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7 **Network Policy Management Profile**

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Foreword

97 The *Network Policy Management Profile* (DSP1048) was prepared by the Network Services Management
98 Working Group of the DMTF.

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

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115

116

Introduction

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

122 Document conventions

123 Typographical conventions

124 The following typographical conventions are used in this document:

- 125 • Document titles are marked in *italics*.
- 126 • ABNF rules are in `monospaced font`.

127

128

Network Policy Management Profile

129 1 Scope

130 The *Network Policy Management Profile* is a base (abstract) profile that will specify the CIM Schema and
131 use cases associated with the general and common aspects of Network Policy Management. This profile
132 includes a specification of the Network Policy Service, Network Policy, Network Policy Rule and Setting
133 Data, Policy Conditions and Action and describes how the network Policies can be applied to the Managed
134 Elements.

135 2 Normative references

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

140 DMTF DSP0004, *CIM Infrastructure Specification 2.7*,
141 http://www.dmtf.org/standards/published_documents/DSP0004_2.7.pdf

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

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

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

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

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

152 3 Terms and definitions

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

155 The terms "shall" ("required"), "shall not", "should" ("recommended"), "should not" ("not recommended"),
156 "may," "need not" ("not required"), "can" and "cannot" in this document are to be interpreted as described
157 in [ISO/IEC Directives, Part 2](#), Clause 7. The terms in parenthesis are alternatives for the preceding term,
158 for use in exceptional cases when the preceding term cannot be used for linguistic reasons. Note that
159 [ISO/IEC Directives, Part 2](#), Clause 7 specifies additional alternatives. Occurrences of such additional
160 alternatives shall be interpreted in their normal English meaning.

161 The terms "clause", "subclause", "paragraph", and "annex" in this document are to be interpreted as
162 described in [ISO/IEC Directives, Part 2](#), Clause 6.

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

166 The terms defined in [DSP0004](#), [DSP0223](#), and [DSP1001](#) apply to this document. The following additional
167 terms are used in this document.

168 **3.1**

169 **conditional**

170 indicates requirements to be followed strictly to conform to the document when the specified conditions
171 are met

172 **3.2**

173 **mandatory**

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

176 **3.3**

177 **optional**

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

179 **3.4**

180 **pending configuration**

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

183 **3.5**

184 **referencing profile**

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

187 **3.6**

188 **unspecified**

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

190 **4 Symbols and abbreviated terms**

191 The abbreviations defined in [DSP0004](#), [DSP0223](#), and [DSP1001](#) apply to this document. The following
192 additional abbreviations are used in this document.

193 **4.1**

194 **IP**

195 Internet Protocol

196 **4.2**

197 **VLAN**

198 Virtual Local Area Network

199 5 Synopsis

200 **Profile name:** Network Policy Management

201 **Version:** 1.0.0

202 **Organization:** DMTF

203 **CIM Schema version:** 2.43

204 **Central class:** CIM_NetworkPolicyService

205 **Scoping class:** CIM_System

206 The *Network Policy Management Profile* is a base profile that specifies the CIM Schema and use cases
 207 associated with the general and common aspects of Network Policy Management. The Network Policy
 208 Management Profile is an adaptation of the CIM Policy Management Profile.

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

210

Table 1 – Referenced profiles

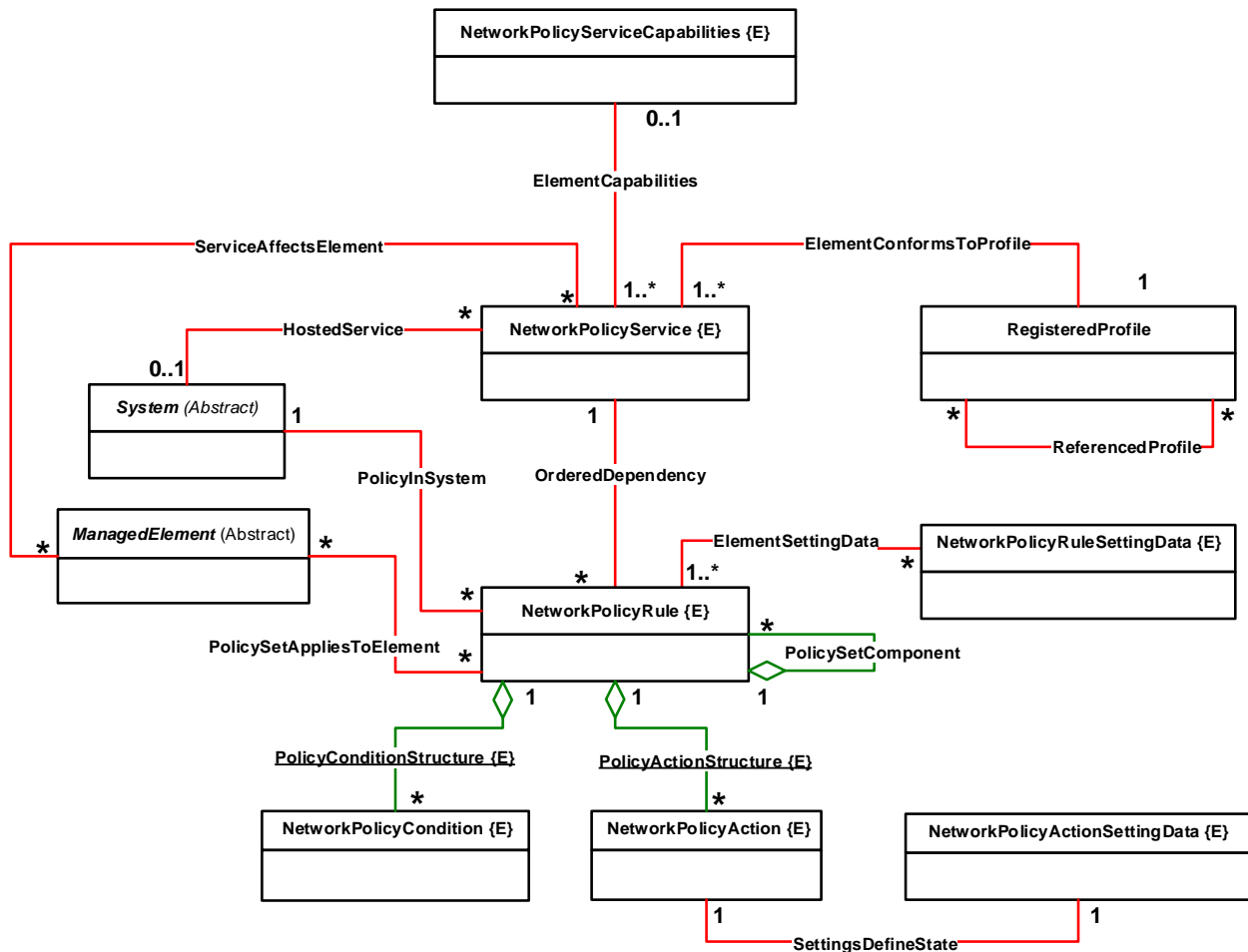
Profile Name	Organization	Version	Requirement	Description
Profile Registration	DMTF	1.0	Mandatory	None
Network Management Profile	DMTF	1.0	Optional	None
Policy Profile	DMTF	1.0	Mandatory	None

