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The Differentiated Services Configuration MIB

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

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Abstract

This memo describes a MIB module that provides a conceptual layer between high-level "network-wide" policy definitions that effect configuration of the Differentiated Services (diffserv) subsystem and the instance-specific information that would include such details as the parameters for all the queues associated with each interface in a system. This essentially provides an interface for configuring differentiated services at a conceptually higher layer than that of the Differentiated Services MIB.

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1. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIV2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

2. Introduction

This memo defines a MIB module that can be used to convey management information about desired network-wide Differentiated Services based policy behavior. This module is designed to integrate with the Differentiated Services MIB module [RFC3289] in order to provide template configurations for the Differentiated Services MIB module. The MIB module defined in this memo (the DIFFSERV-CONFIG-MIB) may be

used in combination with the Policy-based Management MIB module [PMMIBDR], but that is not a requirement. Without the Policy-based Management MIB module, a management application must emulate behavior provided by the Policy-based Management MIB using equivalent "low-level" SNMP operations in normal manager/agent communication.

Together, this memo, [RFC3289], and [PMMIBDR] represent an instance of an integrated architecture for both device-specific and network-wide policy (configuration) management, which is fully integrated with the Internet Standard Management Framework.

The Differentiated Services MIB module [RFC3289] operates on a device level. The MIB module in this memo, the DIFFSERV-CONFIG-MIB, creates a coherent configuration management view as an umbrella over [RFC3289]. That is, the DIFFSERV-CONFIG-MIB provides a conceptual Application Program Interface (API) for configuration of the Differentiated Services parameters. Since the Differentiated Services MIB module is able to maintain configuration information, the DIFFSERV-CONFIG-MIB configuration API consists only of configuration template information and the start of the so-called functional datapath.

3. Other Documents

It is assumed that the reader is familiar with Differentiated Services ([RFC2474] and [RFC2475]), the Policy-based Management MIB ([PMMIBDR]), and "Configuring Networks and Devices With SNMP" ([RFC3512]). These documents include all of the necessary terminology for understanding this memo. However, note that use of the MIB module in this memo does not require the use of [PMMIBDR]. [RFC3512] also provides an example MIB module which may help in understanding the relationship between DIFFSERV-CONFIG-MIB and the Differentiated Services MIB in [RFC3289].

4. Relationship to other MIBs

In this section, we describe the relationship of this MIB module to other MIB modules. The overall architecture used for policy configuration management is described in [PMMIBDR].

4.1. The Policy-based Management MIB Module

[PMMIBDR] defines a MIB module that enables policy-based configuration management of infrastructure using the Internet Standard Management Framework. The document includes a table for configuring policies to be implemented, tables for storing the roles of elements on a particular device, a table for representing the capabilities of a device with respect to policy management, a table

for referencing elements affected by a policy, as well as other infrastructure. There is no requirement that [PMMIBDR] be used in conjunction with the MIB module defined in this memo.

See [PMMIBDR] for a full description of the policy-based configuration framework it provides.

4.2. The Differentiated Services MIB Module

The Differentiated Services MIB module [RFC3289] provides a common set of managed objects useful for configuring Differentiated Services parameters on a Differentiated Services capable device. This is what is referred to as instance-level configuration. It is the alteration of the instance-level information in that MIB module which may be done using the objects in the MIB module defined in this memo.

It is recognized that vendors may include additional managed objects in their devices (via vendor-specific MIB modules) for configuring Differentiated Services parameters. If a vendor chooses to use the objects defined in this memo for configuration, the vendor should provide additional managed objects in a similar approach as defined for the Differentiated Services MIB module.

Since the managed objects of the Differentiated Services MIB [RFC3289] are not directly associated with an instance (interface and interface direction), the same managed objects can be used for traffic treatment configuration templates in a Differentiated Services capable device and can then be applied on multiple instances. Therefore, the tables as defined in the Differentiated Services MIB can be used directly for template configuration purposes. Those tables are:

- diffServClfrTable
- diffServClfrElementTable
- diffServMultiFieldClfrTable
- diffServMeterTable
- diffServTBParamTable
- diffServActionTable
- diffServDscpMarkActTable
- diffServCountActTable
- diffServAlgDropTable
- diffServRandomDropTable
- diffServQTable
- diffServSchedulerTable
- diffServMinRateTable
- diffServMaxRateTable

Readers familiar with the Differentiated Services MIB will notice that these are all templates. Only the diffServDataPathTable defines a managed instance for Differentiated Services traffic treatment by its indexes of the interface and its direction. This also allows the tables mentioned above to be used as a configuration template without defining anything directly related to a managed instance.

