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Integrated Services Management Information Base  
Guaranteed Service Extensions using SMIV2

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.

Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in TCP/IP-based internets. In particular, it defines objects for managing the the interface attributes defined in the Guaranteed Service of the Integrated Services Model. Comments should be made to the Integrated Services Working Group, intserv@isi.edu.

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## 1. The SNMPv2 Network Management Framework

The SNMPv2 Network Management Framework consists of four major components. They are:

- o RFC 1441 which defines the SMI, the mechanisms used for describing and naming objects for the purpose of management.
- o STD 17, RFC 1213 defines MIB-II, the core set of managed objects for the Internet suite of protocols.
- o RFC 1445 which defines the administrative and other architectural aspects of the framework.
- o RFC 1448 which defines the protocol used for network access to managed objects.

The Framework permits new objects to be defined for the purpose of experimentation and evaluation.

### 1.1. Object Definitions

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the subset of Abstract Syntax Notation One (ASN.1) defined in the SMI. In particular, each object type is named by an OBJECT IDENTIFIER, an administratively assigned name. The object type together with an object instance serves to uniquely identify a specific instantiation of the object. For human convenience, we often use a textual string, termed the descriptor, to refer to the object type.

## 2. Overview

### 2.1. Textual Conventions

Several new data types are introduced as a textual convention in this MIB document. These textual conventions enhance the readability of the specification and can ease comparison with other specifications if appropriate. It should be noted that the introduction of these textual conventions has no effect on either the syntax nor the semantics of any managed objects. The use of these is merely an artifact of the explanatory method used. Objects defined in terms of one of these methods are always encoded by means of the rules that define the primitive type. Hence, no changes to the SMI or the SNMP are necessary to accommodate these textual conventions which are adopted merely for the convenience of readers and writers in pursuit

of the elusive goal of clear, concise, and unambiguous MIB documents.

### 3. Definitions

```
INTEGRATED-SERVICES-GUARANTEED-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
    MODULE-IDENTITY, OBJECT-TYPE          FROM SNMPv2-SMI
    RowStatus                             FROM SNMPv2-TC
    MODULE-COMPLIANCE, OBJECT-GROUP       FROM SNMPv2-CONF
    intSrv                                 FROM INTEGRATED-SERVICES-MIB
    ifIndex                                FROM IF-MIB;
```

```
-- This MIB module uses the extended OBJECT-TYPE macro as
-- defined in [9].
```

```
intSrvGuaranteed MODULE-IDENTITY
```

```
    LAST-UPDATED "9511030500Z" -- Thu Aug 28 09:04:22 PDT 1997
```

```
    ORGANIZATION "IETF Integrated Services Working Group"
```

```
    CONTACT-INFO
```

```
    "      Fred Baker
    Postal: Cisco Systems
           519 Lado Drive
           Santa Barbara, California 93111
    Tel:   +1 805 681 0115
    E-Mail: fred@cisco.com"
```

```
DESCRIPTION
```

```
    "The MIB module to describe the Guaranteed Service of
    the Integrated Services Protocol"
```

```
::= { intSrv 5 }
```

```
intSrvGuaranteedObjects          OBJECT IDENTIFIER
::= { intSrvGuaranteed 1 }
intSrvGuaranteedNotifications    OBJECT IDENTIFIER
::= { intSrvGuaranteed 2 }
intSrvGuaranteedConformance      OBJECT IDENTIFIER
::= { intSrvGuaranteed 3 }
```

```
-- The Integrated Services Interface Attributes Database
-- contains information that is shared with other reservation
-- procedures such as ST-II.
```

```
intSrvGuaranteedIfTable OBJECT-TYPE
```

```
    SYNTAX          SEQUENCE OF IntSrvGuaranteedIfEntry
    MAX-ACCESS      not-accessible
    STATUS          current
```

## DESCRIPTION

"The attributes of the system's interfaces exported by the Guaranteed Service."  
 ::= { intSrvGuaranteedObjects 1 }

## intSrvGuaranteedIfEntry OBJECT-TYPE

SYNTAX IntSrvGuaranteedIfEntry

MAX-ACCESS not-accessible

STATUS current

## DESCRIPTION

"The reservable attributes of a given interface."

INDEX { ifIndex }

::= { intSrvGuaranteedIfTable 1 }

IntSrvGuaranteedIfEntry ::=

## SEQUENCE {

intSrvGuaranteedIfBacklog INTEGER,

intSrvGuaranteedIfDelay INTEGER,

intSrvGuaranteedIfSlack INTEGER,

intSrvGuaranteedIfStatus RowStatus

}

## intSrvGuaranteedIfBacklog OBJECT-TYPE

SYNTAX INTEGER (0..'0FFFFFFF'h)

UNITS "bytes"

MAX-ACCESS read-create

STATUS current

## DESCRIPTION

"The Backlog parameter is the data backlog resulting from the vagaries of how a specific implementation deviates from a strict bit-by-bit service. So, for instance, for packetized weighted fair queueing, Backlog is set to the Maximum Packet Size.

The Backlog term is measured in units of bytes. An individual element can advertise a Backlog value between 1 and  $2^{28}$  (a little over 250 megabytes) and the total added over all elements can range as high as  $(2^{32})-1$ . Should the sum of the different elements delay exceed  $(2^{32})-1$ , the end-to-end error term should be  $(2^{32})-1$ ."

