Network Management - Virtual Routing and Forwarding Profile

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122   Foreword

123   The *Network Management - Virtual Routing and Forwarding Profile* (DSP1065) was prepared by the
124   Network Services Management Working Group of the DMTF.

125   DMTF is a not-for-profit association of industry members dedicated to promoting enterprise and systems
126   management and interoperability.

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140   Introduction

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

146   **Document conventions**

147   **Typographical conventions**

148   The following typographical conventions are used in this document:

149   • Document titles are marked in *italics*.
150   • ABNF rules are in `monospaced font`.

151

Network Management - Virtual Routing and Forwarding Profile

1 Scope

The *Network Management - Virtual Routing and Forwarding Profile* is a profile that will specify the CIM schema and use cases associated with the general and common aspects of routing and forwarding table including VRFs found in an Ethernet Switch with routing capabilities. This profile includes a specification of the Layer 3 interface configuration service, Sub-Interface, Tunnel Interface switch virtual interface and loopback interface.

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 2.7*,
http://www.dmtf.org/standards/published_documents/DSP0004_2.7.pdf

DMTF DSP0200, *CIM Operations over HTTP 1.3.1,*
http://www.dmtf.org/standards/published_documents/DSP0200_1.3.pdf

DMTF DSP0223, *Generic Operations 1.0*,
http://www.dmtf.org/standards/published_documents/DSP0223_1.0.pdf

DMTF DSP1001, *Management Profile Specification Usage Guide 1.1*,
http://www.dmtf.org/standards/published_documents/DSP1001_1.1.pdf

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

DMTF DSP1097, *Virtual Ethernet Switch Profile 1.1*,
http://dmtf.org/sites/default/files/standards/documents/DSP1097_1.1.pdf

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.

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

193 The terms defined in DSP0004, DSP0223, and DSP1001 apply to this document. The following additional
194 terms are used in this document (update the entire doc using the following revised terminology)

195 **3.1**
196 **If**

197 indicates requirements to be followed strictly to conform to the document when the specified conditions
198 are met

199 **3.2**
200 **Shall**

201 indicates requirements to be followed strictly to conform to the document and from which no deviation is
202 permitted

203 **3.3**
204 **Should**

205 indicates that among several possibilities, one is recommended as particularly suitable, without
206 mentioning or excluding others, or that a certain course of action is preferred but not necessarily required.

207 **3.4**
208 **May**

209 indicates a course of action permissible within the limits of the document

210 **3.5**
211 **pending configuration**

212 indicates the configuration that will be applied to an IP network connection the next time the IP network
213 connection accepts a configuration

214 **3.6**
215 **referencing profile**

216 indicates a profile that owns the definition of this class and can include a reference to this profile in its
217 "Referenced Profiles" table

218 **3.7**
219 **unspecified**

220 indicates that this profile does not define any constraints for the referenced CIM element or operation

221 # 4 Symbols and abbreviated terms

222 The abbreviations defined in DSP0004, DSP0223, and DSP1001 apply to this document. The following
223 additional abbreviations are used in this document.

224 **4.1**
225 **IP**

226 Internet Protocol

227 **4.2**
228 **VLAN**

229 Virtual Local Area Network

230 **4.3**
231 **VRF**
232 Virtual Routing and Forwarding table

233 **4.4**
234 **BGP**
235 Border Gateway Protocol

236 **5   Synopsis**

237 **Profile name:** Network Management - Virtual Routing and Forwarding Profile

238 **Version:** 1.0.0

239 **Organization:** DMTF

240 **CIM Schema version:** 2.52

241 **Central class:** CIM_VRFConfigurationService

242 **Scoping class:** CIM_System

243 The *Network Management - Virtual Routing and Forwarding Profile* is a base (abstract) profile that will
244 specify the CIM schema and use cases associated with the general and common aspects of Network
245 Policy Management. This profile includes a specification of the Network Policy Service, Network Policy,
246 Network Policy Rule and Setting Data, Policy Conditions and Action and describes how the network
247 Policies can be applied to the Managed Elements.

248 Table 1 identifies profiles on which this profile has a dependency.

249   **Table 1 – Referenced profiles**

Profile Name	Organization	Version	Requirement	Description
Profile Registration	DMTF	1.0	Mandatory	None
Virtual Ethernet Switch	DMTF	1.1	Mandatory	None

250 **6   Description**

251 The *Network Management - Virtual Routing and Forwarding Profile* is a base (abstract) profile that will
252 specify the CIM schema and use cases associated with the general and common aspects of creating and
253 configuring The routes and associated interfaces of a Virtual Routing and Forwarding table typically found
254 in an Ethernet switch with routing capabilities. This includes the VRF configuration service, to instantiate
255 and configure VRFs and their associated routes.

256 **6.1   Class diagram**

257 Figure 1 represents the class schema for the *Network Management - Virtual Routing and Forwarding*
258 *Profile*. For simplicity, the CIM_ prefix has been removed from the names of the classes.