5. The Differentiated Services Configuration MIB Module Design

The Differentiated Services Configuration MIB module (in this memo) of the SNMP-based configuration management framework is positioned between the Policy-based Management MIB module and the instance-specific Differentiated Services MIB module as described above.

The MIB module found in this memo is designed to maintain configuration templates for the Differentiated Services MIB [RFC3289] module. The module only has a template table that describes a Differentiated Services traffic treatment by providing the starting pointer of the functional datapath. The templates represent a specific configuration of traffic treatment in a functional datapath of a Differentiated Services capable device. To avoid duplication of managed objects, the actual templates defining the functional datapath are defined in the Differentiated Services MIB module. These are also used for the management of the instances. Therefore, the implementation of the DIFFSERV-CONFIG-MIB module uses the tables defined in the Differentiated Services MIB. As soon as a configuration is made active via the POLICY-MANAGEMENT-MIB or using normal SNMP operations, the configuration defined within this MIB module will be instantiated in the DIFFSERV-MIB.

Note that this is a conceptual process. That is, the configuration may not actually go through an API available in the subsystem which implements the DIFFSERV-MIB module. However, configuration via the DIFFSERV-CONFIG-MIB module will alter the same instrumentation as the DIFFSERV-MIB module whether it does it via the DIFFSERV-MIB module or not.

The Differentiated Services Configuration MIB module only needs to define a starting point of a traffic treatment configuration template. This table is similar to the diffServDataPathTable [RFC3289]. However, it has a semantic difference in that the diffServDataPathTable is associated with an instance (interface and interface direction), whereas the diffServConfigTable in this memo is not.

Unlike most MIB modules, changes to the managed objects in this MIB module do not cause a change in the external/traffic behavior of the device. This MIB module is used to set up per-hop-behavior configurations. As soon as configurations are made active via the POLICY-MANAGEMENT-MIB or SNMP operations, the configurations defined within this MIB module will be instantiated in the DIFFSERV-MIB.

The only table in this MIB module is the diffServConfigTable, which provides managed objects for registering traffic treatment configurations used in differentiated services. The sole purpose of this table is to provide the starting point for a traffic treatment configuration template. The traffic treatment itself is performed by functional datapath elements [RFC3289].

6. Template Cloning

The concept of the DIFFSERV-CONFIG-MIB is based on having traffic treatment configuration templates. The templates provide a set of configuration values that provide a particular behavior, such as Expedited Forwarding traffic treatment, in the functional datapath. The template (or functional datapath) is similar to a linked list from a starting point and each (functional datapath) element is connected to the next element via the so-called next RowPointer.

The moment a template is activated (instantiated) on an interface and its interface direction, the template needs to be copied/cloned, so that the template remains as a template. Note that the template is logically "locked" through the cloning process. That is, the template cannot be changed part way through the cloning process. With the exception of the indices, the cloned template will be identical to the source template.

A literal copy/clone of the template is not possible, since the same indices inside the element tables cannot be re-used. The instantiation process must therefore generate a new index for each element. As a result of this, the 'NEXT' pointers also need to be updated. Otherwise, those will point to the template.

6.1. An Approach to Template Cloning

What should a system containing Differentiated Services capabilities and Differentiated Services configuration capabilities do conceptually at the moment a template is activated on an interface? The following approach should not be considered implementation guidelines, but rather a conceptual explanation of what should be done.

- 1) Get the index of the template to be activated
- 2) Get RowPointer (current) from
diffServConfigStart.index
of the diffServConfigTable
- 3) Check if RowPointer (current) exists
- 4) Logically "lock" the entry (current) pointed to by
RowPointer so that its values are not changed part way
through the cloning process.
- 5) Copy/Clone the entry (current) pointed to by RowPointer
 - a) Get a new index for the entry
 - b) Configure the new entry with the values
of the entry to be cloned
 - c) Update the NEXT pointer with a new RowPointer
that pointed to the previous entry that was copied
part of this template
- 6) Store RowPointer of cloned entry as (previous) in order to
update the NEXT pointer with the next cloned entry.
- 7) Get the RowPointer of the next element in the template
as (current)
- 8) If (current) RowPointer does not equal zeroDotZero go to 4
- 9) Logically "unlock" all the locked entries done by step 4).