211 6 Description

212 The *Network Policy Management Profile* includes base specification of the Network Policy Management
 213 Service, Network Policy, Network Policy Rule and Setting Data, and Policy Conditions and Action. This
 214 standard describes how a Network Policy is applied to the Managed Elements and contains three
 215 possible extensions representing QoS, Firewall, and Load Balancer policies. Other types of policies, for
 216 example Access Control List (ACL) or routing policies, may be represented in a similar manner.

217 **6.1 Class diagram**

218 Figure 1 represents the class schema for the *Network Policy Management Profile*. For simplicity, the
 219 CIM_ prefix has been removed from the names of the classes.



220

221 **Figure 1 – Network Policy Management Profile: Class diagram**

222 Network Policy model is an extension of the existing CIM Policy model, where the
 223 CIM_NetworkPolicyRule extends the CIM_PolicyRule class, and CIM_NetworkPolicyCondition and
 224 CIM_NetworkPolicyAction extend CIM_Policy. CIM_NetworkPolicyService extends the CIM_Service class
 225 and provides policy management capabilities.

226 The Network Policy Service is hosted on a System (for example an instance of the Computer System
 227 representing a network appliance, device or a network management system/controller) and serves as a
 228 management gateway through which the instances of CIM_NetworkPolicyRule are created, configured,
 229 and applied to the instances of CIM_ManagedElement subclasses, for example, CIM_Network,
 230 CIM_ProtocolEndpoint, subclasses of CIM_Service (e.g., for configuration of the routing policies), etc.

231 The CIM_NetworkPolicyRule may be subclassed to represent different types of network policies, for
 232 example CIM_QoSPolicyRule or CIM_LoadBalancingPolicyRule.

233 There is a set of Network Policy Conditions that can be associated with the particular Network Policy
 234 Rule. These conditions determine when the particular policy will be invoked. The conditions can be
 235 evaluated in the specified order (see the definition of the CIM_PolicyConditionStructure association for

236 how the condition evaluation order is specified). The set of the CIM_NetworkPolicyAction instances
237 associated with the Network Policy via the CIM_PolicyActionStructure determines the actions that will be
238 executed once the policy is triggered.

239 The Network Policy Rule and Network Policy Action are configured via the instances of
240 CIM_NetworkPolicyRuleSettingData and CIM_NetworkPolicyActionSettingData classes or subclasses
241 thereof.

242 The CIM_NetworkPolicyRuleSettingData may be subclassed to represent the settings of the policies
243 extending Network Policy Management Profile, for example CIM_QoSRuleSettingData or
244 CIM_LoadBalancingRuleSettingData.

245 The CIM_NetworkPolicyActionSettingData may be subclassed to represent the settings of the policies
246 extending Network Policy Management Profile, for example CIM_LoadBalancingActionSettingData.

247 The CIM_NetworkPolicyServiceCapabilities class describes the capabilities offered by the Network Policy
248 Management Service. The CIM_RegisteredProfile provides the information about the Policy Management
249 Profile registration.

250 **7 Implementation**

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

253 **7.1 Representing the policy management capabilities**

254 **7.1.1 CIM_NetworkPolicyService**

255 The instance of the CIM_NetworkPolicyService class serves as a management endpoint through which
256 the instances of CIM_NetworkPolicyRule shall be created, configured, and applied to the managed
257 elements. Zero or more instances of CIM_NetworkPolicyService shall be instantiated.

258 The instances of the CIM_NetworkPolicyService shall be associated with the instance of the scoping
259 CIM_System through an instance of CIM_HostedService association.

260 **7.1.2 CIM_NetworkPolicyServiceCapabilities**

261 The CIM_NetworkPolicyServiceCapabilities class represents the capabilities offered by the
262 CIM_NetworkPolicyService. There shall be at most one instance of the
263 CIM_NetworkPolicyServiceCapabilities class associated with at least one or more instances of
264 CIM_NetworkPolicyService.

265 **7.2 Representing the Network Policy**

266 **7.2.1 CIM_NetworkPolicyRule**

267 The CIM_NetworkPolicyRule class extends the CIM_PolicyRule and represents the Network Policy that is
268 instantiated, configured, and applied to the various managed elements. The CIM_NetworkPolicyRule
269 instance shall be associated with the scoping CIM_System through an instance of CIM_PolicyInSystem
270 association. The instance of the CIM_NetworkPolicyRule shall be associated with one instance of the
271 scoping CIM_System.

272 A CIM_NetworkPolicyRule instance that is applied to an instance of CIM_ManagedElement shall be
273 associated with the CIM_ManagedElement instance through an instance of
274 CIM_PolicySetAppliesToElement association.