259
260
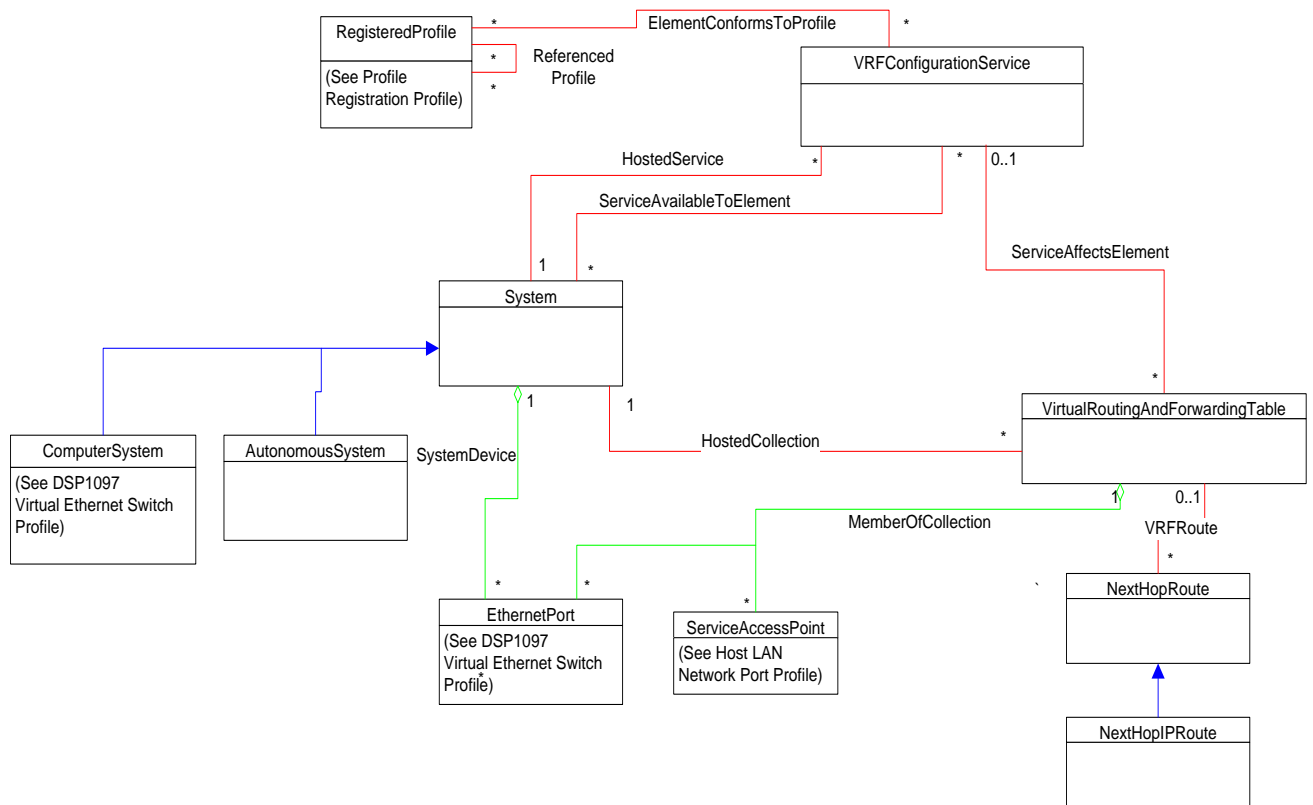
Figure 1 – Network Management - Virtual Routing and Forwarding Profile: Class diagram

262 Figure 1 is a class diagram for the configuration of the virtual routing and forwarding tables (VRF) typically
263 found in an Ethernet switch that supports routing. The figure shows the CIM_VRFConfigurationService
264 and the CIM_VirtualRoutingAndForwardingTable classes and the associated ports and interfaces that are
265 within the VRF. A set of CIM_NextHopIPRoute instances describe the associated routes in the VRF. A
266 VRF is hosted by a System typically either an instance of CIM_ComputerSystem, representing an
267 Ethernet Switch or an Instance of a router possibly within a switch represented by
268 CIM_AutonomousSystem.

6.2 CIM_VirtualRoutingAndForwardingTable

270 A VRF allows multiple routing tables with independent, the same or overlapping IP addresses within the
271 same Ethernet switch. An instance of CIM_VirtualRoutingAndForwardingTable represents a single VRF. It
272 is a subclass of CIM_SystemSpecificCollection where the members are interfaces, represented as
273 CIM_ServiceAccessPoint instances or ports represented by CIM_EthernetPort. Also associated with the
274 VRF are the routes configured for the VRF.

6.3 CIM_VRFConfigurationService

276 The VRF configuration service manages the creation and deletion of VRF, the addition and removal of
277 ports and interfaces to the VRF and the configuration of the next hop routes associated with the VRF.

278   6.4   CIM_System

279   Subclasses of CIM_System represent either an Ethernet switch, CIM_ComputerSystem, or a router,
280   CIM_AutonomousSystem. VRFs can be created and associated with any of these example subclasses of
281   CIM_System.

282   6.5   CIM_ServiceAccessPoint

283   This is the base class for interfaces and service access points in an Ethernet switch or a router. An
284   interface within an Ethernet switch or router can be a member of no more than one
285   CIM_VirtualRoutingAndForwardingTable collection. An example would be an instance of
286   CIM_RemoteServiceAccessPoint representing an NTP or RADIUS service. Another example would be a
287   layer 3 interface such as CIM_IPSubinterface which also has CIM_ServiceAccessPoint as a super class.

288   6.6   CIM_EthernetPort

289   Represents the switch ports in an Ethernet switch. Once a VRF is configured, a port can be assigned to
290   the VRF which would make the CIM_EthernetPort instance a member of the
291   CIM_VirtualRoutingAndForwardingTable collection.

292   6.7   CIM_NextHopIPRoute

293   Each VRF can have an associated set of next hop routes. Static routes can be configured using the
294   associated CIM_VRFConfigurationService. Each route results in an instance of CIM_NextHopIPRoute
295   that is associated to VRF through a CIM_VRFRoute instance.

296   7   Implementation

297   This clause details the requirements related to the arrangement of instances and properties of instances
298   for implementations of this profile.

299   7.1   Representing the Virtual routing and forwarding table management
300   capabilities

301   7.1.1   CIM_System

302   An instance of CIM_System shall be the scoping class for this profile. This scoping instance should be an
303   instance of either CIM_ComputerSystem representing an Ethernet switch or an instance of
304   CIM_AutonomousSystem representing a router.

