtualEthernetSwitchSettingData.EVBmode

The EVBmode property shall be supported if VirtualEthernetSwitchSettingData is used as an instance in a virtual system configuration as specified in this profile. The property shall match one of two enumeration values:

1. 2 (VEB) for a virtual Ethernet bridge configuration of a software or a hardware embedded virtual Ethernet bridge
2. 3 (VEPA) for a virtual Ethernet Port aggregator configuration of a software or a hardware embedded Ethernet switch

The use of the array VLANConnection is optional. If VirtualEthernetSwitchSettingData is used as an instance in a virtual system configuration as specified in this profile, for each non-empty array element contained in the CIM_VirtualEthernetSwitchSettingData.VLANConnection array a corresponding instance of CIM_NetworkVLAN shall be instantiated with the CIM_NetworkVLAN.VLANID property set to the corresponding value contained in the array element.

7.3 CIM_NetworkVLAN

Each instance of CIM_NetworkVLAN representing a VLAN on the Ethernet Switch shall be associated with an instance of the CIM_HostedCollection to the instance of CIM_ComputerSystem used to represent

497 the Ethernet Switch. Each instance of CIM_NetworkVLAN representing a VLAN on the Ethernet Switch
498 shall be associated with an instance of CIM_MemberOfCollection to the instances of CIM_VLANEndpoint
499 scoped to the above described CIM_ComputerSystem, that are configured to be a member of the
500 represented VLAN. CIM_NetworkVLAN.TypeOfMedia property shall be set to the value 3 (Ethernet)

501

502 8 Methods

503 This profile does not define any extrinsic methods beyond those defined or referenced in the DSP1057.

504 8.1 Profile conventions for operations

505 The implementation requirements on operations for each profile class (including associations) are
506 specified in class-specific subclauses of this clause.

507 The default list of operations for all classes is:

508 • GetInstance
509 • EnumerateInstances
510 • EnumerateInstanceNames
511 • Associators
512 • AssociatorNames
513 • References
514 • ReferenceNames

515 Implementation requirements on operations defined in the default list are provided in the class-specific
516 subclauses of this clause.

517 The implementation requirements for methods of classes listed in 8.1, but not addressed by a separate
518 subclause of this clause are specified by the "Methods" clauses of respective base profiles, namely
519 DSP1041 and DSP1043. These profiles are specialized by this profile; in these cases, this profile does
520 not add method specifications beyond those defined in its base profiles.

521 8.1.1 CIM_ComputerSystem

522 All operations in the default list in 8.1 shall be implemented as specified by DSP0200. In addition, the
523 requirements of the CIM schema and other prerequisite specifications (including profiles) apply.

524 8.1.2 CIM_NetworkVLAN

525 All operations in the default list in 8.1 shall be implemented as specified by DSP0200. In addition, the
526 requirements of the CIM schema and other prerequisite specifications (including profiles) apply.

527 8.1.3 CIM_ConnectivityCollection

528 All operations in the default list in 8.1 shall be implemented as specified by DSP0200. In addition, the
529 requirements of the CIM schema and other prerequisite specifications (including profiles) apply.

8.1.4 CIM_ElementSettingData

All operations in the default list in 8.1 shall be implemented as specified by DSP0200. In addition, the requirements of the CIM schema and other prerequisite specifications (including profiles) apply.

8.1.5 CIM_HostedCollection

All operations in the default list in 8.1 shall be implemented as specified by DSP0200. In addition, the requirements of the CIM schema and other prerequisite specifications (including profiles) apply.

8.1.6 CIM_MemberOfCollection

All operations in the default list in 8.1 shall be implemented as specified by DSP0200. In addition, the requirements of the CIM schema and other prerequisite specifications (including profiles) apply.

8.1.7 CIM_RegisteredProfile

All operations in the default list in 8.1 shall be implemented as specified by DSP0200. In addition, the requirements of the CIM schema and other prerequisite specifications (including profiles) apply.

8.1.8 CIM_SystemComponent

All operations in the default list in 8.1 shall be implemented as specified by DSP0200. In addition, the requirements of the CIM schema and other prerequisite specifications (including profiles) apply.