275 7.2.2 CIM_NetworkPolicyCondition

276 The CIM_NetworkPolicyCondition extends the CIM_Policy class and specifies a particular condition,
277 which causes the associated network policy to be triggered once met. Each CIM_NetworkPolicyCondition
278 instance shall be associated with one instance of the CIM_NetworkPolicyRule through the instance of
279 CIM_PolicyConditionStructure association.

280 7.2.3 CIM_NetworkPolicyAction

281 The CIM_NetworkPolicyAction class extends the CIM_Policy class and determines an action taken once
282 the policy is triggered. Each CIM_NetworkPolicyAction instance shall be associated with one instance of
283 the CIM_NetworkPolicyRule through the CIM_PolicyActionStructure association instance.

284 7.3 Network Policy configuration

285 7.3.1 CIM_NetworkPolicyRuleSettingData

286 The CIM_NetworkPolicyRuleSettingData class extends the CIM_SettingData class and specifies the
287 setting data for the network policy.

288 An instance of the CIM_NetworkPolicyRuleSettingData shall be associated to the instance of
289 CIM_NetworkPolicyRule through an instance of CIM_ElementSettingsData association.

290 7.3.1.1 CIM_QoSPolicyRuleSettingData

291 The CIM_QoSPolicyRuleSettingData class extends the CIM_NetworkPolicyRuleSettingData class and
292 specifies the setting data for the QoS network policy.

293 7.3.1.2 CIM_FirewallRuleSettingData

294 The CIM_FirewallRuleSettingData class extends the CIM_NetworkPolicyRuleSettingData class and
295 specifies the setting data for the QoS network policy.

296 7.3.1.3 CIM_LoadBalancingRuleSettingData

297 The CIM_LoadBalancingRuleSettingData class extends the CIM_NetworkPolicyRuleSettingData class
298 and specifies the setting data for the load balancing network policy.

299 7.3.2 CIM_NetworkPolicyActionSettingData

300 CIM_NetworkPolicyActionSettingData class extends the CIM_NetworkPolicySettingData and specifies the
301 setting data for the Network Policy Action.

302 An instance of the CIM_NetworkPolicyActionSettingData shall be associated to the instance of
303 CIM_NetworkPolicyAction through an instance of CIM_SettingsDefineState association.

304 7.3.2.1 CIM_LoadBalancingActionSettingData

305 CIM_LoadBalancingActionSettingData class extends the CIM_NetworkPolicyActionSettingData and
306 specifies the setting data for the load balancing network policy action.

307 8 Methods

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

310 8.1 Extrinsic methods

311 If synchronous execution of a method succeeds, the implementation shall set a return value of
312 0 (Completed with No Error).

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

315 If a method is executed as an asynchronous task, the implementation shall perform all of the following
316 actions:

- 317 • Create a Job object according to DSP1103 Job Control Profile.
- 318 • Set a return value of 4096 (Job Started).

319 8.1.1 Job parameter

320 The implementation shall set the value of the Job parameter as a result of an asynchronous execution of
321 a method of the CIM_NetworkPolicyService as follows:

- 322 • If the method execution is performed synchronously, the implementation shall set the value to
323 NULL.
- 324 • If the method execution is performed asynchronously, the implementation shall set the value to
325 refer to the instance of the CIM_ConcreteJob class that represents the asynchronous task.

326 8.1.2 CIM_NetworkPolicyService.CreatePolicyRule()

327 The implementation of the CreatePolicyRules() method is required; the provisions in this subclause apply
328 in addition to behavior applicable to all extrinsic methods as specified in **Error! Reference source not
329 found.**

330 This method creates instances of CIM_NetworkPolicyRule class, CIM_NetworkPolicyCondition,
331 CIM_NetworkPolicyAction, CIM_NetworkPolicyRuleSettingData, and
332 CIM_NetworkPolicyActionSettingData classes and all mandatory associations between these instances
333 as described in clause 7.

334 Profile implementation should make sure that the types of the policy actions, network policy rule setting
335 data, and network policy action setting data match to represent a configuration of the particular policy
336 type, for example load balancing or firewall policy.

337 **Input:** NetworkPolicyAction[], ActionsOrder[] (uint16) (optional), NetworkPolicyCondition[],
338 ConditionGroupNumber[] (uint16), NetworkPolicyRuleSettingData[], NetworkPolicyActionSettingData[],
339 SequenceNumber, NetworkPolicyRule, REF ParentNetworkPolicyRule (optional), REF
340 ManagedElement[] (optional)

341 **Output:** REF to NetworkPolicyRule

342 8.1.3 CIM_NetworkPolicyService.DeletePolicyRules()

343 The implementation of the DeletePolicyRules() method is required; the provisions in this subclause apply
344 in addition to behavior applicable to all extrinsic methods as specified in 8.1.

345 This method removes all associated instances of CIM_NetworkPolicyAction,
346 CIM_NetworkPolicyCondition, CIM_NetworkPolicyRuleSettingData, and
347 CIM_NetworkPolicyActionSettingData that are only associated with the rule specified in this method input
348 parameter.

349 The requested CIM_NetworkPolicyRule instances shall be associated with this network policy service in
350 order for them to be removed

351 **Input:** REF NetworkPolicyRule[]

352 **8.1.4 CIM_NetworkPolicyService.ApplyPolicyRule() (optional)**

353 The implementation of the ApplyPolicyRules() method is optional; the provisions in this subclause apply
354 in addition to behavior applicable to all extrinsic methods as specified in 8.1.

355 Applies the Network Policy Rule to the specified instances of the CIM_ManagedElement. This method
356 creates the instances of the CIM_PolicySetAppliesToElement association between the specified instance
357 of the CIM_NetworkPolicyRule and the instances of CIM_ManagedElement subclasses, which references
358 are supplied.

