

TN3270E Working Group

INTERNET DRAFT: <[draft-ietf-tn3270e-rt-mib-01.txt](#)>

Expiration Date: September 1998

Kenneth White

Robert Moore

IBM Corp.

September 1997

**Definitions of Managed Objects for TN3270E
Response Time Collection Using SMiv2
(TN3270E-RT-MIB)
<[draft-ietf-tn3270e-rt-mib-01.txt](#)>**

Status of this Memo

This document is an Internet Draft. Internet Drafts are working documents of the Internet Engineering Task Force (IETF), its Areas, and its Working Groups. Note that other groups may also distribute working documents as Internet Drafts.

Internet Drafts are draft documents valid for a maximum of six months. Internet Drafts may be updated, replaced, or obsoleted by other documents at any time. It is not appropriate to use Internet Drafts as reference material or to cite them other than as a "working draft" or "work in progress."

Please check the I-D abstract listing contained in each Internet Draft directory to learn the current status of this or any Internet Draft. Distribution of this document is unlimited.

Abstract

The purpose of this memo is to define the protocol and the Management Information Base (MIB) for performing response time data collection on TN3270 and TN3270E sessions by a TN3270E Server. The response time data collected by a TN3270E Server is structured to support both validation of service level agreements and performance monitoring of TN3270 and TN3270E Sessions. This MIB has as a prerequisite the TN3270E-MIB reference [[10](#)].

Table of Contents

1.0	Introduction.....	2
2.0	The SNMPv2 Network Management Framework.....	2
2.1	Object Definitions.....	3
3.0	Response Time Collection Methodology.....	3
3.1	General Response Time Collection.....	4
3.2	TN3270E Server Response Time Collection.....	5
3.3	Correlating TN3270E Server and Host Response Times.....	9
3.4	Timestamp Calculation.....	10
3.4.1	DR Usage.....	11
3.4.2	TIMEMARK Usage.....	13
3.5	Performance Data Modelling.....	14
3.5.1	Averaging Response Times.....	15
3.5.2	Response Time Buckets.....	17
4.0	Structure of the MIB.....	18
4.1	tn3270eRtCollCtlTable.....	18
4.2	tn3270eRtDataTable.....	21
4.3	Notifications.....	23
5.0	Definitions.....	24
6.0	Security Considerations.....	39
7.0	Acknowledgments.....	40
8.0	References.....	40
9.0	Authors' Addresses.....	42

[1.](#) Introduction

This document is a product of the TN3270E Working Group. Its purpose is to define a protocol and a MIB module to enable a TN3270E server to collect response time data for both TN3270 and TN3270E clients.

Prerequisites for implementing this MIB are:

- o TN3270E-MIB, Base Definitions of Managed Objects for TN3270E Using SMIV2 [[10](#)].
- o TN3270E RFCs
- o SYSAPPL-MIB, import Utf8String Textual Convention for international text string support, reference [[13](#)].

[2.](#) The SNMPv2 Network Management Framework

The SNMP Network Management Framework presently consists of three major components. They are:

Expires March 1998

[Page 2]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

- o the SMI, described in [RFC 1902](#) [1], - the mechanisms used for describing and naming objects for the purpose of management.
- o the MIB-II, STD 17, [RFC 1213](#) [5], - the core set of managed objects for the Internet suite of protocols.
- o the protocol, [RFC 1157](#) [9] and/or [RFC 1905](#) [7] - the protocol for accessing managed information.

It is the intent of this MIB to fully adhere to all prerequisite MIBs unless explicitly stated. Deviations will be documented in corresponding conformance statements. The specification of this MIB uses the Structure of Management Information (SMI) for Version 2 of the Simple Network Management Protocol Version (refer to [RFC1902](#), reference [1]).

Textual conventions are defined in [RFC 1903](#) [6], and conformance statements are defined in [RFC 1904](#) [8].

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

This memo specifies a MIB module that is compliant to the SNMPv2 SMI. A semantically identical MIB conforming to the SNMPv1 SMI can be produced through the appropriate translation.

2.1. 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.

3. Response Time Collection Methodology

This section explains the methodology and approach used by the MIB defined by this memo for response time data collection by a TN3270E Server.

Expires March 1998

[Page 3]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

3.1. General Response Time Collection

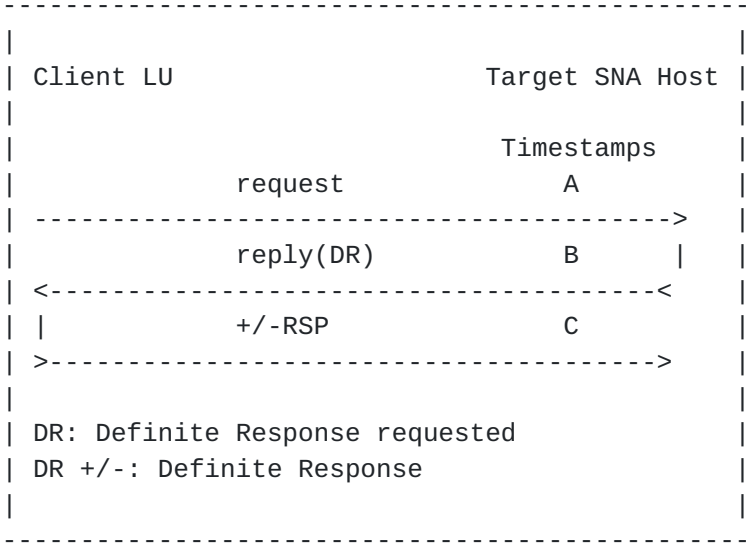
Two primary methods exist for measuring response times in SNA networks:

- o The SNA Management Services (SNA/MS) Response Time Monitoring (RTM) function
- o Timestamping using definite response flows.