8.1.9 CIM_VirtualEthernetSwitchSettingData

All operations in the default list in 8.1 shall be implemented as specified by DSP0200. In addition, the requirements of the CIM schema and other prerequisite specifications (including profiles) apply.

9 Use cases

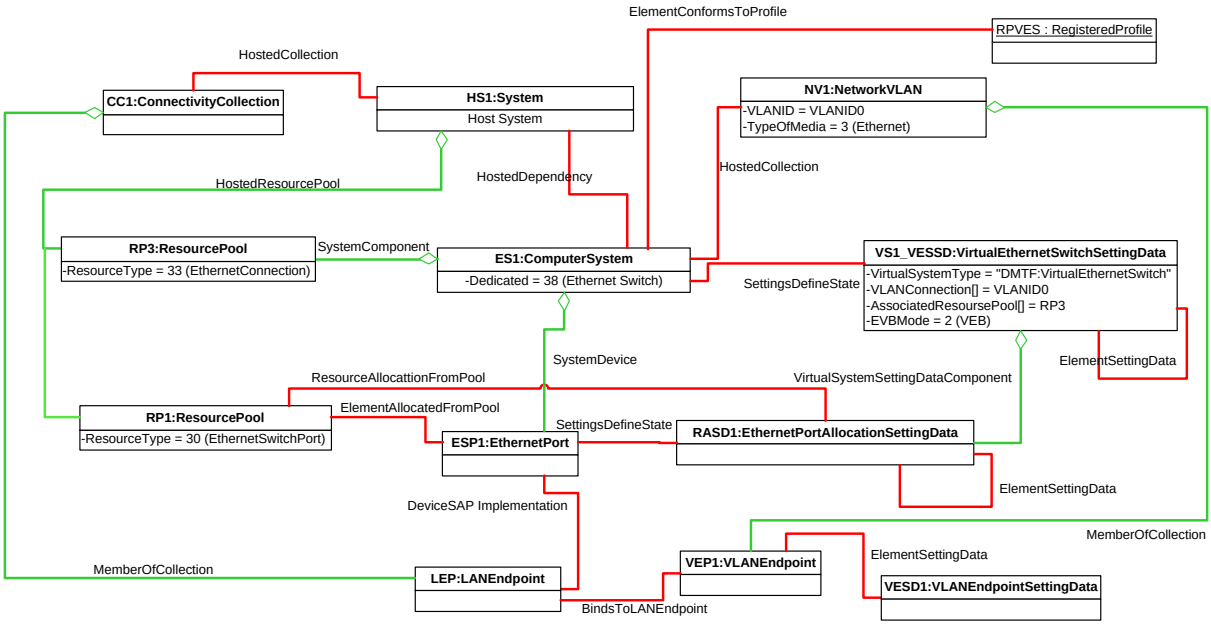
The following use cases and object diagrams illustrate the use of this profile. They are for informational purposes only and do not introduce behavioral requirements for implementations of the profile.

9.1 Virtual system detection and inspection

The DSP1057 includes a set of valid use cases that are not included in this document. This document includes only those use cases that are specific to the understanding, discovery, configuration and management specific to this profile's specialization of the DSP1057.

9.1.1 Example of virtual Ethernet switch and its relationship to a virtualization platform's host system

Figure 3 shows an example of a virtual Ethernet Switch (ES1) hosted by the virtualization platform (HS1). Although the diagram is simplified, the virtual Ethernet switch as modeled is a compliant virtual system as specified in the DSP1057 and this profile. This example switch has one Ethernet switch port represented by the instance of the CIM_EthernetPort class, ESP1. The allocation of the Ethernet switch port instance was from resource pool RP1 and is a compliant Ethernet switch port allocation as specified in the DSP1050 and the DSP1042. The Ethernet switch port is a member of the connectivity collection CC1, as shown with the CIM_MemberOfCollection association between instances LEP1:LANEndpoint and CC1:ConnectivityCollection. The DSP1050 compliant Ethernet switch port in the example is VLAN aware, as shown through the VLANEndpoint instance VEP1 and its membership in the NetworkVLAN collection NV1. This Ethernet switch currently has one VLAN (VLANID0) as defined in the instance VS1 of the VirtualEthernetSwitchSettingData.VLANConnection array property. ES1 is associated with one Ethernet Connection resource pool, RP2, that is used for the allocation for connections between virtual machines and Ethernet switch port on the associated Ethernet switch as specified in the DSP1050. RP2 is associated to ES1 with the SystemComponent association and configured in the instance VS1 of the VirtualEthernetSwitchSettingData.AssociatedResourcePool array property. Also the switch is configured or described in the EVBmode property of this instance of the class to be in Virtual Ethernet Bridge (VEB) mode.