If a configuration/template is activated via a means other than a direct SNMP SET request, such as via the Policy-based Management MIB, the handling of the activation and potential error response code must be provided via that mechanism. If a configuration/template is activated using SNMP SET requests, an accurate error response value must be returned. For example, if a configuration/template has inconsistent values, the SNMP SET should return an error. Whether the configuration is already finished is not of direct importance, since the SNMP SET response must be accurate. On systems where the activation may take a long time, a response may be given prior to completion, but extra mechanisms must be provided to detect any errors.

6.2. Example

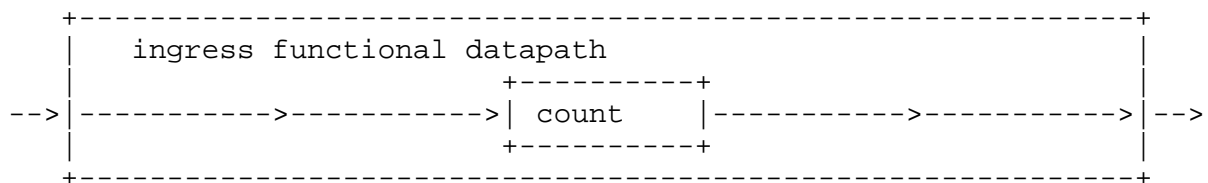
This section provides an example of the process described in the previous section. This example will show a Differentiated Services capable incoming (ingress) interface that only counts the traffic stream. Then, with the policy-based configuration concept as defined in this document and in [PMMIBDR], a traffic marking configuration will be applied. The example will walk the reader through all of the steps involved in this process. Again, the use of [PMMIBDR] is simply an example and is not required.

NOTE WELL: For brevity and clarity, the example does not always show the complete entry (row) of a table. The only objects shown are those needed for creating the row pointers to the next functional datapath element or needed to provide information about the specific parameters of the functional datapath elements. The column named 'INDEX' always defines the complete index as defined for the associated entry. In some cases, this is a combined index of multiple components. Therefore, the names of the columns are omitted.

Also note that the values Assured Forwarding and Expedited Forwarding are abstracted as DSCP(AF) and DSCP(EF) (respectively) or simply as AF and EF. For the actual values refer to [RFC3289].

6.2.1. The Initial Situation

The initial configuration is the existing configuration of an ingress interface.



This figure depicts a simple traffic treatment functional datapath for an ingress interface. The functional datapath only consists of a count action.

Within the DIFFSERV-MIB, this would be instantiated as follows. Note that RowPointer objects must point to the first accessible columnar object in the conceptual row. Thus, while perhaps more instructive to use the index value for the RowPointer object's value (e.g., diffServCountActId.1) in the example, it would nonetheless be incorrect, and the first accessible columnar object has been used as should be done (e.g., diffServCountActOctets.1).