This memo defines an approach using definite responses to timestamp the flows between a client and its TN3270E server, rather than on the RTM method. Extensions to the SNA/MS RTM flow were considered, but this approach was deemed unsuitable since not all TN3270E Server implementations have access to their underlying SNA stacks. The RTM concepts of keeping response time buckets for service level agreements and of interval-based response time collection for performance monitoring are preserved in the MIB module defined in this memo.

As mentioned, this memo focuses on using definite responses to timestamp the flows between a client and its TN3270E server for generating performance data. Use of a definite response flow requires that the client supports TN3270E with the RESPONSES function negotiated. The TN3270 TIMEMARK option can be used instead of definite response for supporting TN3270 Clients or TN3270E Clients that don't support RESPONSES. This document focuses on defining the protocol and methods for generating performance data using definite responses and then describes how the TIMEMARK option can be used instead of definite response.

In an SNA network, a transaction between a client Logical Unit (LU) and a target host in general looks as follows:



This transaction is a simple one, and is being used only to illustrate how timestamping at a target SNA host can be used to generate response times. An IBM redbook [\[12\]](#) provides a more detailed description of response time collection for a transaction of this type. Note that for the purpose of calculating an approximation for network transit time, it doesn't matter if the response is positive or negative. Two response time values are typically calculated:

- o Host Transit Time: Timestamp B - A
- o Network Transit Time: Timestamp C - B

Network transit time is an approximation for the amount of time that a transaction requires to flow across a network, since the response flow is being substituted for the request flow at the start of the transaction. Network transit time, timestamp C - B, is the amount of time that the definite response request and its response required. Host time, timestamp B - A, is the actual time that the host required to process the transaction. Experience has shown that using the response flow to approximate network transit times is useful, and does correlate well with actual network transit times.

The TN3270E-RT-MIB describes a method of collecting performance data that is not appropriate for printer (LU Type 1 or LU Type 3) sessions; thus collection of performance data for printer sessions is excluded from this MIB. This exclusion of printer sessions is not considered a problem, since these sessions are not the most important ones for response time monitoring, and since historically they were excluded from SNA/MS RTM collection. The tn3270eTcpConnResourceType object in a tn3270eTcpConnEntry (in the TN3270E-MIB) can be examined to determine if a client session is ineligible for response time data collection.

3.2. TN3270E Server Response Time Collection

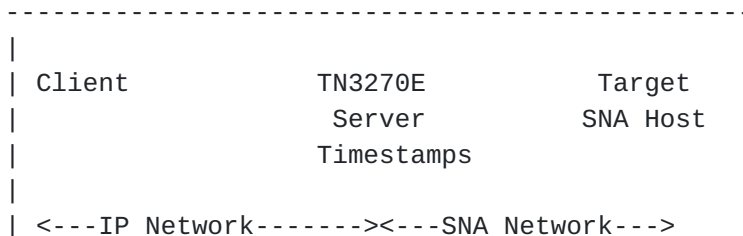
A TN3270E Server connects an IP client performing 3270 emulation to a target SNA host over both an IP network (IP client to TN3270E server) and an SNA Network (TN3270E server to target SNA host). A TN3270E server can use SNA definite responses and the TN3270 Enhancement ([RFC 1647](#) [[11](#)]) RESPONSES function to calculate response times for a transaction, by timestamping when a client sends a request, when the reply arrives from the target host, and when the response acknowledging this reply arrives from the client.

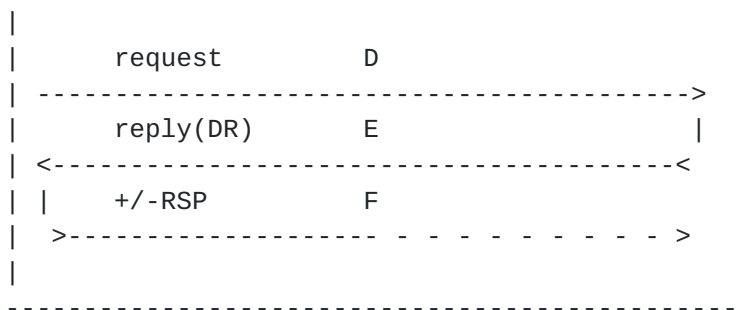
[Section 3.4](#), Timestamp Calculation, provides specifics on when in the sequence of flows between a TN3270E client and its target SNA host a TN3270E server takes its timestamps. In addition, there is information on how the TN3270 TIMEMARK request/response flow can be used instead

White, Moore TN3270E Response Time Collection MIB 29 September 1997

of DR for approximating IP network transit times.

The following figure adds a TN3270E server between the client, in this case a TN3270E client and the target SNA host:





A TN3270E server can save timestamp D when it receives a client request, save timestamp E when the target SNA host replies, and save timestamp F when the client responds to the definite response request that flowed with the reply. In fact, it doesn't matter whether the target SNA host requested a definite response on its reply: if it didn't, the TN3270E server makes the request on its own, to enable it to produce timestamp F. In this case the TN3270E server does not forward the response to the target SNA host, as the dotted line in the figure indicates.

In order to generate timestamp F, a TN3270E server must insure that the transaction specifies DR, and that the TN3270E RESPONSES function has been negotiated between itself and the client. Negotiation of the TN3270E RESPONSES function occurs during the client's TN3270E session initialization. The TN3270E servers that the authors are aware of do request the RESPONSES function during client session initialization. TN3270E clients either automatically support the RESPONSES function, or can be configured during startup to support it.