305   The scoping class instance of CIM_System shall be associated to central class instance of
306   CIM_VRFConfigurationService through an instance of CIM_HostedService.

307   If a CIM_System instance can be the TargetRouter of a CIM_VRFConfigurationService.CreateVRF()
308   method call, the CIM_System instance shall be associated to that instance of the
309   CIM_VRFConfigurationService through an instance of CIM_ServiceAvailableToElement.

310   7.1.2   CIM_VRFConfigurationService

311   One or more instances of CIM_VRFConfigurationService shall be instantiated.

312   Each instance of the CIM_VRFConfigurationService shall be associated with the instance of the scoping
313   CIM_System through an instance of CIM_HostedService.

314   Instances of CIM_System that may be used as the HostSystem parameter of a
315   CIM_VRFConfigurationService.CreateVRF() method shall be associated to the
316   CIM_VRFConfigurationService instance through an instance of CIM_ServiceAvailableToElement.

317   The instances of the CIM_VRFConfigurationService class shall be associated to each
318   CIM_VirtualRoutingAndForwardingTable instance that may be used as the VRF parameter of its
319   AddRoute(), AddPortMember() or AddSAPMember() method through an instance of
320   CIM_ServiceAffectsElement.

321   7.1.3   CIM_VirtualRoutingAndForwardingTable

322   Each CIM_VirtualRoutingAndForwardingTable instance shall be associated to an instance of
323   CIM_System through an instance of CIM_HostedCollection.

324   If the CIM_VirtualRoutingAndForwardingTable instance was created with a
325   CIM_VRFConfigurationService.CreateVRF() method, the CIM_System instance referenced in the
326   TargetRoutre method parameter shall be associated through an instance of CIM_HostedCollection.

327   If the CIM_VirtualRoutingAndForwardingTable instance was created with a
328   CIM_VRFConfigurationService.CreateVRF() method with a null TargetRouter method parameter, the
329   CIM_VirtualRoutingAndForwardingTable instance shall be associated to the scoping instance of
330   CIM_System through an instance of CIM_HostedCollection.

331   7.1.4   CIM_NextHopIPRoute

332   Each instance of CIM_NextHopIPRoute that describes a route for an instance of a
333   CIM_VirtualRoutingAndForwardingTable (see 7.1.3) shall be associated to that instance through an
334   instance of CIM_VRFRoute.

335   7.1.5   CIM_EthernetPort

336   Each instance of CIM_EthernetPort that describes a switch port contained in a VRF,
337   CIM_VirtualRoutingAndForwardingTable (see 7.1.3), shall be associated to the VRF instance through an
338   instance of CIM_MemberOfCollection. An instance of CIM_EthernetPort shall be associated to no more
339   than one instance of CIM_VirtualRoutingAndForwardingTable.

340   7.1.6   CIM_ServiceAccessPoint

341   Each instance of CIM_ServiceAccessPort that describes an interface or a remote service access point
342   contained in a VRF, CIM_VirtualRoutingAndForwardingTable (see 7.1.3), shall be associated to the VRF
343   instance through an instance of CIM_MemberOfCollection. An instance of CIM_ServiceAccessPoint shall
344   be associated to no more than one instance of CIM_VirtualRoutingAndForwardingTable.

345   8   Methods

346   This clause details the requirements for supporting intrinsic operations and extrinsic methods for the CIM
347   elements defined by this profile.

348   8.1   Extrinsic Methods

349   If synchronous execution of a method succeeds, the implementation shall set a return value of
350   0 (Completed with No Error).

351   If synchronous execution of a method fails, the implementation shall set a return value of 2 (Failed) or a
352   more specific return code as specified with the respective method.

353 If a method is executed as an asynchronous task, the implementation shall perform all of the following ac-
354 tions:

355   • Set a return value of 4096 (Job Started).

356   • Set the value of the Job output parameter to refer to an instance of the CIM_ConcreteJob class
357   that represents the asynchronous task.

358   • Set the values of the JobState and TimeOfLastStateChange properties in that instance to repre-
359   sent the state and last state change time of the asynchronous task.

360 In addition, the implementation may present state change indications as task state changes occur.

361 If the method execution as an asynchronous task succeeds, the implementation shall perform all of the
362 following actions:

363   • Set the value of the JobState property to 7 (Completed).

364   • Provide an instance of the CIM_AffectedJobEntity association with property values set as fol-
365   lows:

366   – The value of the AffectedElement property shall refer to the object that represents the top-
367   level entity that was created or modified by the asynchronous task. For example, for the
368   CIM_IPConfigurationService. AddIPProtocolEndpoint() method, this is an instance of the
369   CIM_IPProtocolEndpoint class

370   – The value of the AffectingElement property shall refer to the instance of the
371   CIM_ConcreteJob class that represents the completed asynchronous task.

372   – The value of the first element in the ElementEffects[ ] array property (ElementEffects[0])
373   shall be set to 5 (Create) for the CIM_IPConfigurationService. AddIPProtocolEndpoint()
374   method. Otherwise, this value shall be 0 (Unknown).

375 If the method execution as an asynchronous task fails, the implementation shall set the value of the
376 JobState property to 9 (Killed) or 10 (Exception).

8.1.1 Job parameter

378 The implementation shall set the value of the Job parameter as a result of an asynchronous execution of
379 a method of the CIM_IPConfigurationService as follows:

380   • If the method execution is performed synchronously, the implementation shall set the value to
381   NULL.

382   • If the method execution is performed asynchronously, the implementation shall set the value to
383   refer to the instance of the CIM_ConcreteJob class that represents the asynchronous task.