diffServDataPathTable

INDEX	diffServDataPathStart
ifIndex.ingress	diffServActionNext.1

diffServActionTable

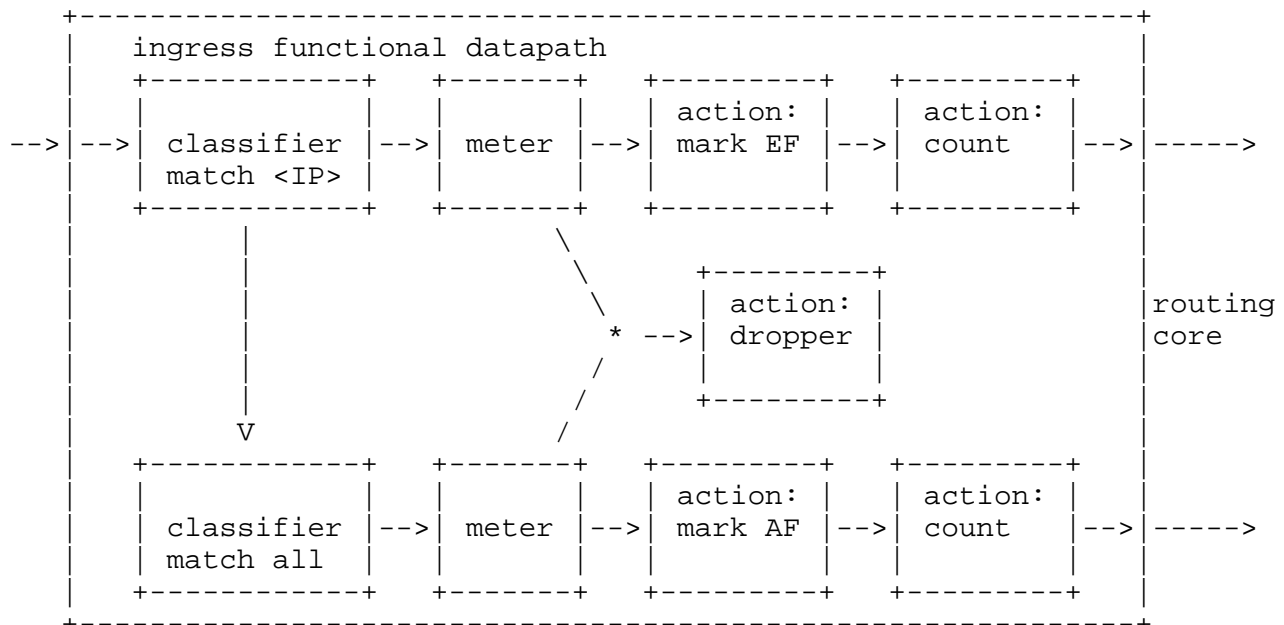
INDEX	diffServActionNext	diffServActionSpecific
1	0.0	diffServCountActOctets.1

diffServCountActTable

INDEX	diffServCountActOctets
1	

6.2.2. The Configuration Template

The following provides an example of a policy configuration in which traffic is classified by a specific IP filter, that results in two classifiers (one for the IP filter and one for match all). Both streams are then metered, marked, and counted. This is an example of usage on the edge (an ingress interface) of a Differentiated Services domain that wants to have Expedited Forwarding and Assured Forwarding marked traffic within the Differentiated Services domain.



This figure depicts a policy configuration for ingress traffic treatment in a Differentiated Services capable device. The

configuration is represented as follows in the DIFFSERV-CONFIG-MIB module and the DIFFSERV-MIB module.

Note that the original (existing) traffic treatment described in 6.2.1 is also in the tables.

Note also that in the diffServDscpMarkActTable, DSCP(EF) represents the DSCP value for Expedited Forwarding and DSCP(AF) represents the DSCP value for Assured Forwarding.

diffServConfigTable (in the MIB module in this memo)

INDEX	diffServConfigStart	diffServConfigDescr
"foo"	diffServClfrStorage.1	Example traffic treatment

diffServClfrTable

INDEX	diffServClfrStorage	diffServClfrStatus
1		

diffServClfrElementTable (shares index with diffServClfrTable)

INDEX	diffServClfrElementNext	diffServClfrElementPrecedence
1.1	diffServMeterSucceedNext.1	1
1.2	diffServMeterSucceedNext.2	2

diffServMeterTable

INDEX	diffServMeterSucceedNext	diffServMeterFailNext
1	diffServActionNext.2	diffServAlgDropType.1
2	diffServActionNext.3	diffServAlgDropType.1

diffServActionTable

INDEX	diffServActionNext	diffServActionSpecific
1	0.0	diffServCountActOctets.1
2	diffServActionNext.4	diffServDscpMarkActDscp.EF
3	diffServActionNext.5	diffServDscpMarkActDscp.AF
4	0.0	diffServCountActOctets.2
5	0.0	diffServCountActOctets.3

diffServCountActTable

INDEX	diffServCountActOctets
1	
2	
3	

diffServAlgDropTable

INDEX	diffServAlgDropType	diffServAlgDropSpecific
1	alwaysDrop(5)	0.0

diffServDscpMarkActTable

diffServDscpMarkActDscp
DSCP(EF)
DSCP(AF)

6.2.3. Applying the Template

Now we have the original ingress interface configuration and the policy configuration we want to apply to the actual interface.

The example policy must provide the required Differentiated Services traffic treatment to all interfaces used by system administrators. The traffic treatment required is described in 6.2.2 above.