Using timestamps D, E, and F the following response times can be calculated by a TN3270E server:

- o Total Response time: F - D
- o IP Network Transit Time: F - E

The MIB provides an object, tn3270eRtCollCtlType, to control several aspects of response time data collection. One of the available options in setting up a response time collection policy is to eliminate the IP-network component altogether. This might be done because it is determined either that the additional IP network traffic

would not be desirable, or that the IP-network components of the overall response times are not significant.

Excluding the IP-network component from response times also has an implication for the way in which response time data is aggregated. A TN3270E server may find that some of its clients simply don't support any of the functions necessary for the server to calculate the IP-network component of response times. For these clients, the most that the server can calculate is the SNA-network component of their overall response times; the server records this SNA-network component as the TOTAL response time each of these clients' transactions. If a response time collection is aggregating data from a number of clients, some of which have the support necessary for including the IP-network component in their total response time calculations, and some of which do not, then the server aggregates the data differently depending on whether the collection has been defined to include or exclude the IP-network component:

- o If the IP-network component is included, then transactions for the clients that don't support calculation of the IP-network component of their response times are excluded from the aggregation altogether.
- o If the IP-network component is excluded, then total response times for ALL clients include only the SNA-network component, even though the server could have included an IP-network component in the overall response times for some of these clients. The server does this by setting timestamp F, which marks the end of a transaction's total response time, equal to timestamp E, the end of the transaction's SNA-network component.

The principle here is that all the transactions contributing their response times to an aggregated value must make the same contribution. If the aggregation specifies that an IP-network component must be included in the aggregation's response times, then transactions for which an IP-network component cannot be calculated aren't included at all. If the aggregation specifies that an IP-network component is not to be included, then only the SNA-network component is used, even for those transactions for which an IP-network component could have been calculated.

There is one more complication here: the MIB allows a management application to enable or disable dynamic definite responses for a

response time collection. Once again the purpose of this option is to give the network operator control over the amount of traffic introduced into the IP network for response time data collection. A DYNAMIC definite response is one that the TN3270E server itself adds to a reply, in a transaction for which the SNA application at the target SNA host did not specify DR in its reply. When the +/-RSP comes back from the client, the server uses this response to calculate timestamp F, but then it does not forward it on to the SNA application (since the application is not expecting a response to its reply).

This dynamic definite responses option is related to the option of including or excluding the IP-network component of response times (discussed above) as follows:

- o If the IP-network component is excluded, then there is no reason for enabling dynamic definite responses: the server always sets timestamp F equal to timestamp E, so the additional IP-network traffic elicited by a dynamic definite response would serve no purpose.
- o If the IP-network component is included, then enabling dynamic definite responses causes MORE transactions to be included in the aggregated response time values:
 - For clients that do not support sending of responses, timestamp F can never be calculated, and so their transactions are never included in the aggregate.
 - For clients that support sending of responses, timestamp F will always be calculated for transactions in which the host SNA application specifies DR in its reply, and so these transactions will always be included in the aggregate.
 - For clients that support sending of responses, having dynamic definite responses enabled for a collection results in the inclusion of additional transactions in the aggregate: specifically, those for which the host SNA application did not specify DR in its reply.

A TN3270E server also has the option of substituting TIMEMARK processing for definite responses in calculating the IP-network component of a transaction's response time. Once again, there is no reason for the server to do this if the collection has been set up to exclude the IP-network component altogether in computing response times.

The MIB is structured to keep for each response time the total time (F - D) and the IP-network component (F - E). A management application can obviously calculate from these two values a response time's SNA-

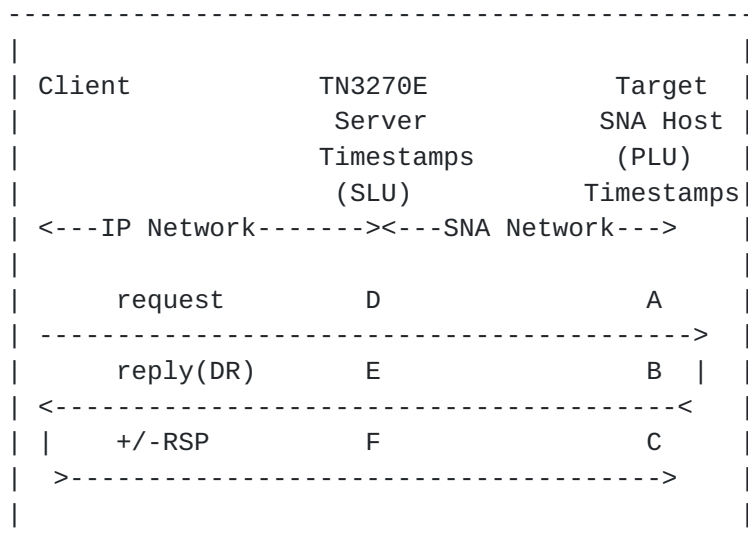
White, Moore TN3270E Response Time Collection MIB 29 September 1997

network component (E - D). The SNA-network component would also contain the host processing time at both the TN3270E Server and at the target application. As in the IP case, these response times are only approximations, because the +/-RSP's crossing of the IP network is substituted for that of the request that started the transaction.

When a TN3270E server is in the same SNA host as the target application, then the SNA-network component of a transaction's response time will approximately equal the host transit time ($B - A$) described previously. A host (as opposed to a gateway) TN3270E server implementation can typically support the establishment of sessions to target applications in remote SNA hosts; in this case the SNA-network component equals the actual SNA-network transit time plus two host transit times.

3.3. Correlating TN3270E Server and Host Response Times

It is possible that response time data is collected from TN3270E servers at the same time as a management application is monitoring the SNA sessions at a host. For example, a management application can be monitoring a secondary logical unit (SLU) while retrieving data from a TN3270E server. Consider the following figure:



The following response times are available:

- o Target SNA host transit time: B - A
- o Target SNA host (total) network transit time: C - B
- o TN3270E server total response time: F - D
- o TN3270E server IP-network component: F - E

Expires March 1998

[Page 9]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

The value added by the TN3270E server in this situation is its approximation of the IP-network component of the overall response time. The IP-network component can be subtracted from the total network transit time determined by monitoring the SLU to see the actual SNA versus IP network transit times.