359 **Input:** REF NetworkPolicyRule, REF ManagedElement[]

360 **8.1.5 CIM_NetworkPolicyService.ReleasePolicyRule() (optional)**

361 The implementation of the ReleasePolicyRules() method is optional; the provisions in this subclause
362 apply in addition to behavior applicable to all extrinsic methods as specified in 8.1.

363 Removes the Network Policy Rule from the ManagedElement instances it was applied before. This
364 method deletes the instances of the CIM_PolicySetAppliesToElement association between the specified
365 instance of the CIM_NetworkPolicyRule and the instances of CIM_ManagedElement subclasses, which
366 references are supplied.

367 **Input:** REF NetworkPolicyRule, REF ManagedElement[]

368 **8.2 Profile conventions for operations**

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

371 The default list of operations is as follows:

- 372 • GetInstance
- 373 • EnumerateInstances
- 374 • EnumerateInstanceNames
- 375 • Associators
- 376 • AssociatorNames
- 377 • References
- 378 • ReferenceNames

379 **8.3 CIM_NetworkPolicyService**

380 All operations in the default list in 8.1 shall be implemented as defined in [DSP0200](#).

381 **8.4 CIM_NetworkPolicyServiceCapabilities**

382 All operations in the default list in 8.1 shall be implemented as defined in [DSP0200](#).

383 **8.5 CIM_NetworkPolicyRule**

384 All operations in the default list in 8.1 shall be implemented as defined in [DSP0200](#).

385 **8.6 CIM_NetworkPolicyCondition**

386 All operations in the default list in 8.1 shall be implemented as defined in [DSP0200](#).

387 **8.7 CIM_NetworkPolicyAction**

388 All operations in the default list in 8.1 shall be implemented as defined in [DSP0200](#).

389 **8.8 CIM_NetworkPolicyRuleSettingData**

390 All operations in the default list in 8.1 shall be implemented as defined in [DSP0200](#).

391 **8.9 CIM_NetworkPolicyActionSettingData**

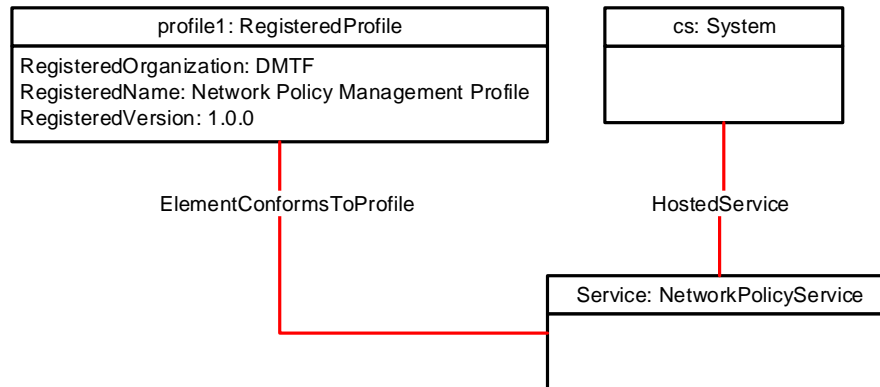
392 All operations in the default list in 8.1 shall be implemented as defined in [DSP0200](#).

393 9 Use cases

394 This clause contains object diagrams and use cases for the *Network Policy Management Profile*.

395 9.1 Profile registration

396 The object diagram in Figure 2 shows one possible method for advertising profile conformance.



397

398

Figure 2 – Registered profile

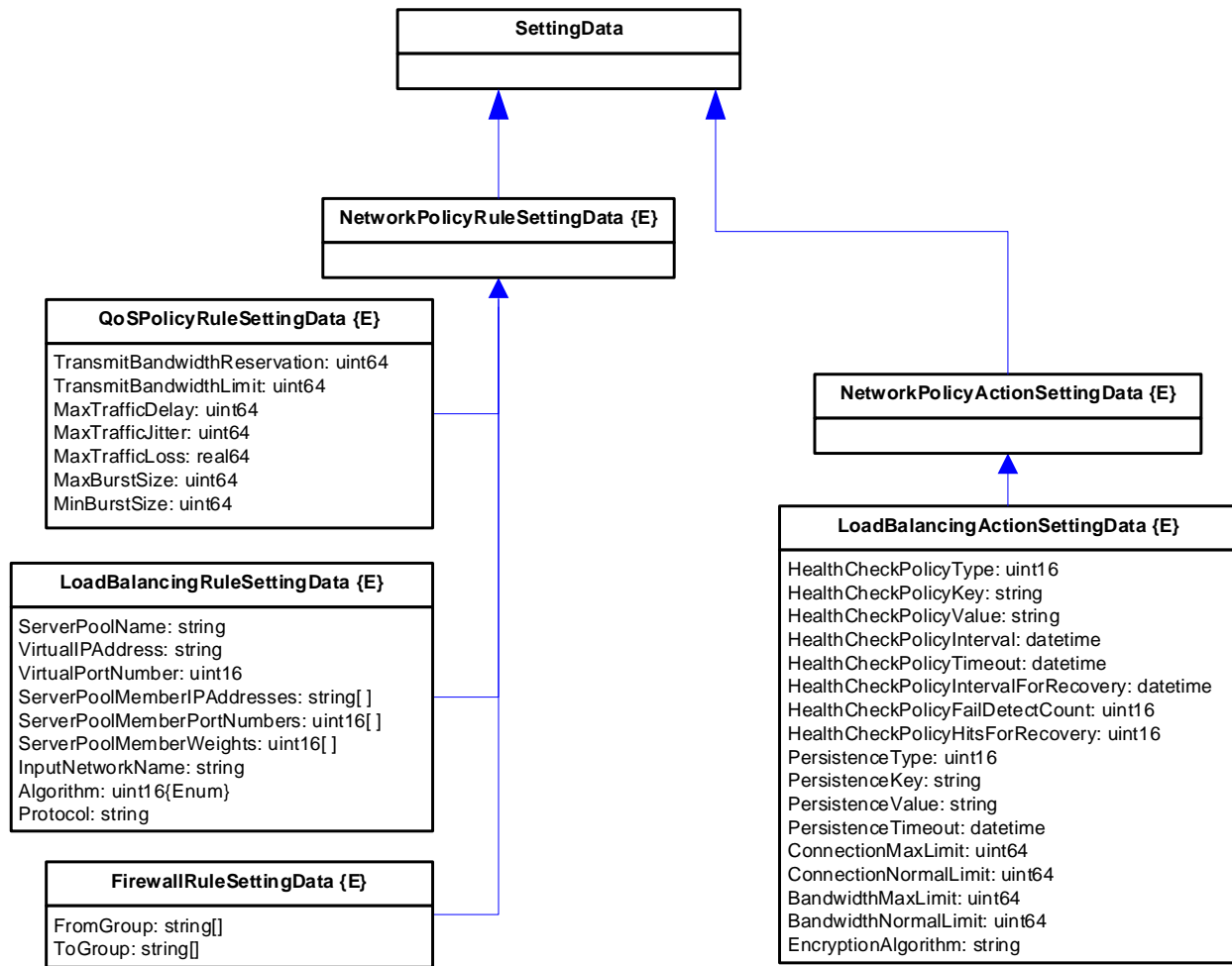
399 9.2 Profile extension and usage examples