Therefore, we have the following example policy which is configured via the POLICY-BASED-MANAGEMENT-MIB module (see [PMMIBDR]):

```
if ( roleMatch("Administrator") )
```

```

then
/*
 * The $0 gets the "element" returned from the previous
 * statement.  the .1 at the end is the ingress interface
 * This sets, for example, diffServDataPathStart.3.1 to be
 * "diffServConfigStart.3.f.o.o" if interface 3 has the role
 * "Administrator".
 */
setVar("diffServDataPathStart.$0.1",
       "diffServConfigStart.3.f.o.o", Oid)

```

For our purposes, we only apply this on the inbound (ingress) direction of the interface.

Note that although object descriptors are used in this PolicyScript example, the object identifiers must be used in the running script. For more information on policies and their syntax refer to [PMMIBDR].

The following tables in this section provide the cloned entries in the tables of the DIFFSERV-MIB module. All tables may have columns that contain contents or administrative objects that are not shown. These columns do not determine a function in the datapath and they are not shown for clarity of the cloning mechanism.

Note that the original (existing) traffic treatment of 6.2.1 and 6.2.2 are also in the tables.

diffServConfigTable

INDEX	diffServConfigStart	diffServConfigDescr
"foo"	diffServClfrStorage.1	Example traffic treatment

diffServDataPathTable

INDEX	diffServDataPathStart
ifIndex.ingress	diffServActionNext.2

diffServClfrTable

INDEX	diffServClfrStorage	diffServClfrStatus
1		
2		

diffServClfrElementTable

INDEX	diffServClfrElementNext	diffServClfrElementPrecedence
1.1	diffServMeterSucceedNext.1	1
1.2	diffServMeterSucceedNext.2	2
2.3	diffServMeterSucceedNext.3	1
2.4	diffServMeterSucceedNext.4	2

diffServMeterTable

INDEX	diffServMeterSucceedNext	diffServMeterFailNext
1	diffServActionNext.2	diffServAlgDropType.1
2	diffServActionNext.3	diffServAlgDropType.1
3	diffServActionNext.6	diffServAlgDropType.2
4	diffServActionNext.7	diffServAlgDropType.2

diffServActionTable

INDEX	diffServActionNext	diffServActionSpecific
1	0.0	diffServCountActOctets.1
2	diffServActionNext.4	diffServDscpMarkActDscp.EF
3	diffServActionNext.5	diffServDscpMarkActDscp.AF
4	0.0	diffServCountActOctets.2
5	0.0	diffServCountActOctets.3
6	diffServActionNext.8	diffServDscpMarkActDscp.EF
7	diffServActionNext.9	diffServDscpMarkActDscp.AF
8	0.0	diffServCountActOctets.4
9	0.0	diffServCountActOctets.5

diffServCountActTable

INDEX	diffServActCountOctets
1	
2	
3	
4	
5	

diffServAlgDropTable

INDEX	diffServAlgDropType	diffServAlgDropSpecific
1	alwaysDrop(5)	0.0

diffServDscpMarkActTable

diffServDscpMarkActDscp
DSCP(EF)
DSCP(AF)

As one can see in the example, the main elements from which a functional datapath is constructed are duplicated/copied/cloned. That process is needed in order to preserve the policy configuration for reuse at a later time.

It is up to the SNMP agent to keep track of which network interfaces are under policy control and which policy rules are being used. This avoids duplication of policy enforcement. How the agent does this is an implementation issue.

One can see that the old functional datapath configurations stay in the MIB module tables. It is up to the SNMP agent implementation to decide whether to delete stale entries or keep them. Garbage collection of stale entries is an implementation issue.

6.2.4. Applying the Template Using SNMP Messages

In this section, the above example is explained by using SNMP communication between the SNMP "manager" and the SNMP "agent".

In order to apply the template to all interfaces that have a role match of "Administrator," the SNMP manager must have a list of the roles of the interface. This means the SNMP manager must do an SNMP-SET for all those interfaces. This is expressed in the following pseudo code function.

```
set_template_if_administrator_interface(
    <interface_list>, <template_name>
) {
    template_oid = SNMP-GET("diffServConfigStart.<template_name>");
    foreach interface (<ifRole_list>) {
        if (interface.role == "Administrator") {
            SNMP-SET("diffServDataPathStart.$interface.1",
                Oid, template_oid);
        }
    }
}
```