574
575

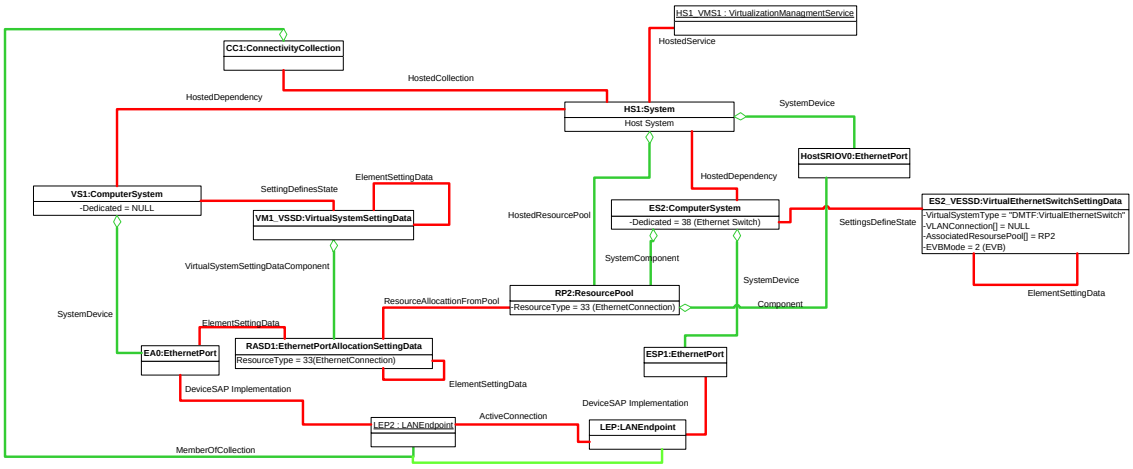
576 **Figure 3 – Basic example of virtual Ethernet switch**

577 ### 9.1.2 Virtual system connected to an SRIOV capable switch.

578 Figure 4 illustrates a virtual system directly connected to an Ethernet switch port on the embedded
579 hardware Ethernet switch. The Ethernet switch ports associated to the instance of the
580 CIM_ComputerSystem, ES1, represent the vNICs provided by the associated host Ethernet adapter
581 instance HostSRIOV0. A hardware embedded switch is basically modeled the same as a software virtual
582 Ethernet switch. In Figure 4 following the component association from the Ethernet connection resource
583 pool RP2 to the associated CIM_EthernetPort instance, HostSRIOV0, shows the host resource for the
584 resource pool is an Ethernet adapter. Not shown in Figure 4, the uplink port for this switch would be the
585 CIM_LANEndpoint instance associated with the host Ethernet adapter.

586 Instance EA0 represents a virtual NIC of the virtual system instance VS1. EA0 is connected to the
587 Ethernet switch port instance ESP1. This connection was allocated out of the resource pool instance RP2
588 as part of an Ethernet connection allocation as specified in DSP1050.

589



590

591 **Figure 4 – Virtual system connected to an SRIOV capable switch (Direct-I\O).**

592 ### 9.1.3 Virtual Ethernet switch connected to an embedded IOV switch.

593 Figure 5 and Figure 6 show examples of a software Ethernet Switch (VS1), hosted by the virtualization
594 platform (HS1), connected to an IOV capable Ethernet adapter's embedded Ethernet switch (ES2).
595 Figure 5 shows a software VEB that gains its network connectivity through an embedded switch that
596 represents the network connectivity through an IOV network adapter (HostSRIOV0:EthernetPort.) Figure
597 6 shows the same instance diagram with both the software Ethernet switch and the embedded hardware
598 Ethernet switch in VEPA mode. It is important to note that if any switch in a cascade of virtual switches
599 are in EVBMode 3 (VEPA), all of the switches in the cascade should be in VEPA mode for proper
600 functionality.