The MIB defined by this memo does not specifically address correlation of the data it contains with response time data collected by direct monitoring of SNA resources: its focus is exclusively response time data collection from a TN3270E server perspective. It has, however, in conjunction with the TN3270E-MIB [[10](#)], been structured to provide the information necessary for correlation between TN3270E server-provided response time information and that gathered from directly monitoring SNA resources.

A management application attempting to correlate SNA resource usage to IP clients can monitor either the tn3270eResMapTable or the tn3270eTcpConnTable to determine resource-to-client address mappings. Both of these tables are defined by the TN3270E-MIB [[10](#)]. Another helpful table is the tn3270eSnaMapTable, which provides a mapping between SLU names as they are known at the SSCP (VTAM) and their local names at the TN3270E server. Neither the tn3270eClientGroupTable, the tn3270eResPoolTable, nor the tn3270eClientResMapTable from the TN3270E-MIB can be used for correlation, since the mappings defined by these tables can overlap and may not provide one-to-one mappings.

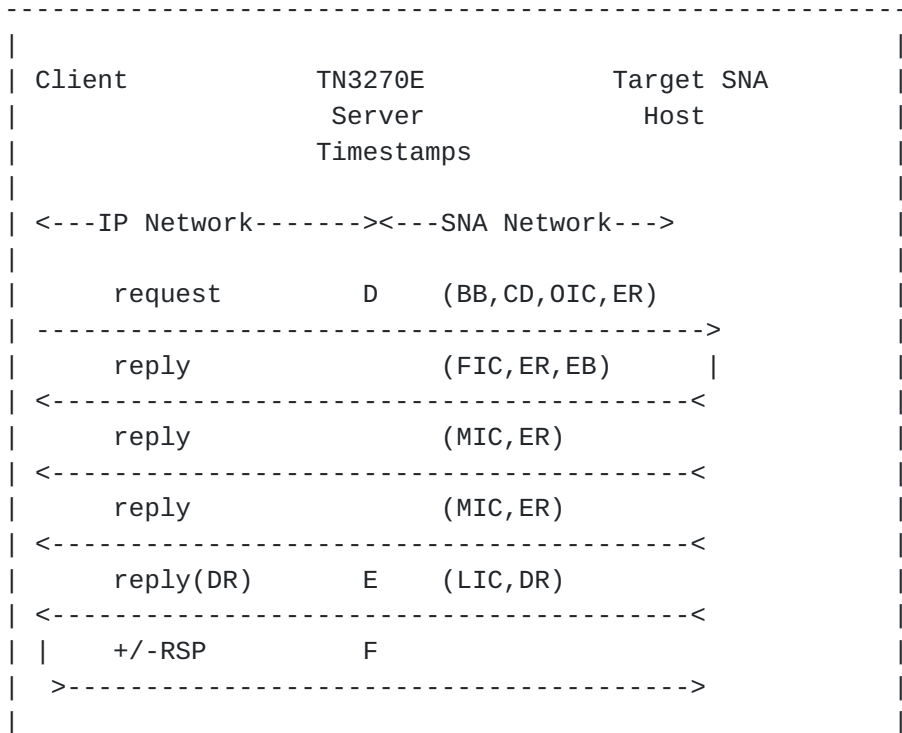
[3.4.](#) Timestamp Calculation

This section goes into more detail concerning when the various timestamps can be taken as the flows between a TN3270E client and its target SNA host pass through a TN3270E server. In addition,

information is provided on how the TN3270 TIMEMARK request/response flow can be used in place of DR for approximating IP network transit times.

3.4.1. DR Usage

Consider the following flow:



BB : Begin Bracket	ER : Response by exception	
EB : End Bracket	DR : Definite Response Requested	
CD : Change Direction	FIC : First in chain	
OIC: Only in chain	MIC: Middle in chain	
LIC: Last in chain		

Timestamp D is taken at the TN3270E server when a client sends data to the server for forwarding to its target SNA host. This is most likely when the server finds the end of record indicator in the TCP data received from the client. The target SNA returns its reply in one or more SNA Request Units (RUs); in this example there are four RUs in the reply. The first RU is marked as first in chain (FIC), the next two are marked as middle in chain (MIC), and the last is marked as last in chain (LIC). Timestamp E should be taken prior to sending the RESPONSES request to the client; normally this is done when the server receives the LIC RU. Timestamp F is taken when the RESPONSES response is received from the client.

A target SNA application doesn't necessarily return data to a client in a transaction; it may, for example, require more data from the client before it can formulate a reply. In this case the application may simply return to the TN3270E server a change of direction