8.1.2 CIM_VRFConfigurationService.CreateVRF()

385 The implementation of the CreateVRF( ) method is optional, the provisions in this subclause apply in
386 addition to behavior applicable to all extrinsic methods as specified in 8.1.

387 The successful execution of the CreateVRF( ) method shall create an instance of
388 CIM_VirtualRoutingAndForwardingTable as described in the subclause 7.1.3.

389 Table 2 contains requirements for parameters of this method.

390 <div align="center">**Table 2 – CreateVRF( ) Method: Parameters**</div>

Qualifiers	Name	Type	Description/Values
IN	TargetRouter	CIM_System REF	See 8.1.2.1
IN	VRF	String	See 8.1.2.2
OUT	ResultingVRF	REF	See 8.1.2.3
OUT	Job	CIM_ConcreteJob REF	See 8.1.2.4

391 **8.1.2.1 TargetRouter**

392 An optional reference to a CIM_System instance. The referenced instance shall comply with the
393 subclause 7.1.1.

394 **8.1.2.2 VRF**

395 A required string containing one embedded instances of the class-subclass of
396 CIM_VirtualRoutingAndForwardingTable that describes the configuration of the resultant
397 CIM_VirtualRoutingAndForwardingTable instance. The populated properties of the embedded instance
398 should not contain key properties, and any key property values may be ignored.

399 **8.1.2.3 ResultingVRF**

400 If the creation of the VRF was successful, a reference to the resultant instance of class
401 CIM_VirtualRoutingAndForwardingTable that represents the newly defined VRF shall be returned. The
402 created CIM_VirtualRoutingAndForwardingTable instance shall comply with subclause 7.1.3.

403 **8.1.2.4 Job**

404 See 8.1.1

405 **8.1.3 CIM_VRFConfigurationService.RemoveVRF()**

406 The implementation of the RemoveVRF( ) method is optional, the provisions in this subclause apply in
407 addition behavior applicable to all extrinsic methods as specified in 8.1.

408 The successful execution of the RemoveVRF( ) method shall remove the instance referenced in the
409 methods VRF parameter and should also remove any associated CIM_NextHopRoute instances.

410 Table 3 contains requirements for parameters of this method.

411   **Table 3 – RemoveVRF( ) Method: Parameters**

Qualifiers	Name	Type	Description/Values
IN	VRF	CIM_VirtualRoutingAndForwardingTable REF	See 8.1.3.1
OUT	Job	CIM_ConcreteJob REF	See 8.1.3.2

412   **8.1.3.1   VRF**

413   A reference to the instance of the class CIM_VirtualRoutingAndForwardingTable that shall be removed.

414   **8.1.3.2   Job**

415   See 8.1.1

416   **8.1.4   CIM_VRFConfigurationService.AddRoute()**

417   The implementation of the AddRoute( ) method is required, the provisions in this subclause shall apply in
418   addition to the behavior applicable to all extrinsic methods as specified in 8.1.

419   The successful execution of the AddRoute( ) method shall create an instance of CIM_NextHopIPRoute as
420   described in the subclause 7.1.4. This instance shall be associated with the referenced VRF through an
421   instance of CIM_VRFRoute.

422   Table 4 contains requirements for parameters of this method.

423   **Table 4 – AddRoute( ) Method: Parameters**

Qualifiers	Name	Type	Description/Values
IN	VRF	CIM_VirtualRoutingAndForwardingTable REF	See 8.1.4.1
IN	Route	String	See 8.1.4.2
OUT	ResultingRoute	CIM_NextHopIPRoute REF	See 8.1.4.3
OUT	Job	CIM_ConcreteJob REF	See 8.1.4.4

424   **8.1.4.1   VRF**

425   A required reference to a CIM_VirtualRoutingAndForwardingTable instance.

426   **8.1.4.2   Route**

427   A required string containing one embedded instance of the class or subclass of CIM_NextHopIPRoute
428   that describes the configuration of the resultant CIM_NextHopIPRoute instance. The populated properties
429   of the embedded instance should not contain key properties, and any key property values may be
430   ignored.

431   **8.1.4.3   ResultingRoute**

432   If the creation of the next hop route was successful, a reference to the resultant instance of class
433   CIM_NextHopIPRoute that represents the newly defined route for the VRF shall be returned. The created
434   CIM_NextHopIPRoute instance shall comply with subclause 7.1.4.

435 **8.1.4.4   Job**

436 See 8.1.1

437 **8.1.5   CIM_VRFConfigurationService.RemoveRoute()**

438 The implementation of the RemoveRoute( ) method is required, the provisions in this subclause shall
439 apply in addition to the behavior applicable to all extrinsic methods as specified in 8.1.

440 The successful execution of the RemoveRoute( ) method shall remove the instance referenced in the
441 method's Route parameter from the VRF referenced in the VRF parameter

442 Table 5 contains requirements for parameters of this method.

443   **Table 5 – RemoveRoute( ) Method: Parameters**

Qualifiers	Name	Type	Description/Values
IN	VRF	CIM_VirtualRoutingAndForwardingTable REF	See 8.1.5.1
IN	Route	CIM_NextHopIPRoute REF	See 8.1.5.2
OUT	Job	CIM_ConcreteJob REF	See 8.1.5.3

444

445 **8.1.5.1   VRF**

446 A required reference to a CIM_VirtualRoutingAndForwardingTable instance from which the route shall be
447 removed.

448 **8.1.5.2   Route**

449 A reference to instance of the class CIM_NextHopIPRoute that shall be removed.

450 **8.1.5.3   Job**

451 See 8.1.1

452 **8.1.6   CIM_VRFConfigurationService.AddPortMember()**

453 The implementation of the AddPortMember( ) method is required, the provisions in this subclause shall
454 apply in addition to the behavior applicable to all extrinsic methods as specified in 8.1.