601 In the diagrams, both of the Ethernet switches are modeled as compliant virtual systems as specified in
602 the DSP1057 and this profile. In these instance diagrams, the embedded switch ES2 has one Ethernet
603 switch port represented by the instance of the CIM_EthernetPort class ESP1. Ethernet switch ES2 has
604 one Ethernet Connection resource pool, RP2, that is modeled as specified in the DSP1050 and is
605 associated to ES2 with the SystemComponent association. This pool is referenced in the instance
606 ES2_VESSD:VirtualEthernetSwitchSettingData.AssociatedResourcePool array property. The
607 EthernetPort (HostSRIOV0) representing the SRIOV capable Ethernet adapter is associated with the
608 Ethernet connection resource pool RP2. This configuration shows that the RP2 represents the capability
609 of the Ethernet adapter.

610 The diagrams each show an Ethernet connection allocation from the resource pool RP2 represented by
611 the CIM_EthernetPortAllocationSettingData instance RASD1 and the CIM_ActiveConnection association
612 between the two CIM_LANEndpoint instances LEP1 and LEP2. Also the two CIM_LANEndpoint
613 instances are members of the connectivity collection CC1, as shown with the CIM_MemberOfCollection
614 association between instances LEP1 and LEP2 and the CIM_ConnectivityCollection instance CC1. Both
615 DSP1050 compliant Ethernet switch ports in the examples are VLAN aware, as shown through the
616 VLANEndpoint instances VEP1 and VEP2 and their respective memberships in the NetworkVLAN
617 collections NV1 and NV2. Each Ethernet switch currently has one VLAN (VLANID0) as defined in the
618 instances VS1_VESSD and ES1_VESSD of the VirtualEthernetSwitchSettingData.VLANConnection array
619 property. Each switch has one Ethernet Connection resource pool RP2 and RP3 that are used as
620 specified in the DSP1050 and are associated to CIM_ComputerSystem instances ES2 and VES1 with the
621 SystemComponent association as configured in instances VS1_VESSD and ES2_VESSD of the
622 VirtualEthernetSwitchSettingData.AssociatedResourcePool array property.

In Figure 5 the virtual Ethernet switch VS1 and the embedded Ethernet switch ES2 as respectively configured in VS1_VSSD and ES2_VSSD are in VEB mode.
CIM_VirtualEthernetSwitchSettingData.EVBmode matches 2 (VEB) in each instance.

In Figure 6 the virtual Ethernet switch VS1 and the embedded Ethernet switch ES2 as respectively configured in VS1_VSSD and ES2_VSSD are in VEPA mode.
CIM_VirtualEthernetSwitchSettingData.EVBmode matches 3 (VEBA) in each instance.