Expires March 1998

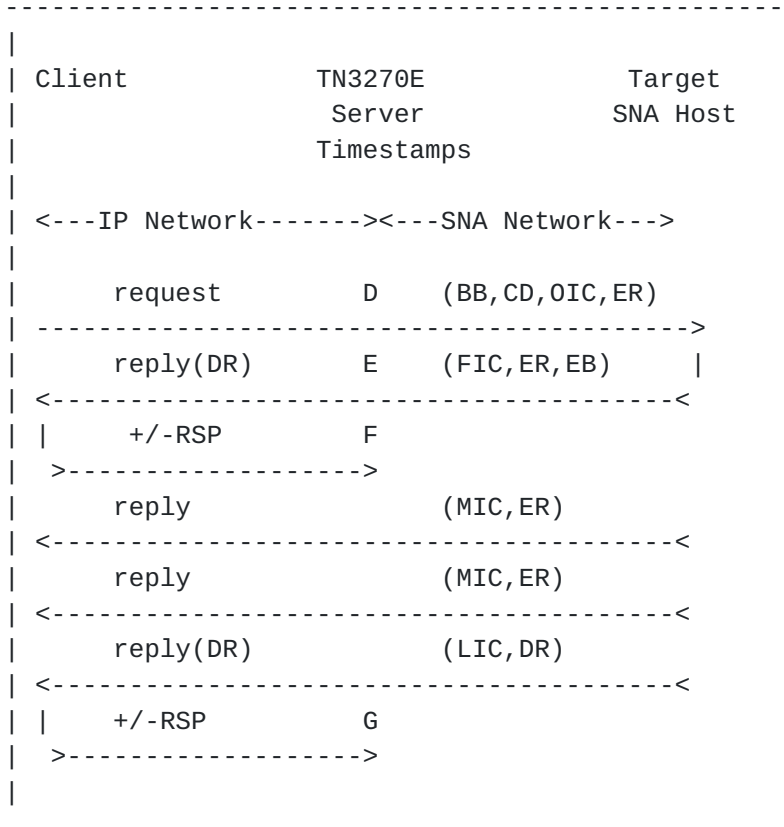
[Page 11]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

indicator. A TCP connection is full duplex: data can be received and sent on it at the same time. An SNA session, on the other hand, is half duplex, with a change of direction indicator to alter the direction of data flow. Timestamps E and F require a reply to flow to the client. A best-effort approach should be followed by a TN3270E server when it attempts to calculate timestamps. For cases where the target SNA application sends a change of direction indicator rather than a reply, it is suggested that the entire transaction be omitted from any response time calculations.

Another consideration is a mismatch between DR requested on the SNA side and DR requested by a TN3270E server. If the SNA host sends a multiple-RU chain, the server does not know until the last RU is received whether DR is being requested. Meanwhile, the server may have forwarded the first RU in the chain to the client. In practice, therefore, some servers convert ER flows to DR flows. Timestamp E can be taken when the first RESPONSES request flows to the client, and

timestamp F when its response is received. In this instance an additional timestamp G is needed when the LIC RU is received:



The response times can then be calculated as follows:

- o Total response time: $G - D$

- o IP network transit time: $F - E$

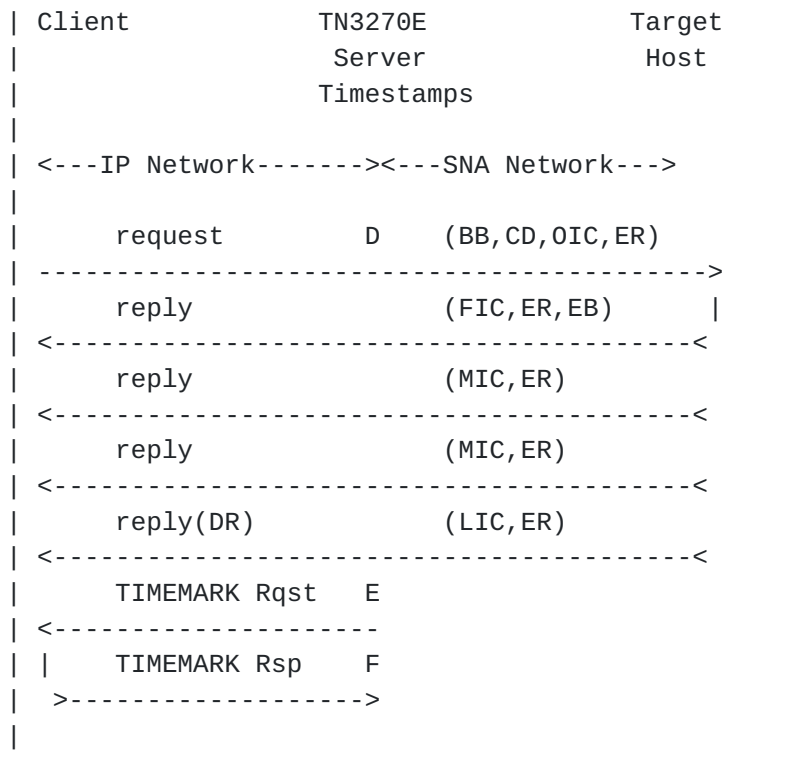
If DR is requested by the LIC RU, then the TN3270E server can use either its response or the earlier one for approximating IP network transit time.

3.4.2. TIMEMARK Usage

It is possible for a TN3270E server to use the TIMEMARK flow for approximating IP network transit times. Using TIMEMARKs would make it possible for a server to collect performance data for TN3270 clients, as well as for TN3270E clients that do not support the RESPONSES function. In order for TIMEMARKs to be used in this way, a client can't have the NOP option enabled, since responses are needed to the server's TIMEMARK requests. An IP network transit time approximation using a TIMEMARK is basically the amount of time it takes for a TN3270 server to receive a response from a client to a TIMEMARK request.

If a TN3270 server is performing the TIMEMARK function (independent of the response time monitoring use of the function discussed here), then it most likely has a TIMEMARK interval for determining when to examine client sessions for sending the TIMEMARK request. (This interval, which is ordinarily a global value for an entire TN3270E server, is represented in the TN3270E-MIB by the tn3270eSrvrConfActivityInterval object.) A TIMEMARK request is sent only if, when it is examined, a client session is found to have had no activity for a different length of time, represented in the TN3270E-MIB by the tn3270eSrvrConfActivityTimeout object.