400 9.2.1 Extending and using the Network Policy Management Profile

401 The *Network Policy Management Profile* is a base profile that specifies the CIM Schema and use cases
 402 associated with the general and common aspects of Network Policy Management. This profile is intended
 403 to be extended to represent various kinds of network policies, such as Load Balancing, Firewall, QoS,
 404 Routing, etc.

405 The extension is generally performed by subclassing `CIM_NetworkPolicyRuleSettingData` to represent
 406 the settings specific to the particular type of Network Policy, for example Load Balancer by introducing
 407 `CIM_LoadBalancingRuleSettingData` and by subclassing `CIM_NetworkPolicyActionSettingData` if the
 408 particular type of actions require specific configuration parameters, for example by introducing
 409 `CIM_LoadBalancingActionSettingData` to specify the action settings for the load balancing actions.

410 The class diagram on Figure 3 represents the Policy Rule and Action extensions for the Load Balancer,
 411 Firewall, and QoS specific Network Policies.



412

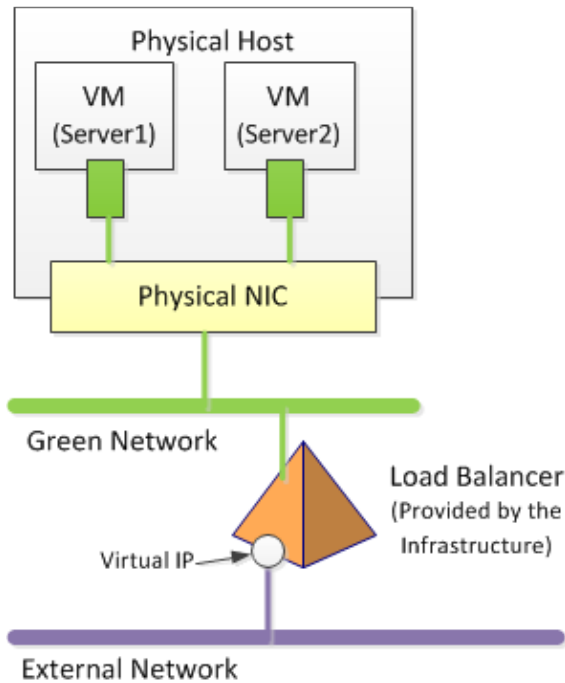
413

Figure 3 – Network Management Policy extensions

414 **9.2.2 Load Balancer configuration**

415 Figure 4 illustrates one of the possible load balancing scenarios. In this case the Load Balancer needs to
 416 redirect the IP traffic, coming from the external network to one of the Virtual Machines (VM), hosted by the
 417 same Physical Host. The VMs are connected to the internal network and their IP addresses can be
 418 resolved via NAT.

419 The IP traffic that needs to be load balanced is coming to port 80 and the load balancing needs to be
 420 performed using Round Robin algorithm, where each VM can be assigned its own weight. In this example
 421 VM1 has been assigned weight equal to 6 and VM2 has been assigned weight equal to 3.