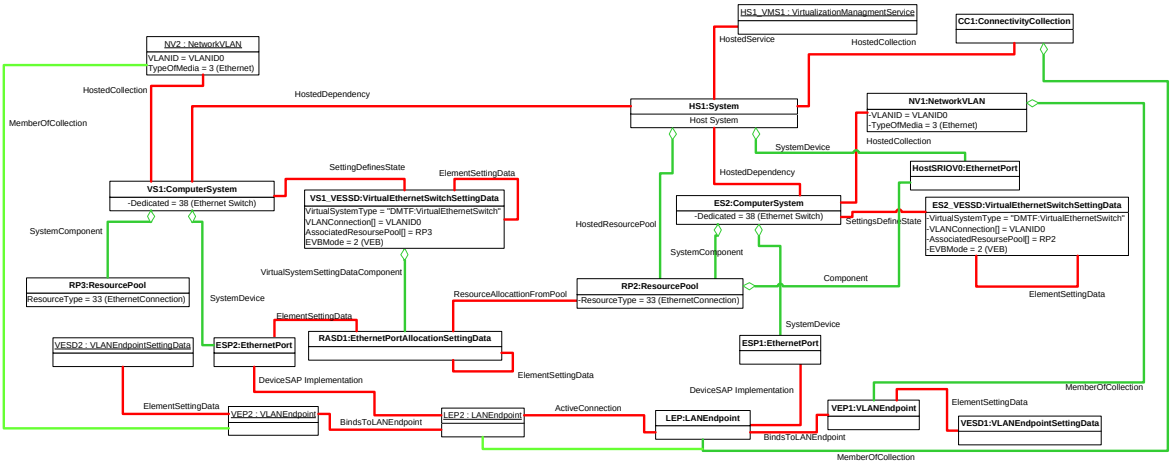


Figure 5 – Virtual Switch connected to an embedded IOV bridge

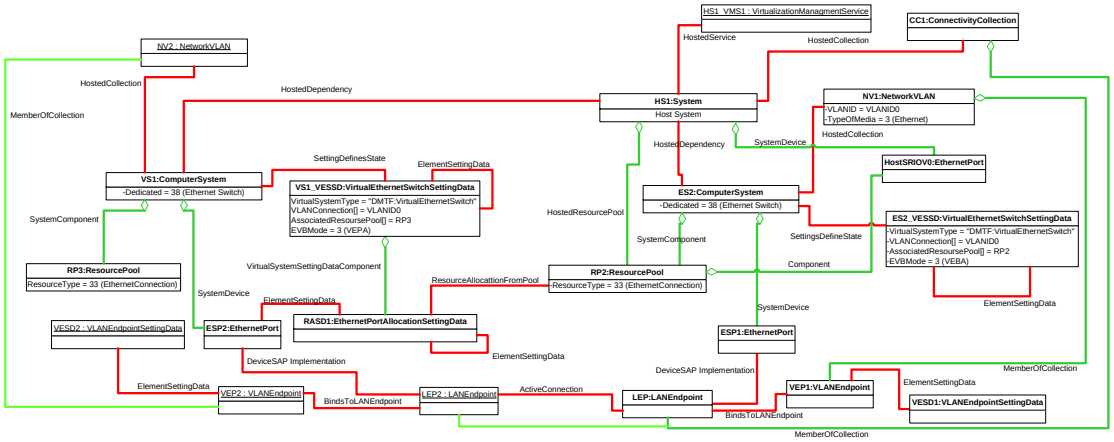


Figure 6 – Cascaded VEPA switch

9.1.4 Discover conformant virtual Ethernet switches using SLP

This use case describes how to locate instances of the CIM_ComputerSystem class that represent virtual Ethernet Switches that are central instances of this profile (the *Virtual Ethernet Switch Profile*). This process requires two steps:

1) The service location protocol (SLP) is used to locate CIM object managers (CIMOMs) where this profile is implemented. A CIMOM using SLP facilities provides information about itself to SLP in the form of an SLP service template. The service template may contain information about the set of DMTF management profiles that is implemented at the CIMOM.

2) Normal CIM enumeration and association resolution is used to find instances of the CIM_ComputerSystem class that represent central instances of this profile.

Assumption: This profile is registered in at least one CIMOM that maintains a registration with an SLP Directory Agent; the registration includes information about registered DMTF management profiles. The client is able to make SLP calls and invoke intrinsic CIM operations.

A client can locate instances of the CIM_ComputerSystem class that represent virtual systems that are central instances of this profile as follows:

1) The client invokes the SLPFindSrvs( ) SLP function:

   – The value of the srvtype parameter is set to “service:wbem”.

   – The value of the scopelist parameter is set to “default”.

   – The value of the filter parameter is set to “(RegisteredProfilesSupported=DMTF:Virtual Ethernet Switch Profile)”.

   The result is a list of URLs that identify CIMOMs where this profile (the *Virtual Ethernet Switch Profile*) is implemented.

2) The client contacts each of the CIMOMs and enumerates or queries the CIM_RegisteredProfile class.

   – As input, the client needs to use the address information of one server obtained in step 1) and issue the intrinsic EnumerateInstanceNames( ) CIM operation on the CIM_RegisteredProfile class. Alternatively, the client may issue the intrinsic ExecuteQuery CIM operation and specify a where clause that, for example, limits the value ranges for the RegisteredName and RegisteredVersion properties of the CIM_RegisteredProfile class.