455 The successful execution of the AddPortMember( ) shall associate the referenced port in the PortMember
456 method parameter to the referenced VRF in the VRF method parameter through an instance of
457 CIM_MemberOfCollection.

458 Table 6 contains requirements for parameters of this method.

459   **Table 6 – AddPortMember( ) Method: Parameters**

Qualifiers	Name	Type	Description/Values
IN	VRF	CIM_VirtualRoutingAndForwardingTable REF	See 8.1.6.1
IN	PortMember	CIM_EthernetPort REF	See 8.1.4.2
OUT	Job	CIM_ConcreteJob REF	See 8.1.6.3

460   **8.1.6.1   VRF**

461   A required reference to a CIM_VirtualRoutingAndForwardingTable instance to which the port shall be
462   added.

463   **8.1.6.2   PortMember**

464   A reference to the CIM_EthernetPort instance that is being added to the VRF.

465   **8.1.6.3   Job**

466   See 8.1.1

467   **8.1.7   CIM_VRFConfigurationService.RemovePortMember()**

468   The implementation of the RemovePortMember( ) method is required, the provisions in this subclause
469   shall apply in addition to the behavior applicable to all extrinsic methods as specified in 8.1.

470   The successful execution of the RemovePortMember( ) method shall remove the referenced
471   CIM_EthernetPort passed in the PortMember parameter from the VRF passed in the VRF method
472   parameter, by removing the CIM_MemberOfCollection instance forming the association.

473   Table 7 contains requirements for parameters of this method.

474   **Table 7 – RemovePortMember( ) Method: Parameters**

Qualifiers	Name	Type	Description/Values
IN	VRF	CIM_VirtualRoutingAndForwardingTable	See 8.1.7.1
IN	PortMember	CIM_EthernetPort REF	See 8.1.7.2
OUT	Job	CIM_ConcreteJob REF	See 8.1.7.3

475   **8.1.7.1   VRF**

476   A required reference to a CIM_VirtualRoutingAndForwardingTable instance from which the port shall be
477   removed.

478   **8.1.7.2   PortMember**

479   A required reference to instance of the class CIM_EthrenetPort that shall be removed from the referenced
480   VRF.

481   **8.1.7.3   Job**

482   See 8.1.1

483   **8.1.8   CIM_VRFConfigurationService.AddSAPMember()**

484   The implementation of the AddSAPMember( ) method is required, the provisions in this subclause shall
485   apply in addition to the behavior applicable to all extrinsic methods as specified in 8.1.

486   The successful execution of the AddSAPMember( ) shall associate the referenced instance of
487   CIM_ServiceAccessPoint in the SAPMember method parameter to the referenced VRF in the VRF
488   method parameter through an instance of CIM_MemberOfCollection.

489   Table 8 contains requirements for parameters of this method.

490 **Table 8 – AddSAPMember( ) Method: Parameters**

Qualifiers	Name	Type	Description/Values
IN	VRF	CIM_VirtualRoutingAndForwardingTable REF	See 8.1.8.1
IN	SAPMember	CIM_ServiceAccessPoint REF	See 8.1.8.2
OUT	Job	CIM_ConcreteJob REF	See 8.1.8.3

491 **8.1.8.1 VRF**

492 A required reference to a CIM_VirtualRoutingAndForwardingTable instance to which the instance of
493 CIM_ServiceAccessPoint shall be added.

494 **8.1.8.2 SAPMember**

495 A required reference to the instance of CIM_ServiceAccessPoint that shall be added to the referenced
496 VRF.

497 **8.1.8.3 Job**

498 See 8.1.1

499 **8.1.9 CIM_VRFConfigurationService.RemoveSAPMember()**

500 The implementation of the RemoveSAPMember( ) method is required, the provisions in this subclause
501 shall apply in addition to the behavior applicable to all extrinsic methods as specified in 8.1.

502 The successful execution of the RemoveSAPMember( ) method shall remove the referenced
503 CIM_EthernetPort passed in the SAPMember parameter from the VRF passed in the VRF method
504 parameter, by removing the CIM_MemberOfCollection instance forming the association.

505 Table 9 contains requirements for parameters of this method.

506 **Table 9 – RemoveSAPMember( ) Method: Parameters**

Qualifiers	Name	Type	Description/Values
IN	VRF	CIM_VirtualRoutingAndForwardingTable	See 8.1.9.1
IN	SAPMember	CIM_ServiceAccessPoint REF	See 8.1.9.2
OUT	Job	CIM_ConcreteJob REF	See 8.1.9.3

507 **8.1.9.1 VRF**

508 A required reference to a CIM_VirtualRoutingAndForwardingTable instance from which the
509 CIM_ServiceAccessPoint shall be removed.

510 **8.1.9.2 SAPMember**

511 A required reference to instance of the class CIM_ServiceAccessPoint that shall be removed from the
512 referenced VRF.

513 **8.1.9.3 Job**

514 See 8.1.1

515 ## 8.2   Profile conventions for operations

516 For each profile class (including associations), the implementation requirements for operations, including
517 those in the following default list, are specified in class-specific subclauses of this clause.

518 The default list of operations is as follows:

519 - GetInstance

520 - EnumerateInstances

521 - EnumerateInstanceNames

522 - Associators

523 - AssociatorNames

524 - References

525 - ReferenceNames

526 ## 8.3   CIM_HostedService

527 Table 10 lists implementation requirements for operations. If implemented, these operations shall be
528 implemented as defined in DSP0200. In addition, and unless otherwise stated in Table 10, all operations
529 in the default list in 8 shall be implemented as defined in DSP0200.