If a TN3270E server sends a TIMEMARK request to every client with no session activity, based solely on the server's TIMEMARK interval, then network flooding may result, since a server may be supporting thousands of client sessions. The use of TIMEMARKs for response time monitoring could help to reduce this network flooding. Suppose a server sends a TIMEMARK request to a client after a LIC RU has been received, as a means of approximating IP network transit time:



The response times can then be calculated as follows:

- o TN3270E server total response time: $F - D$
- o TN3270E server IP network time: $F - E$

A TN3270E server would need to consider its normal TIMEMARK processing when using TIMEMARKs for this purpose. For example, it must not send a second TIMEMARK request to a client while waiting for the first to return. Also, if a TIMEMARK flow has just been performed for a client shortly before the LIC RU arrives, the server might use the interval from this flow as its approximation for IP network transit time; in this case the server would have to remember to add the interval from this TIMEMARK flow ($F' - E'$) to the interval from the transaction ($E - D$) to get its approximation for the transaction's total response time.

3.5. Performance Data Modelling

The following two subsections detail how the TN3270E-RT-MIB models and controls capture of two types of response time data: average response times and response time buckets.

3.5.1. Averaging Response Times

Average response times play two different roles in the MIB:

- o They are made available for management applications to retrieve.
- o They serve as triggers for emitting notifications.

Sliding-window averages are used rather than straight interval-based averages, because they are often more meaningful, and because they cause less notification thrashing. Sliding-window average calculation can, if necessary, be disabled, by setting the sample period multiplier, `tn3270eRtCollCtlSPMult`, to 1, and setting the sample period, `tn3270eRtCollCtlSPeriod`, to the required collection interval.

In order to calculate sliding-window averages, a TN3270E server must:

- o Select a fixed, relative short, sample period `SPeriod`; the default value for `SPeriod` in the MIB is 20 seconds.
- o Select an averaging period multiplier `SPMult`. The actual collection interval will then be `SPMult` times `SPeriod`. The default value for `SPMult` in the MIB is 30, yielding a default collection interval of 10 minutes. Note that the collection interval (`SPMult*SPeriod`) is always a multiple of the sample period.
- o Maintain the following counters to keep track of activity within the current sample period; these are internal counters, not made visible to a management application via the MIB.
 - `T` (number of transactions in the period)
 - `TotalRt` (sum of the total response times for all transactions in the period)
 - `TotalIpRt` (sum of the IP network transit times for all transactions in the period; note that if IP network transit times are being excluded from the response time collection, this value will always be 0).
- o Also maintain sliding counters, initialized to zero, for each of the quantities being counted:
 - `AvgTransCount` (sliding count of transactions)
 - `TotalRtSliding` (sliding count of total response times)
 - `TotalIpRtSliding` (sliding count of IP network transit times)
- o At the end of each sample period, update the sliding counters:

$$\text{AvgTransCount} = \text{AvgTransCount} + T$$

Expires March 1998

[Page 15]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

$$- (\text{AvgTransCount} / \text{SPMult})$$

$$\begin{aligned} \text{TotalRtSliding} &= \text{TotalRtSliding} + \text{TotalRt} \\ &- (\text{TotalRtSliding} / \text{SPMult}) \end{aligned}$$

$$\begin{aligned} \text{TotalIpRtSliding} &= \text{TotalIpRtSliding} + \text{TotalIpRt} \\ &- (\text{TotalIpRtSliding} / \text{SPMult}) \end{aligned}$$

Then reset T, TotalRt, and TotalIpRt to zero for use during the next sample period.

- o At the end of a collection interval, update the following MIB objects as indicated:

$$\begin{aligned} \text{tn3270eRtDataAvgTransCount} &= \text{AvgTransCount} \\ \text{tn3270eRtDataAvgRt} &= \text{TotalRtSliding} / \text{AvgTransCount} \\ \text{tn3270eRtDataAvgIpRt} &= \text{TotalIpRtSliding} / \text{AvgTransCount} \end{aligned}$$

As expected, if IP network transit times are being excluded from response time collection, then tn3270eRtDataAvgIpRt will always return 0.

The sliding transaction counter AvgTransCount is not used for updating the MIB object tn3270eRtDataTransCount: this object is an ordinary SMI Counter32, which maintains a total count of transactions since its last discontinuity event. The sliding counters are used only for calculating averages.

Two mechanisms are present in the MIB to inhibit the generation of an excessive number of notifications related to average response times. First, there are high and low thresholds for average response times. A tn3270eRtExceeded notification is generated the first time a statistically significant average response time is found to have exceeded the high threshold. After this, no other tn3270eRtExceeded notifications are generated until an average response time is found to have fallen below the low threshold.

The other mechanism to limit notifications is the significance test

for a high average response time. Intuitively, the significance of an average is directly related to the number of samples that go into it; so we might be inclined to use a rule such as "for the purpose of generating tn3270eRtExceeded notifications, ignore average response times based on fewer than 20 transactions in the sample period."

In the case of response times, however, the number of transactions sampled in a fixed sampling period is tied to these transactions' response times. A few transactions with long response times can guarantee that there will not be many transactions in a sample,

Expires March 1998

[Page 16]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

because these transactions "use up" the sampling time. Yet this case of a few transactions with very poor response times should obviously be classified as a problem, not as a statistical anomaly based on too small a sample.

The solution is to make the significance level for a sample a function of the average response time. In order to determine at a collection interval whether to generate a tn3270eRtExceeded notification, a TN3270E server uses the following algorithm:

```
if AvgTransCount * ((AvgRt/ThreshHigh - 1) ** 2) < IdleRate
then generate the notification
```

Two examples illustrate how this algorithm works. Suppose that IdleRate has been set to 20 transactions, and the high threshold to 200 msec per transaction. If the average observed response time is 300 msec, then a notification will be generated only if AvgTransCount >= 80. If, however, the observed response time is 500 msec, then a notification is generated if AvgTransCount >= 9.