   – As a result, the client receives a list of references to instances of the CIM_RegisteredProfile class that represent implementations of this profile (the *Virtual Ethernet Switch Profile*) at the intended target location. On a query operation this list is already limited according to the input selection criteria.

3) The client selects one reference and resolves the CIM_ElementConformsToProfile association from the instance of the CIM_RegisteredProfile class to instances of the CIM_ComputerSystem class.

   – As input, the client needs to provide the reference to an instance of the CIM_RegisteredProfile class that was selected from the result set obtained in step 2).

   – As a result, the client receives a list of references referencing instances of the CIM_ComputerSystem class that represents virtual Ethernet switches.

Result: The result is that the client knows a set of references referencing instances of the CIM_ComputerSystem class that represent virtual Ethernet Switches that are central instances of this profile.

9.1.5 Locate Ethernet switches hosted by a host system

Assumption: The client knows a reference to an instance of the CIM_System class that is a central instance of the DSP1042 and represents a host system.

- The client invokes the intrinsic AssociatorNames( ) CIM operation for the list of virtual systems, as follows:

681 – The value of the ObjectName parameter is set to refer to the instance of the CIM_System
682 class.

683 – The value of the AssocClass parameter is set to "CIM_HostedDependency".

684 – The value of the ResultClass parameter is set to "CIM_ComputerSystem".

685 The result is a list of references to instances of the CIM_ComputerSystem class.

686 • The resulting set of references to instances of the CIM_ComputerSystem class where the
687 property Dedicated matches “38 (Ethernet Switch)” represent Ethernet switches that are hosted
688 by the host system. From this list the client invokes the intrinsic AssociatorNames( ) CIM
689 operation on each element for an associated CIM_VirtualEthernetSwitchSettingData as follows:

690 • The value of the ObjectName parameter is set to refer to the instance of the
691 CIM_ComputerSystem class received in the previous operation.

692 • The value of the AssocClass parameter is set to "CIM_SettingsDefineState".

693 • The value of the ResultClass parameter is set to "CIM_VirtualEthernetSwitchSettingData".

694 **Result:** Each ComputerSystem with an associated instance of CIM_VirtualEthernetSwitchSettingData
695 where the VirtualSystemType matches “DMTF:VirtualEthernetSwitch” is a host virtual Ethernet switch.

696 10 CIM elements

697 Table 2 lists CIM elements that are defined or specialized for this profile. Each CIM element shall be
698 implemented as described in Table 2. The CIM Schema descriptions for any referenced element and its
699 subelements apply.

700 Clauses 7 (“Implementation”) and 8 (“Methods”) may impose additional requirements on these elements.

701 **Table 2 – CIM Elements: Virtual System Profile**

Element	Requirement	Notes
Classes		
CIM_ComputerSystem	Mandatory	See 10.1.
CIM_ConnectivityCollection	Optional	See 10.2.
CIM_ElementSettingData for CIM_VirtualEthernetSwitchSettingData	Mandatory	See 10.3.
CIM_ElementSettingData for CIM_VLANEndpointSetttingData	Conditional	See DMTF DSP1050
CIM_ElementSettingData for CIM_VirtualEthernetPortSettingData	Conditional	See DMTF DSP1050
CIM_HostedCollection	Conditional	See 10.4.
CIM_MemberOfCollection	Mandatory	See 10.5
CIM_NetworkVLAN	Optional	See 10.6
CIM_RegisteredProfile	Mandatory	See 10.7
CIM_SettingsDefineState	Mandatory	See 10.8.
CIM_SystemComponent	Conditional	See 10.9.
CIM_VirtualEthernetSwitchSettingData	Mandatory	See 10.10.
CIM_VirtualSystemSettingDataComponent	Conditional	See 10.11.
Indications		
None defined in this profile		

10.1 CIM_ComputerSystem

The use of the CIM_ComputerSystem class is specialized in the DSP1052 and refined in this profile.

The requirements in Table 3 are in addition to those mandated by the DSP1052.

Table 3 – Class: CIM_ComputerSystem

Elements	Requirement	Notes
Dedicated	Mandatory	See 7.1.1.