530 NOTE   Related profiles may define additional requirements on operations for the profile class.

531 **Table 10 – Operations: CIM_HostedService**

Operation	Requirement	Messages
Associators	Unspecified	None
AssociatorNames	Unspecified	None
References	Unspecified	None
ReferenceNames	Unspecified	None

532 ## 8.4   CIM_HostedCollection

533 Table 11 lists implementation requirements for operations. If implemented, these operations shall be
534 implemented as defined in DSP0200. In addition, and unless otherwise stated in Table 10, all operations
535 in the default list in 8 shall be implemented as defined in DSP0200.

536 NOTE   Related profiles may define additional requirements on operations for the profile class.

537 **Table 11 – Operations: CIM_HostedCollection**

Operation	Requirement	Messages
Associators	Unspecified	None
AssociatorNames	Unspecified	None
References	Unspecified	None
ReferenceNames	Unspecified	None

538 ## 8.5 CIM_ServiceAvailableToElement

539 Table 12 lists implementation requirements for operations. If implemented, these operations shall be
540 implemented as defined in DSP0200. In addition, and unless otherwise stated in Table 10, all operations
541 in the default list in 8 shall be implemented as defined in DSP0200.

542 NOTE Related profiles may define additional requirements on operations for the profile class.

543 **Table 12 – Operations: CIM_ServiceAvailableToElement**

Operation	Requirement	Messages
Associators	Unspecified	None
AssociatorNames	Unspecified	None
References	Unspecified	None
ReferenceNames	Unspecified	None

544 ## 8.6 CIM_ServiceAffectsElement

545 Table 13 lists implementation requirements for operations. If implemented, these operations shall be
546 implemented as defined in DSP0200. In addition, and unless otherwise stated in Table 10, all operations
547 in the default list in 8 shall be implemented as defined in DSP0200.

548 NOTE Related profiles may define additional requirements on operations for the profile class.

549 **Table 13 – Operations: CIM_ServiceAffectsElement**

Operation	Requirement	Messages
Associators	Unspecified	None
AssociatorNames	Unspecified	None
References	Unspecified	None
ReferenceNames	Unspecified	None

550 ## 8.7 CIM_VRFRoute

551 Table 14 lists implementation requirements for operations. If implemented, these operations shall be
552 implemented as defined in DSP0200. In addition, and unless otherwise stated in Table 10, all operations
553 in the default list in 8 shall be implemented as defined in DSP0200.

554 NOTE Related profiles may define additional requirements on operations for the profile class.

555 **Table 14 – Operations: CIM_VRFRoute**

Operation	Requirement	Messages
Associators	Unspecified	None
AssociatorNames	Unspecified	None
References	Unspecified	None
ReferenceNames	Unspecified	None

556 ## 8.8 CIM_MemberOfCollection

557 Table 15 lists implementation requirements for operations. If implemented, these operations shall be
558 implemented as defined in DSP0200. In addition, and unless otherwise stated in Table 10, all operations
559 in the default list in 8 shall be implemented as defined in DSP0200.

560 NOTE   Related profiles may define additional requirements on operations for the profile class.

561   **Table 15 – Operations: CIM_MemberOfCollection**

Operation	Requirement	Messages
Associators	Unspecified	None
AssociatorNames	Unspecified	None
References	Unspecified	None
ReferenceNames	Unspecified	None

562 ## 8.9 CIM_VRFConfigurationService

563 All operations in the default list in 0 shall be implemented as defined in DSP0200.

564 ## 8.10 CIM_NextHopIPRoute

565 All operations in the default list in 0 shall be implemented as defined in DSP0200.

566 ## 8.11 CIM_VirtualRoutingAndForwardingTable

567 All operations in the default list in 0 shall be implemented as defined in DSP0200.

568 ## 8.12 CIM_System

569 All operations in the default list in 0 shall be implemented as defined in DSP0200.

9 Use cases

This clause contains object diagrams and use cases for the *Network Management - Virtual Routing and Forwarding Profile*.

9.1 Profile Registration

The object diagram in Figure 2 shows an example for advertising profile conformance. Figure 2 is an example where an instance of CIM_ComputerSystem that is a compliant Virtual Ethernet Switch is the scoping class.
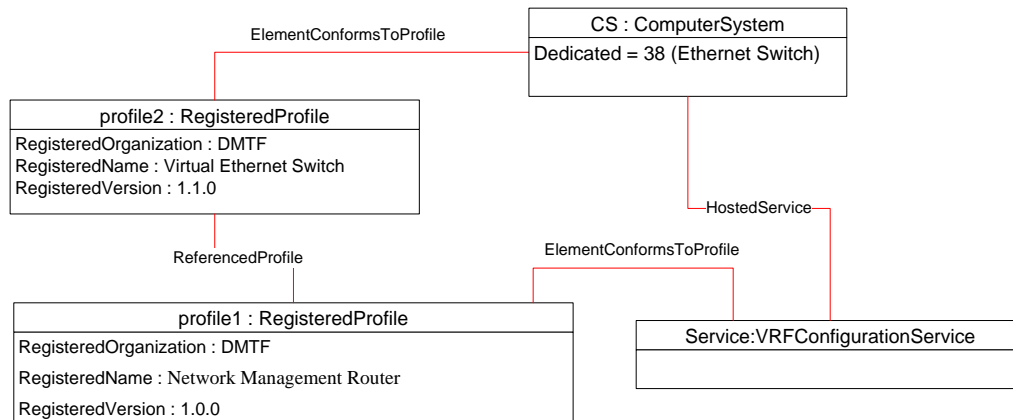
Figure 2 – Registered profile with Computer System Profile

9.2 VRF with Routes and Interfaces

The object diagram is Figure 3 contains the basic element used to model a VRF. The instance diagram shows a CIM_ComputerSystem instance CS0 hosting an instance of CIM_VRFConfigurationService, CS0VRF. In this instance diagram one instance of a VRF, ManagementVRF has been created and is under the CIM_VRFConfigurationService instance CSOVRF. The diagram also shows that the ManagementVRF has two members, one an Ethernet port (E0/1) the other a remote service access point (NPT0).