There is no corresponding significance test for the tn3270eRtOkay notification: this notification is generated based on an average response time that falls below the low threshold, regardless of the sample size behind that average.

3.5.2. Response Time Buckets

The MIB also supports collection of response time data into a set of five buckets. This data is suitable either for verification of service

level agreements, or for monitoring by a management application to identify performance problems. The buckets provide counts of transactions whose total response times fall into a set of specified ranges.

Like everything for a collection, the "total" response times collected in the buckets are governed by the specification of whether IP network transit times are to be included in the totals. Depending on how this option is specified, the response times being counted in the buckets will either be total response times (F - D), or only SNA network transit times (effectively E - D, because when it is excluding the IP-network component of transactions, a server makes timestamp F identical to timestamp E).

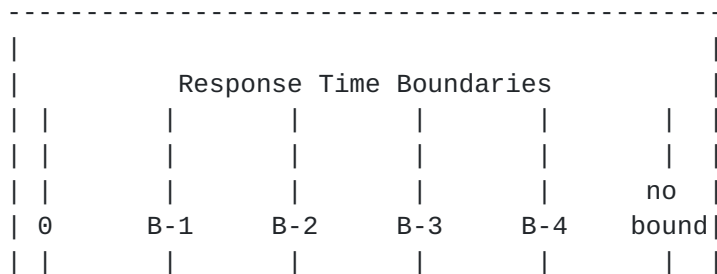
Four bucket boundaries are specified for a response time collection, resulting in five buckets. The first response time bucket counts those transactions whose total response times were less than or equal to Boundary 1, the second bucket counts those whose response times were greater than Boundary 1 but less than or equal to Boundary 2, and so

on. The fifth bucket is unbounded on the top, counting all transactions whose response times were greater than Boundary 4.

The four bucket boundaries have default values of: 1 second, 2 seconds, 5 seconds, and 10 seconds, respectively. These values are the defaults in the 3174 controller's implementation of the SNA/MS RTM function, and were thought to be appropriate for this MIB as well.

In SNA/MS the counter buckets were (by today's standards) relatively small, with a maximum value of 65,535. The bucket objects in the MIB are all Counter32's.

The following figure represents the buckets pictorially:



	Bucket1 Bucket2 Bucket3 Bucket4 Bucket5	

4. Structure of the MIB

The TN3270E-RT-MIB has the following components:

- o tn3270eRtCollCtlTable
- o tn3270eRtDataTable
- o Notifications

4.1. tn3270eRtCollCtlTable

The tn3270eRtCollCtlTable is indexed by tn3270eSrvrConfIndex, imported from the TN3270E-MIB, and by tn3270eRtCollCtlClientGroupName. tn3270eSrvrConfIndex identifies within a host a particular TN3270E server. tn3270eRtCollCtlClientGroupName identifies a collection of IP clients for which response time data is to be collected. The collection itself is defined using the tn3270eClientGroupTable from the TN3270E-MIB. The index from the tn3270eClientGroupTable, tn3270eClientGroupName, was not used directly, since doing so causes an inconsistent indexing scheme error in some MIB compilers. To avoid

Expires March 1998

[Page 18]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

this error, tn3270eRtCollCtlClientGroupName was defined directly in the tn3270eRtCollCtlEntry.

A tn3270eRtCollCtlEntry contains the following objects:

1st Index	tn3270eSrvrConfIndex	Unsigned32
2nd Index	tn3270eRtCollCtlClientGroupName	Utf8String
	tn3270eRtCollCtlType	BITS
	tn3270eRtCollCtlSPeriod	Unsigned32
	tn3270eRtCollCtlSPMult	Unsigned32
	tn3270eRtCollCtlThreshHigh	Unsigned32
	tn3270eRtCollCtlThreshLow	Unsigned32
	tn3270eRtCollCtlIdleRate	Unsigned32

tn3270eRtCollCtlBucketBndry1	Unsigned32	
tn3270eRtCollCtlBucketBndry2	Unsigned32	
tn3270eRtCollCtlBucketBndry3	Unsigned32	
tn3270eRtCollCtlBucketBndry4	Unsigned32	
tn3270eRtCollCtlRowStatus	RowStatus	

The tn3270eRtCollCtlType object controls the type(s) of response time collection that occur, the granularity of the collection, whether dynamic definite responses should be initiated, and whether notifications should be generated. This object is of BITS SYNTAX, and thus allows selection of multiple options.

The BITS in the tn3270eRtCollCtlType object have the following meanings:

- o aggregate(0) - If this bit is set to 1, then data should be aggregated for the whole client group. In this case there will be only one row created for the collection in the tn3270eRtDataTable. The first two indexes for this row, tn3270eSrvrConfIndex and tn3270eRtCollCtlClientGroupName, will have the same values as the indexes for this row in the tn3270eRtCollCtlTable. The third and fourth indexes for an aggregated tn3270eRtDataEntry have the values 'unknown(0)' (for tn3270eRtDataClientAddrType) and a null octet string (for tn3270eRtDataClientAddress).

If this bit is set to 0, then a separate entry is created in the tn3270eRtDataTable for each member of the client group. In this case the tn3270eRtDataClientAddress contains the client's actual IP Address, and tn3270eRtDataClientAddrType indicates the type of this address.

- o excludeIpComponent(1) - If this bit is set to 1, then the

server should exclude the IP-network component from all the response times for this collection. If the target SNA application specifies DR in any of its replies, this DR will still be passed down to the client, and the client's response will still be forwarded to the application. But this response will play no role in the server's response time calculations.