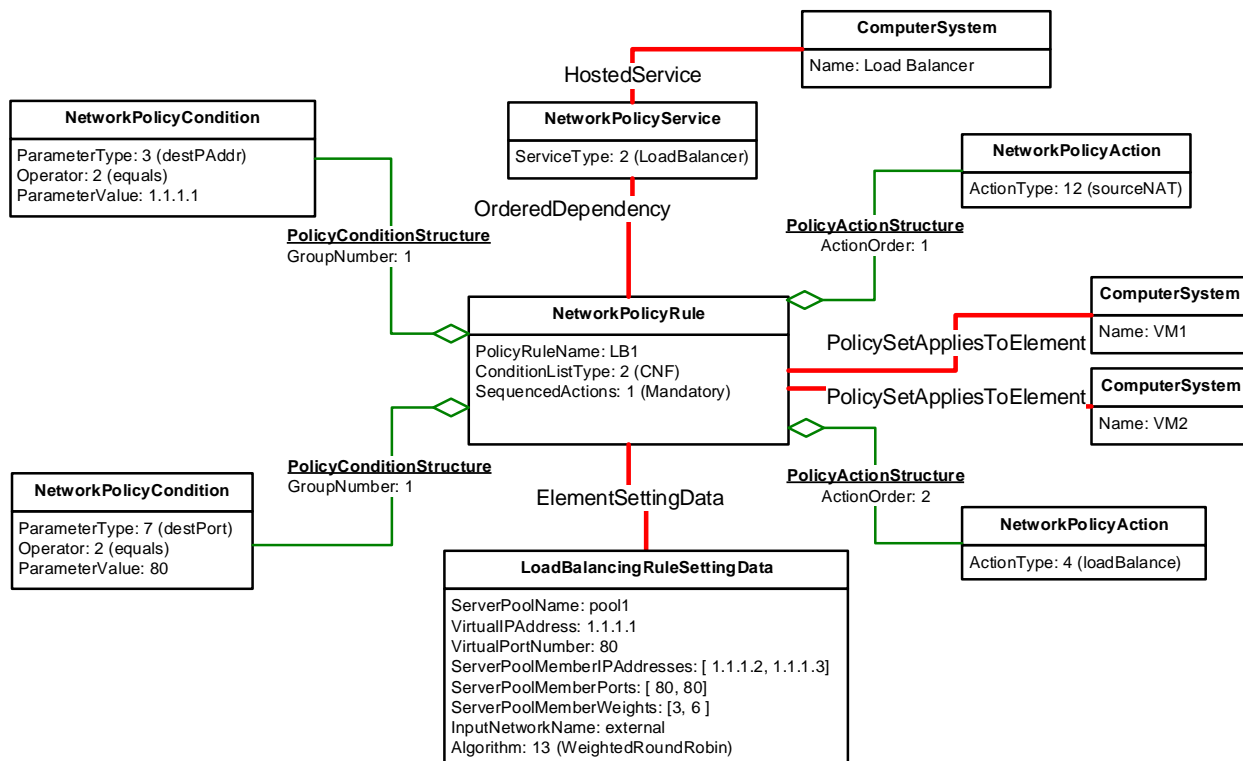


Parameter	Configuration Value
Algorithm	RoundRobin
Virtual Port	80
VM1 Destination Port	80
VM2 Destination Port	80
VM1 weight	6
VM2 weight	3
NetworkPolicyActions	Source NAT Load balance

422

423

Figure 4 – Example load balancing scenario



424

425

Figure 5 – Example load balancing configuration using Network Policy

426

427

Figure 5 shows how such load balancing configuration can be modeled using Network Policy model. As per Network Policy model extension principles described earlier in clause 9.2.1, we are creating instances

428 of CIM_LoadBalancingRuleSettingData classes to capture the specific configuration parameters of the
 429 load balancer, such as VM weights, load balancing algorithm, and VM destination ports.

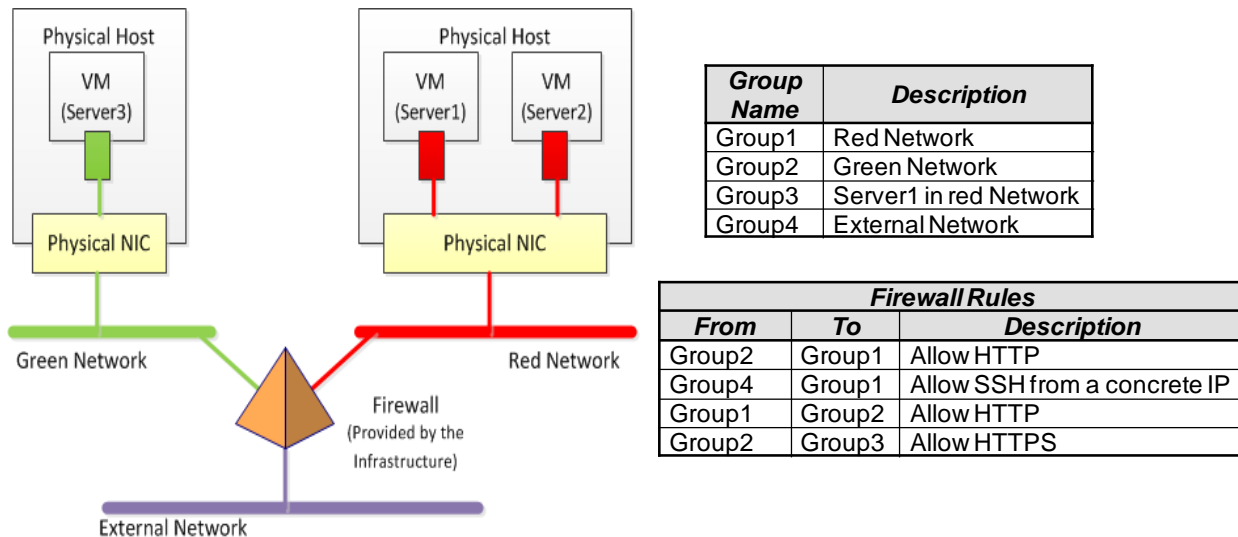
430 In the case of the Round Robin load balancing algorithm, there is no need to create the additional
 431 instances of the CIM_LoadBalancingActionSettingData class.

432 The instances of CIM_NetworkPolicyCondition classes capture some of the configuration parameters,
 433 notably the destination ports for incoming IP traffic.

434 **9.2.3 Firewall configuration**

435 Another example of extending and using the Network Policy Management profile is configuration of
 436 firewalls. Consider the example firewall configuration scenario outlined on the Figure 6. Here we are
 437 configuring four network groups with the different rules permitting or denying traffic flow between them
 438 and the external network.

439 Each group can contain individual or several networks (e.g., Red Network or Green Network) or can be a
 440 collection of virtual machines or servers in the particular network (e.g., Server 1 in Red Network).