10.2 CIM_ConnectivityCollection (Optional)

An implementation may use an instance of the CIM_ConnectivityCollection class to represent a collection of associated CIM_LANEndpoint instances that have current or potential connectivity between the endpoints in this collection.

10.3 CIM_ElementSettingData (CIM_VirtualEthernetSwitchSettingData)

The CIM_ElementSettingData association associates the top-level instance of the CIM_VirtualEthernetSwitchSettingData class in a “State” virtual Ethernet switch configuration and top-level instances of the CIM_VirtualEthernetSwitchSettingData class in other virtual Ethernet Switch system configurations. The use of the CIM_ElementSettingData class is specialized in the DSP1052 and refined in this profile.

Table 4 lists the requirements for this association.

Table 4 – Association: CIM_ElementSettingData

Element	Requirement	Notes
ManagedElement	Mandatory	**Key:** Reference to an instance of the CIM_VirtualEthernetSwitchSettingData class that represents the virtual-switch specific properties of the virtual Ethernet Switch **Cardinality:** 0..1
SettingData	Mandatory	**Key:** Reference to an instance of the CIM_VirtualEthernetSwitchSettingData class that represents a virtual Ethernet switch configuration **Cardinality:** *
IsDefault	Mandatory	None
IsCurrent	Unspecified	None
IsNext	Mandatory	None
IsMinimum	Mandatory	Shall be set to 1 (Not Applicable)
IsMaximum	Mandatory	Shall be set to 1 (Not Applicable)

NOTE 1:	The cardinality of the ManagedElement role is 0..1 (and not 1) because there are instances of the CIM_VirtualEthernetSwitchSettingData class that do not have an associated instance of the CIM_VirtualEthernetSwitchSettingData class through the CIM_ElementSettingData association.
NOTE 2:	The cardinality of the SettingData role is * (and not 1) because there are instances of the CIM_VirtualEthernetSwitchSettingData class that do not have an associated instance of the CIM_VirtualEthernetSwitchSettingData class through the CIM_ElementSettingData association.

10.4 CIM_HostedCollection (conditional)

The CIM_HostedCollection association may associate an instance of the CIM_ComputerSystem class representing a virtual Ethernet Switch and an instance of CIM_NetworkVLAN or associates an instance of the CIM_System class representing the host system and an instance of CIM_ConnectivityCollection.

Support of the CIM_HostedCollection association is conditional on the support of CIM_NetworkVLAN or CIM_ConnectivityCollection.

Table 5 lists the requirements for this association.

Table 5 – Association: CIM_HostedCollection

Elements	Requirement	Notes
Antecedent	Mandatory	**Key:** Reference to an instance of the CIM_ComputerSystem class that represents a virtual Ethernet Switch or the instance of CIM_ComputerSystem class that represent the host. **Cardinality:** 1
Dependent	Mandatory	**Key:** Reference to an instance of CIM_NetworkVLAN or an instance of CIM_ConnectivityCollection **Cardinality:** *

10.5 CIM_MemberOfCollection (optional)

The CIM_MemberOfCollection association associates an aggregation of instances of the CIM_ProtocolEndpoint class representing either a CIM_VLANEndpoint instances or CIM_LANEndpoint instances to either an instance of CIM_ConnectivityCollection for LAN endpoints or NetworkVLAN for VLAN endpoints.

Table 6 lists the requirements for this association.

Table 6 – Association: CIM_MemberOfCollection

Elements	Requirement	Notes
CIM_Collection	Mandatory	**Key:** Reference to an instance of the CIM_ProtocolEndpoint **Cardinality:** 1
CIM_ManagedElement	Mandatory	**Key:** Reference to an instance of CIM_NetworkVLAN or an instance of CIM_ConnectivityCollection **Cardinality:** *

10.6 CIM_NetworkVLAN (optional)

The CIM_NetworkVLAN class represents a collection of VLANEndpoints that are members of the VLAN. If modeling switches with VLAN support, there should be an instance of NetworkVLAN for every VLAN available in a switch.