The following method calls through the CS0VRF instance of CIM_VRFConfigurationService were performed to create and configure the VRF.

The ManagementVRF was created with a CIM_VRFConfigurationService.CreateVRF() method with the following parameters. Note this is for illustration purposes; other properties can be populated in the embedded class instances as required.

- TargetRouter - Reference to CS0:CIM_ComputerSystem

- VRF

  – Embedded instance of CIM_VirtualRoutingAndForwardingTable {
    ElementName = ManagementVRF }

595 The method call would return:

596 • ResultingVRF – Reference to ManagmentVRF:CIM_VirtualRoutingAndForwardingTable.

597 The Ethernet port E0/1 was added to the VRF with the CIM_VRFConfigurationService.AddMemberPort()
598 method with the following parameters.

599 • VRF - Reference to CIM_VirtualRoutingAndForwardingTable:ManagementVRF

600 • MemberPort – Reference to CIM_EthernetPort:E0/1

601 The remote service access point NTP0 was added to the VRF with the
602 CIM_VRFConfigurationService.AddMemberSAP() method with the following parameters.

603 • VRF - Reference to CIM_VirtualRoutingAndForwardingTable:ManagementVRF

604 • MemberSAP – Reference to CIM_RemoteServiceAccessPoint:NTP0

605 A single route was added using the CIM_VirtualRoutingAndForwardingTable.AddRoute method with the
606 following parameters.

607 • VRF - Reference to CIM_VirtualRoutingAndForwardingTable:ManagementVRF

608 • Route -
609   – Embedded instance of CIM_NextHopIPRoute {
610   DestinationAddress = 192.0.2.0
611   DestinationMask = 255.0.0.0
612   NextHopInterface = ...E0\1
613   NextHopAddress = 192.0.2.4
614   AdminDistance = 1 }

615 The method call would return:

616 • ResultingRoute – Reference Route0:CIM_NextHopIPRoute.
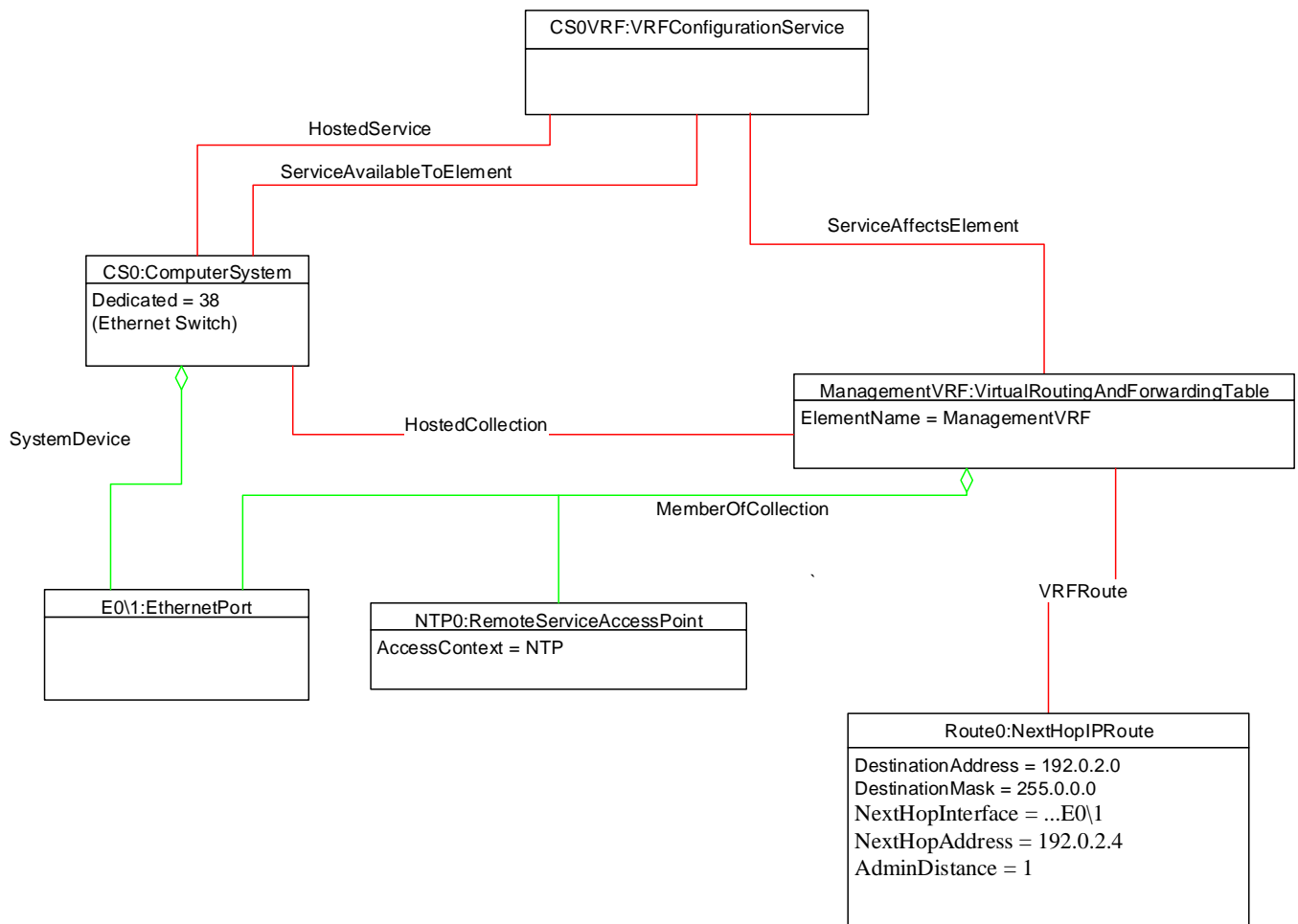
617
618

619 **Figure 3 – VRF Instance Diagram**

10 CIM Elements

620

621 Table 16 shows the instances of CIM Elements for this profile. Instances of the CIM Elements shall be
622 implemented as described in Table 16. Clauses 7 ("Implementation") and 8 ("Methods") may impose
623 additional requirements on these elements.