::= { intSrvGuaranteedIfEntry 1 }

## intSrvGuaranteedIfDelay OBJECT-TYPE

```

SYNTAX      INTEGER (0..'0FFFFFFF'h)
UNITS       "microseconds"
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION

```

"The Delay parameter at each service element should be set to the maximum packet transfer delay (independent of bucket size) through the service element. For instance, in a simple router, one might compute the worst case amount of time it take take for a datagram to get through the input interface to the processor, and how long it would take to get from the processor to the outbound interface (assuming the queueing schemes work correctly). For an Ethernet, it might represent the worst case delay if the maximum number of collisions is experienced.

The Delay term is measured in units of one microsecond. An individual element can advertise a delay value between 1 and  $2^{28}$  (somewhat over two minutes) and the total delay added all elements can range as high as  $(2^{32})-1$ . Should the sum of the different elements delay exceed  $(2^{32})-1$ , the end-to-end delay should be  $(2^{32})-1$ ."

```
 ::= { intSrvGuaranteedIfEntry 2 }
```

```
intSrvGuaranteedIfSlack OBJECT-TYPE
```

```

SYNTAX      INTEGER (0..'0FFFFFFF'h)
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION

```

"If a network element uses a certain amount of slack,  $S_i$ , to reduce the amount of resources that it has reserved for a particular flow,  $i$ , the value  $S_i$  should be stored at the network element. Subsequently, if reservation refreshes are received for flow  $i$ , the network element must use the same slack  $S_i$  without any further computation. This guarantees consistency in the reservation process.

As an example for the use of the slack term, consider the case where the required end-to-end delay,  $D_{req}$ , is larger than the maximum delay of the fluid flow system. In this,  $C_{tot}$  is the

sum of the Backlog terms end to end, and Dtot is the sum of the delay terms end to end. Dreq is obtained by setting R=r in the fluid delay formula, and is given by

$$b/r + Ctot/r + Dtot.$$

In this case the slack term is

$$S = Dreq - (b/r + Ctot/r + Dtot).$$

The slack term may be used by the network elements to adjust their local reservations, so that they can admit flows that would otherwise have been rejected. A service element at an intermediate network element that can internally differentiate between delay and rate guarantees can now take advantage of this information to lower the amount of resources allocated to this flow. For example, by taking an amount of slack  $s \leq S$ , an RCSD scheduler [5] can increase the local delay bound, d, assigned to the flow, to d+s. Given an RSpec, (Rin, Sin), it would do so by setting Rout = Rin and Sout = Sin - s.

Similarly, a network element using a WFQ scheduler can decrease its local reservation from Rin to Rout by using some of the slack in the RSpec. This can be accomplished by using the transformation rules given in the previous section, that ensure that the reduced reservation level will not increase the overall end-to-end delay."

```
::= { intSrvGuaranteedIfEntry 3 }
```

```
intSrvGuaranteedIfStatus OBJECT-TYPE
```

```
SYNTAX RowStatus
```

```
MAX-ACCESS read-create
```

```
STATUS current
```

```
DESCRIPTION
```

```
"'valid' on interfaces that are configured for the Guaranteed Service."
```

```
::= { intSrvGuaranteedIfEntry 4 }
```

```
-- No notifications are currently defined
```

```
-- conformance information
```

```
intSrvGuaranteedGroups      OBJECT IDENTIFIER
                             ::= { intSrvGuaranteedConformance 1 }
intSrvGuaranteedCompliances OBJECT IDENTIFIER
                             ::= { intSrvGuaranteedConformance 2 }

-- compliance statements

intSrvGuaranteedCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The compliance statement "
    MODULE -- this module
    MANDATORY-GROUPS {
        intSrvGuaranteedIfAttribGroup
    }
    ::= { intSrvGuaranteedCompliances 1 }

intSrvGuaranteedIfAttribGroup OBJECT-GROUP
    OBJECTS {
        intSrvGuaranteedIfBacklog,
        intSrvGuaranteedIfDelay,
        intSrvGuaranteedIfSlack,
        intSrvGuaranteedIfStatus
    }
    STATUS current
    DESCRIPTION
        "These objects are required for Systems sup-
        porting the Guaranteed Service of the Integrat-
        ed Services Architecture."
    ::= { intSrvGuaranteedGroups 2 }
```

END

#### 4. Security Considerations

The use of an SNMP SET results in an RSVP or Integrated Services reservation under rules that are different compared to if the reservation was negotiated using RSVP. However, no other security considerations exist other than those imposed by SNMP itself.

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## 6. Acknowledgements

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## 7. References

- [1] Rose, M., Editor, "Management Information Base for Network Management of TCP/IP-based internets", STD 17, RFC 1213, May 1990.
- [2] Information processing systems - Open Systems Interconnection - Specification of Abstract Syntax Notation One (ASN.1), International Organization for Standardization. International Standard 8824, (December, 1987).
- [3] Information processing systems - Open Systems Interconnection - Specification of Basic Encoding Rules for Abstract Notation One (ASN.1), International Organization for Standardization. International Standard 8825, (December, 1987).