441

442 **Figure 6 – Example firewall configuration scenario**

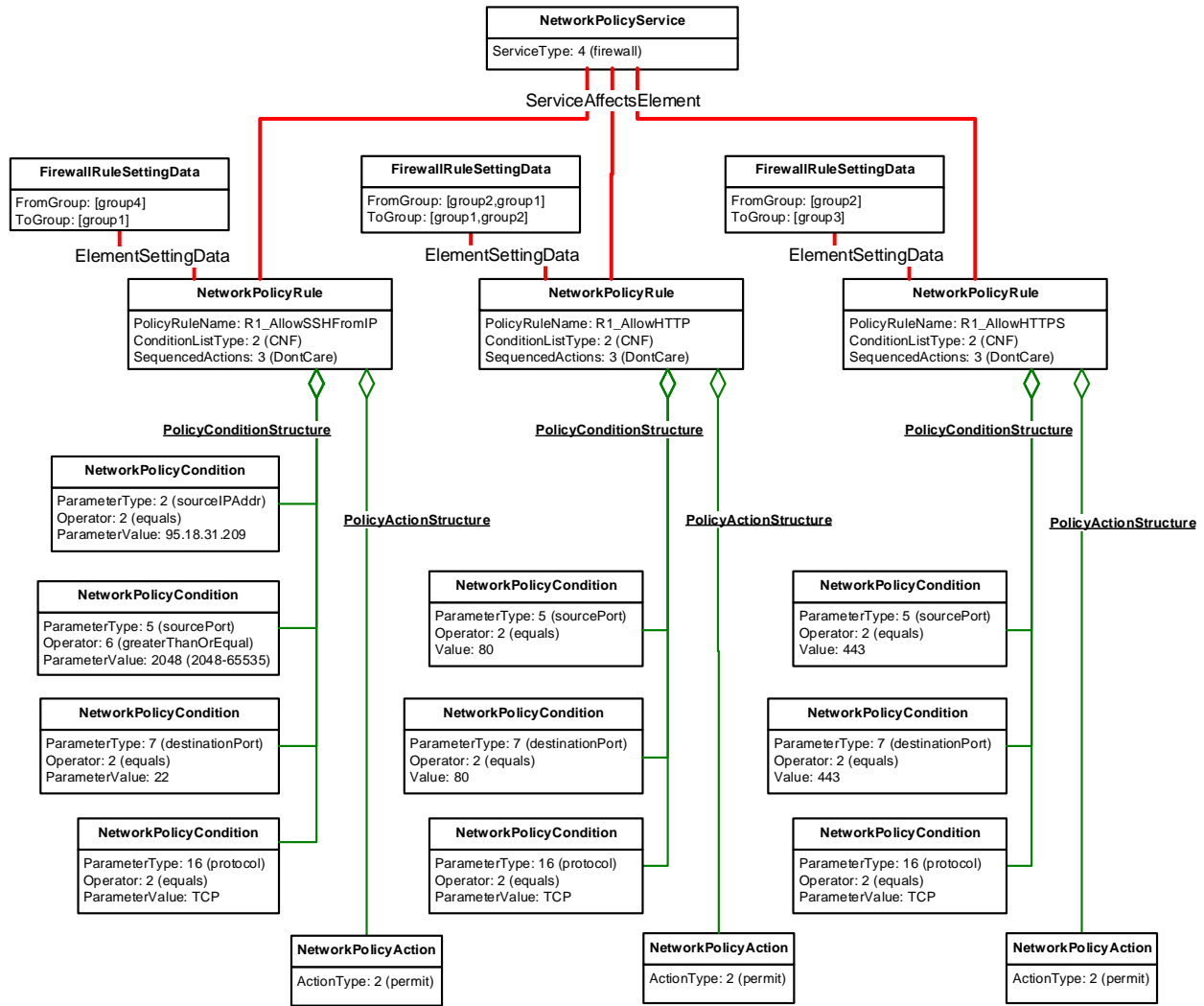
443 The Firewall Rules table in Figure 6 describes the traffic flow rules between various groups used in this
 444 example.

445 Figure 7 illustrates how the firewall rules described earlier can be modeled using Network Policy model.

446 In this case we are using instances of CIM_FirewallRuleSettingData to specify some of the firewall
 447 configuration data, such as the names of the Groups for which the particular policy instance is configured.

448 The instances of CIM_NetworkPolicyCondition class specify the traffic characteristics (e.g., source IP
 449 address and port number) that are used to trigger the particular policy (represented as an instance of
 450 CIM_NetworkPolicyRule), which controls the traffic flow in the system.

451 The only type of action used by this model is the Permit action (represented via the instance of
 452 CIM_NetworkPolicyAction class with the actionType property set to 'permit'), which indicates that the
 453 particular policy permits the flow of traffic between the groups once the matching conditions trigger the
 454 execution of the particular policy instance.



455

456

Figure 7 – Example firewall configuration scenario using Network Policy

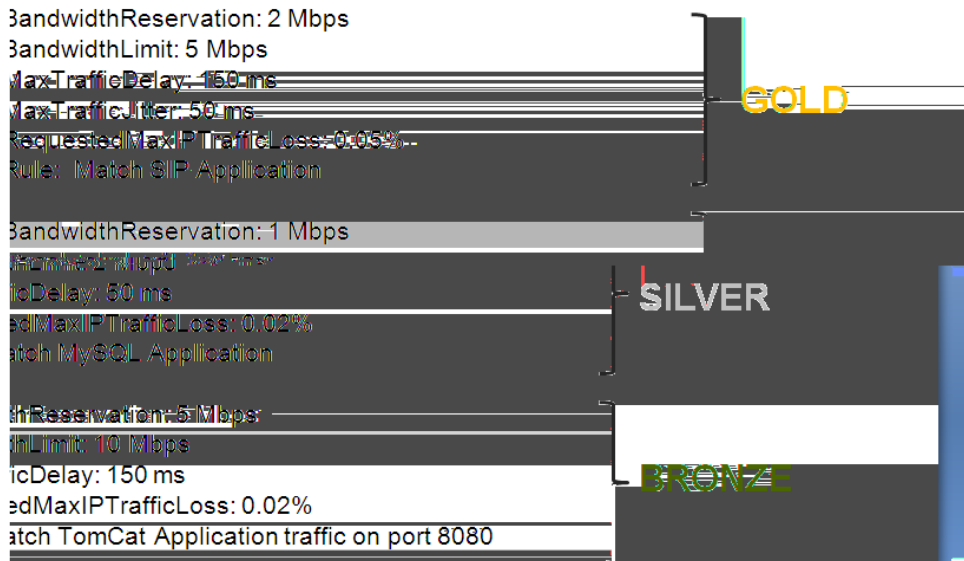
457 **9.2.4 QoS Service configuration**

458 Figure 8 shows the example Quality of Service (QoS) configurations. Here we have three classes of
 459 service – Gold, Bronze, and Silver, each with different traffic characteristics, such as maximum allowed
 460 bandwidth, maximum delay, jitter, and others.