624 **Table 16 – CIM Elements: Network Management - Virtual Routing and Forwarding Profile**

Element Name	Requirement	Description
Classes		
CIM_VRFRoute	Optional	See clause 7.1.3
CIM_AutonomousSystem	Optional	See clause 7.1.1
CIM_EthernetPort	Optional	See clause 7.1.5
CIM_HostedCollection	Mandatory	See clause 7.1.3
CIM_HostedService	Mandatory	See clause 7.1.2

Element Name	Requirement	Description
CIM_MemberOfCollection	Optional	See clause 7.1.5 and 7.1.6
CIM_NextHopIPRoute	Optional	See clause 7.1.4
CIM_ServiceAccessPoint	Optional	See clause 7.1.6
CIM_ServiceAffectsElement	Mandatory	See clause 7.1.2
CIM_ServiceAvailableToElement	Mandatory	See clause 7.1.2
CIM_System	Mandatory	See clause 7.1.1
CIM_VirtualRoutingAndForwardingTable	Mandatory	See clause 7.1.3
CIM_VRFConfigurationService	Mandatory	See clause 7.1.2
Indications		
None defined in this profile		

10.1 CIM_HostedService

626 CIM_HostedService relates the CIM_VRFConfigurationService instance to its scoping
627 CIM_ComputerSystem instance. Table 17 provides information about the properties of
628 CIM_HostedService.

629 **Table 17 – Class: CIM_HostedService**

Elements	Requirement	Description
Antecedent	Mandatory	**Key:** This shall be a reference to the Central Instance. Cardinality 1
Dependent	Mandatory	**Key:** This shall be a reference to an instance of CIM_VRFConfigurationService. Cardinality *

10.2 CIM_VRFRoute

631 CIM_VRFRoute is used to associate a set of CIM_NextHopRoute instances with a
632 CIM_VirtualRoutingAndForwardingTable instance. Table 18 provides information about the properties of
633 CIM_HostedService.

634 **Table 18 – Class: CIM_VRFRoute**

Elements	Requirement	Description
Antecedent	Mandatory	**Key:** This shall be a reference to a CIM_VirtualRoutingAndForwardingTable instance. Cardinality 1
Dependent	Mandatory	**Key:** This shall be a reference to an instance CIM_NextHopRoute. Cardinality *

635 **10.3 CIM_RegisteredProfile**

636 CIM_RegisteredProfile identifies the *Network Management - Virtual Routing and Forwarding Profile* in
637 order for a client to determine whether an instance of CIM_IPProtocolEndpoint is conformant with this
638 profile. The CIM_RegisteredProfile class is defined by the *Profile Registration Profile*. With the exception
639 of the mandatory values specified for the properties in Table 19, the behavior of the
640 CIM_RegisteredProfile instance is in accordance with the *Profile Registration Profile*.

641 **Table 19 – Class: CIM_RegisteredProfile**

Elements	Requirement	Description
RegisteredName	Mandatory	This property shall have a value of "Network Management Routing and Forwarding Profile".
RegisteredVersion	Mandatory	This property shall have a value of "1.0.0c".
RegisteredOrganization	Mandatory	This property shall have a value of "DMTF".

642 **10.4 CIM_VirtualForwardingAndRoutingTable**

643 CIM_VirtualForwardingAndRoutingTable is a collection of interfaces and routes that form the context
644 used for a virtual routing and forwarding table (VRF). Table 20 provides information about the properties
645 of CIM_VirtualForwardingAndForwardingTable.

646 **Table 20 – Class: CIM_VirtualForwardingAndRoutingTable**

Elements	Requirement	Description
InstanceID	Mandatory	**Key:** This property shall contain a unique ID to uniquely identify the specific instance.
ElementName	Optional	This property should contain the friendly VRF context name.
RouteDistinguisher	Optional	If populated this shall be an eight Octet field that uniquely distinguishes a route when there are multiple VRFs in a single router.

647 **10.5 CIM_NextHopRoute**

648 CIM_NextHopRoute represents one of a series a "hops" to reach a network destination.

649 **Table 21 – Class: CIM_NextHopRoute**

Elements	Requirement	Description
InstanceID	Mandatory	**Key:** This property shall contain a unique ID to uniquely identify the specific instance.
DestinationAddress	Mandatory	The address of the destination that needs to be reached.

650   ## 10.6 CIM_NextHopIPRoute

651   CIM_NextHopIPRoute contains the properties required to specialize CIM_NextHopRoute for an IP route.

652   **Table 22 – Class: CIM_NextHopIPRoute**

Elements	Requirement	Description
InstanceID	Mandatory	**Key:** This property shall contain a unique ID to uniquely identify the specific instance.

653

654 <div align="center">**ANNEX A**</div>
655 <div align="center">**(informative)**</div>
656
657 <div align="center">**Change log**</div>

Version	Date	Description
1.0.0	2018-09-04	

658