737 Table 7 contains the requirements for this association specific to this profile.

738 **Table 7 – Class: CIM_NetworkVLAN**

Element	Requirement	Notes
TypeOfMedia	Mandatory	See 7.3

739 10.7 CIM_RegisteredProfile

740 The use of the CIM_RegisteredProfile class is specialized by the DSP1033. The requirements denoted in
741 Table 8 are in addition to those mandated by the DSP1033.

742 **Table 8 – Class: CIM_RegisteredProfile**

Elements	Requirement	Notes
RegisteredOrganization	Mandatory	Shall be set to 2 (DMTF)
RegisteredName	Mandatory	Shall be set to “Virtual Ethernet Switch”
RegisteredVersion	Mandatory	Shall be set to the version of this profile: “1.1.0b”

743 10.8 CIM_SettingsDefineState

744 The CIM_SettingsDefineState association associates an instance of the CIM_ComputerSystem class
745 representing a virtual Ethernet Switch and an instance of the CIM_VirtualEthernetSwitchSettingData class
746 that represents the virtualization-specific properties of a virtual system and is the top-level instance of the
747 “State” virtual system configuration.

748 Table 9 contains the requirements for this association.

749 **Table 9 – Association: CIM_SettingsDefineState**

Elements	Requirement	Notes
ManagedElement	Mandatory	**Key:** Reference to an instance of the CIM_ComputerSystem class that represents a virtual Ethernet switch **Cardinality:** 0..1
SettingData	Mandatory	**Key:** Reference to an instance of the CIM_VirtualEthernetSwitchSettingData class that represents the virtualization-specific properties of a virtual system **Cardinality:** 1
NOTE: The cardinality of the ManagedElement role is 0..1 (and not 1) because there are instances of the CIM_VirtualEthernetSwitchSettingData class that do not have an associated instance of the CIM_ComputerSystem class through the CIM_SettingsDefineState association.		

750 10.9 CIM_SystemComponent

751 The CIM_SystemComponent association associates an instance of the CIM_ComputerSystem class
752 representing a virtual Ethernet Switch and one or more instances of the CIM_ResourcePool class that
753 represent a pool of available Ethernet switch port connections for allocation to a virtual computer system.

754 Table 10 lists the requirements for this association.

755 **Table 10 – Association: CIM_SystemComponent**

Elements	Requirement	Notes
GroupComponent	Mandatory	**Key:** Reference to an instance of the CIM_ComputerSystem class that represents a virtual Ethernet Switch **Cardinality:** 1
PartComponent	Mandatory	**Key:** Reference to an instance of the CIM_ResourcePool that represents a pool of allowable Ethernet Connection allocations **Cardinality:** *

756 10.10 CIM_VirtualEthernetSwitchSettingData

757 The CIM_VirtualEthernetSwitchSettingData class specializes the CIM_VirtualSystemSettingData class,
758 specified in the DSP1057, by adding switch-specific properties.

759 The requirements in Table 11 are in addition to those mandated by the DSP1057.

760 Table 11 contains the requirements for this class.

761 **Table 11 – Class: CIM_VirtualEthernetSwitchSettingData**

Element	Requirement	Notes
VirtualSystemType	Mandatory	See 7.2.1.
AssociatedResourcePool	Mandatory	See 7.2.2.
EVBmode	Mandatory	See 7.2.3.
VLANConnection	Optional	See 7.2.3.

762 10.11 CIM_VirtualSystemSettingDataComponent (conditional)

763 CIM_VirtualSystemSettingDataComponent is specialized in the DSP1042. The requirements in Table 12
764 are in addition to those mandated by the DSP1042.

765 **Table 12 – Association: CIM_VirtualSystemSettingDataComponent**

Elements	Requirement	Notes
GroupComponent	Mandatory	**Key:** Reference to an instance of the CIM_VirtualEthernetSwitchSettingData class that represents the virtual aspects of a virtual Ethernet switch **Cardinality:** 1
PartComponent	Mandatory	**Key:** Reference to an instance of the CIM_ResourceAllocationSettingData class that represents virtual aspects of a virtual resource **Cardinality:** 0..*

766

ANNEX A
(informative)

Change log

Version	Date	Description
1.0.0	2010-07-29	
1.1.0	2012-06-21	Released as DMTF Standard