For example, on a system with 3 interfaces, the following list would be known to the manager. The first value indicates the interface number (ifIndex) and the second value is its role.

```
interface_list IF_LIST = {
    { 1, ... , "Administrator", ... },
    { 2, ... , "User", ... },
    { 3, ... , "Administrator", ... } }
```

This will result in the communication between a manager and agent of 1 SNMP-GET and 2 SNMP-SETs:

```
- SNMP-GET("diffServConfigStart.3.f.o.o")
- SNMP-SET("diffServDataPathStart.1.1", Oid, "diffServActionNext.1")
- SNMP-SET("diffServDataPathStart.3.1", Oid, "diffServActionNext.1")
```

7. Managed Objects Definitions (MIB Module)

DIFFSERV-CONFIG-MIB DEFINITIONS ::= BEGIN

IMPORTS

```
OBJECT-TYPE, MODULE-IDENTITY,
zeroDotZero, mib-2                FROM SNMPv2-SMI                -- [RFC2578]

RowStatus, StorageType,
RowPointer, DateAndTime            FROM SNMPv2-TC                -- [RFC2579]

MODULE-COMPLIANCE,
OBJECT-GROUP                      FROM SNMPv2-CONF                -- [RFC2580]
```

SnmpAdminString FROM SNMP-FRAMEWORK-MIB; -- [RFC3411]

diffServConfigMib MODULE-IDENTITY

LAST-UPDATED "200401220000Z" -- 22 January 2004

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DESCRIPTION

"This MIB module contains differentiated services specific managed objects to perform higher-level configuration management. This MIB allows policies to use 'templates' to instantiate Differentiated Services functional datapath configurations to be assigned (associated with an interface and direction) when a policy is activated.

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REVISION "200401220000Z" -- 22 January 2004

DESCRIPTION

"Initial version published as RFC 3747"

::= { mib-2 108 }

diffServConfigMIBObjects OBJECT IDENTIFIER ::= { diffServConfigMib 1 }

diffServConfigMIBConformance OBJECT IDENTIFIER ::= { diffServConfigMib 2 }

--

-- The Differentiated Services configuration objects

--

diffServConfigTable OBJECT-TYPE

SYNTAX SEQUENCE OF DiffServConfigEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table which defines the various per-hop-behaviors for which the system has default 'templates'."

::= { diffServConfigMIBObjects 2 }

diffServConfigEntry OBJECT-TYPE

SYNTAX DiffServConfigEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry defining a per-hop-behavior. Each entry in this table combines the various parameters (entries) into a specific per-hop-behavior. Entries in this table might be defined by a vendor (pre-configured) or defined by a management application."

INDEX { diffServConfigId }

::= { diffServConfigTable 1 }

DiffServConfigEntry ::= SEQUENCE {

diffServConfigId SnmpAdminString,

diffServConfigDescr SnmpAdminString,

diffServConfigOwner SnmpAdminString,

diffServConfigLastChange DateAndTime,

diffServConfigStart RowPointer,

diffServConfigStorage StorageType,

diffServConfigStatus RowStatus

}

diffServConfigId OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE(1..116))

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A unique id for the per-hop-behavior policy for at least the SNMP agent. For ease of administration the value may be unique within an administrative domain, but this is not required."

The range of up to 116 octets is chosen to stay within the SMI limit of 128 sub-identifiers in an object identifier."

::= { diffServConfigEntry 1 }

diffServConfigDescr OBJECT-TYPE

SYNTAX SnmpAdminString
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"A human-readable description to identify this defined per-hop-behavior. Note that this is an SnmpAdminString, which permits UTF-8 strings. An administratively assigned identifier for a template that would be unique within an administrative domain. It is up to the management applications to agree how these are assigned within the administrative domain. Once a description, such as 'EF' is assigned, that has a certain set of parameters that achieve 'EF' from box to box. Management application code or script code can then scan the table to find the proper template and then assign it."

::= { diffServConfigEntry 2 }

diffServConfigOwner OBJECT-TYPE
SYNTAX SnmpAdminString
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"The owner who created this entry."

::= { diffServConfigEntry 3 }

diffServConfigLastChange OBJECT-TYPE
SYNTAX DateAndTime
MAX-ACCESS read-only
STATUS current
DESCRIPTION

"The date and time when this entry was last changed."