461 These QoS characteristics can be applied to the traffic, generated by the particular applications, for
 462 example between SIP clients and server, MySQL applications deployed in Tomcat, etc.

463 The purpose of the QoS policies is to control the use of the network resources according to selected class
 464 of service.

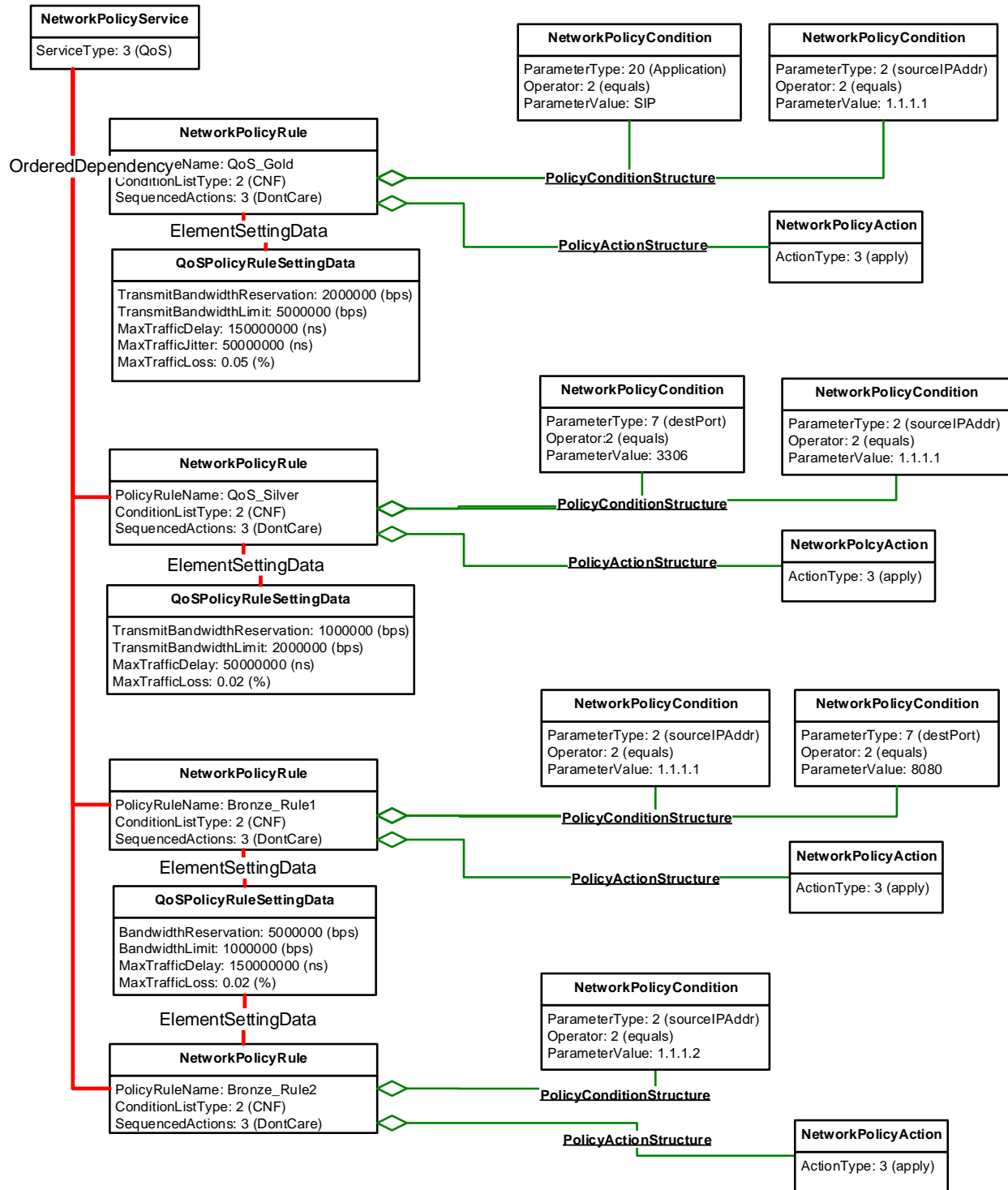
Scenario.



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Figure 8 – Example QoS Service configuration



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Figure 9 - Example QoS Service configuration

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Figure 9 illustrates how various QoS policies can be configured using Network Policy Management Profile.

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471 **10 CIM Elements**

472 Table 2 shows the instances of CIM Elements for this profile. Instances of the CIM Elements shall be
 473 implemented as described in Table 2. Clauses 7 (“Implementation”) and 8 (“Methods”) may impose
 474 additional requirements on these elements.

475 **Table 2 – CIM Elements: Network Policy Management Profile**

Element Name	Requirement	Description
Classes		
CIM_NetworkPolicyService	Required	See clauses 7.1.1
CIM_NetworkPolicyRule	Optional	See clauses 7.2.1
CIM_NetworkPolicyCondition	Optional	See clauses 7.2.2
CIM_NetworkPolicyAction	Optional	See clauses 7.2.3
CIM_NetworkPolicyRuleSettingData	Optional	See clauses 7.3.1
CIM_NetworkPolicyActionSettingData	Optional	See clauses 7.3.2
CIM_NetworkPolicyServiceCapabilities	Optional	See clauses 7.1.2
Association and endpoints		
Indications		
None defined in this profile		

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**ANNEX A
(informative)**

Change log

Version	Date	Description
1.0.0	2021-02-26	

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