::= { diffServConfigEntry 4 }

diffServConfigStart OBJECT-TYPE
SYNTAX RowPointer
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"The pointer to a functional datapath configuration template as set up in the DIFFSERV-MIB. This RowPointer should point to an instance of one of:

- diffServClfrEntry
- diffServMeterEntry
- diffServActionEntry
- diffServAlgDropEntry
- diffServQEntry

A value of zeroDotZero in this attribute indicates no further Diffserv treatment is performed on traffic of this functional datapath. This also means that the template described by this row is not defined.

If the row pointed to does not exist, the treatment is as if this attribute contains a value of zeroDotZero."

REFERENCE

"Differentiated Services MIB module"

DEFVAL { zeroDotZero }

::= { diffServConfigEntry 5 }

diffServConfigStorage OBJECT-TYPE

SYNTAX StorageType

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The type of storage used for this row.

Since an entry in this table serves as a starting point for a configuration, it is recommended that all entries comprising the configuration started by diffServConfigStart follow the storage type of this entry. Otherwise, after agent reboots a configuration may differ. It may very well be that the agent is not capable of detecting such changes and therefore, the management application should verify the correct configuration after a reboot. Rows with a StorageType of 'permanent' do not need to allow write access to any of the columnar objects in that row."

DEFVAL { nonVolatile }

::= { diffServConfigEntry 6 }

diffServConfigStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"RowStatus object used for creation and deletion of rows in this table. All writable objects in this row may be modified at any time."

DEFVAL { notInService }

::= { diffServConfigEntry 7 }

--

-- MIB Compliance statements.

--

```

diffServConfigMIBCompliances
  OBJECT IDENTIFIER ::= { diffServConfigMIBConformance 1 }
diffServConfigMIBGroups
  OBJECT IDENTIFIER ::= { diffServConfigMIBConformance 2 }

diffServConfigMIBFullCompliance MODULE-COMPLIANCE
  STATUS          current
  DESCRIPTION
    "The full compliance for this MIB module.

    For this compliance level the 'diffServMIBFullCompliance'
    must be met, since this MIB module depends on it in order
    to provide the configuration entries.
    "
  MODULE -- This module
  MANDATORY-GROUPS { diffServConfigMIBConfigGroup }

  OBJECT diffServConfigStatus
  SYNTAX RowStatus { active(1) }
  WRITE-SYNTAX RowStatus { createAndGo(4), destroy(6) }
  DESCRIPTION
    "Support for createAndWait and notInService is not required."

    ::= { diffServConfigMIBCompliances 1 }

diffServConfigMIBConfigGroup OBJECT-GROUP
  OBJECTS { diffServConfigDescr,
            diffServConfigOwner,
            diffServConfigLastChange,
            diffServConfigStart,
            diffServConfigStorage,
            diffServConfigStatus
          }
  STATUS current
  DESCRIPTION
    "The per-hop-behavior Group defines the MIB objects that
    describe the configuration template for the per-hop-behavior."
    ::= { diffServConfigMIBGroups 1 }
END

```

8. Security Considerations

There are a number of management objects defined in this MIB module with a MAX-ACCESS clause of read-write and/or read-create. Such objects may be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations. These managed objects are:

- The diffServConfigDescr, diffServConfigOwner, and diffServConfigStatus are not security sensitive since these three objects do not affect any direct operational behavior of a diffserv capable device.
- Unauthorized change of the diffServConfigStart could lead to a different configuration, and the 'changed' configuration could lead to different traffic treatment for the diffserv capable device than desired.
- Unauthorized change of the diffServConfigStorage could lead to unknown behavior of the diffserv capable device after a reboot of the SNMP agent. This may be caused by 'not having saved changes of the configuration' or unavailable configurations.

In addition, the managed objects of the DIFFSERV-MIB are also security sensitive, since unauthorized changes may cause configuration changes. For more detail, refer to [RFC3289].

Allowing read access to objects in this MIB module is generally not considered sensitive, as read access only provides information that a template exists. This is due to the fact that the managed objects that actually instantiate the template are in the DIFFSERV-MIB [RFC3289]. However, in environments where the template description (diffServConfigDescr) or owner (diffServConfigOwner) is considered sensitive information, appropriate access control should be exercised for these objects.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPSec), there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, deployment of SNMPv3 with cryptographic security enabled is RECOMMENDED. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate rights to GET or SET (change/create/delete) them.

9. Acknowledgments

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