If this bit is set to 0, then the server includes in the collection only those transactions for which it can include an (approximate) IP-network component in the total response time for the transaction. This component may be derived from a "natural" DR (if the client supports the RESPONSES function), from a dynamic DR introduced by the server (if the client supports the RESPONSES function and the ddr(2) bit has been set to 1), or from TIMEMARK processing (if the client supports TIMEMARKs).

If this bit is set to 1, then the ddr(2) bit is ignored, since there is no reason for the server to request additional responses from the client(s) in the group.

- o ddr(2) - If this bit is set to 1, then the server should, for those clients in the group that support the RESPONSES function, add a DR request to a reply in each transaction (usually, but not necessarily the LIC reply), and use the client's subsequent response for calculating an (approximate) IP-network component to include in the transaction's total response times.

If this bit is set to 0, then the server does not add a DR request to any replies from the target SNA application.

If the excludeIpComponent(1) bit is set to 1, then this bit is ignored by the server.

- o average(3) - If this bit is set to 1, then the server should calculate a sliding-window average for the collection, based on the parameters specified for the group.

If this bit is set to 0, then an average is not calculated. In this case the tn3270eRtExceeded and tn3270eRtOkay notifications are not generated, even if the traps(5) bit is set to 1.

- o buckets(4) - If this bit is set to 1, then the server should create and increment response time buckets for the collection, based on the parameters specified for the group.

If this bit is set to 0, then response time buckets are not created.

- o traps(5) - If this bit is set to 1, then the server generates the notifications defined in this MIB. The tn3270CollStart and tn3270CollEnd notifications are always generated when this bit is set to 1; the tn3270eRtExceeded and tn3270eRtOkay notifications are generated only if the average(3) bit is also set to 1.

If this bit is set to 0, then none of the notifications defined in this MIB are generated by the server.

Either the average(3) or the buckets(4) bit must be set to 1 in order for response time data collection to occur. If the average(3) bit is set to 1, then the following objects have meaning, and are used to control the calculation of the averages, as well as the generation of the two notifications related to them:

- o tn3270eRtCollCtlSPeriod
- o tn3270eRtCollCtlSPMult
- o tn3270eRtCollCtlThreshHigh
- o tn3270eRtCollCtlThreshLow
- o tn3270eRtCollCtlIdleRate

If the buckets(4) bit is set to 1, then the following objects have meaning, and specify the bucket boundaries:

- o tn3270eRtCollCtlBucketBndry1
- o tn3270eRtCollCtlBucketBndry2
- o tn3270eRtCollCtlBucketBndry3
- o tn3270eRtCollCtlBucketBndry4

4.2. tn3270eRtDataTable

Either a single entry or multiple entries are created in the tn3270eRtDataTable for each tn3270eRtCollCtlEntry, depending on whether tn3270eRtCollCtlType in the control entry has aggregate(0) selected. The contents of an entry in the tn3270eRtDataTable depend on the contents of the corresponding entry in the tn3270eRtCollCtlTable: some objects in the data entry return meaningful values only when the average(3) option is selected in the control entry, while others return meaningful values only when the buckets(4) option is selected. If both options are selected, then all the objects return meaningful values. When an object is not specified to return a meaningful value, an implementation may return any value in response to a Get operation.

The following objects return meaningful values if and only if the

White, Moore TN3270E Response Time Collection MIB 29 September 1997

average(3) option was selected in the corresponding
tn3270eRtCollCtlEntry:

- o tn3270eRtDataAvgRt
- o tn3270eRtDataAvgIpRt
- o tn3270eRtDataAvgTransCount
- o tn3270eRtDataIntTimeStamp
- o tn3270eRtDataTotalRt
- o tn3270eRtDataTotalIpRt
- o tn3270eRtDataTransCount
- o tn3270eRtDataDrCount
- o tn3270eRtDataElapsRndTrpSq
- o tn3270eRtDataElapsIpRtSq

The first three objects in this list return values derived from the sliding-window average calculations described earlier. The time of the most recent sample for these calculations is returned in the tn3270eRtDataIntTimeStamp object. The next four objects are normal Counter32 objects, maintaining counts of total response time and total transactions. The last two objects return sum of the squares values, to enable variance calculations by a management application.

- o tn3270eRtDataElapsRndTrpSq
- o tn3270eRtDataElapsIpRtSq

The following objects return meaningful values if and only if the buckets(4) option was selected in the corresponding
tn3270eRtCollCtlEntry:

- o tn3270eRtDataBucket1
- o tn3270eRtDataBucket2
- o tn3270eRtDataBucket3
- o tn3270eRtDataBucket4
- o tn3270eRtDataBucket5

A discontinuity object, tn3270eRtDataDiscontinuityTime, can be used by a management application to detect when the values of the counter objects in this table may have been reset, or otherwise experienced a discontinuity. A possible cause for such a discontinuity is the TN3270E server's being stopped or restarted. This object returns a meaningful value regardless of which collection control options were

selected.

When an entry is created in the tn3270eRtCollCtlTable with its tn3270eRtCollCtlType aggregate(0) bit set to 1, an entry is automatically created in the tn3270eRtDataTable; this entry's tn3270eRtDataClientAddress has the value of a null octet string, and

Expires March 1998

[Page 22]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

its tn3270eRtDataClientAddrType has the value of unknown(0).

When an entry is created in the tn3270eRtCollCtlTable with its tn3270eRtCollCtlType aggregate(0) bit set to 0, a separate entry is created in the tn3270eRtDataTable for each member of the client group that currently has a session with the TN3270E server. Entries are subsequently created for clients that the TN3270E server determines to be members of the client group when these clients establish sessions with the server.

All entries associated with a tn3270eRtCollCtlEntry are deleted from the tn3270eRtDataTable when that entry is deleted from the tn3270eRtCollCtlTable. An entry for an individual client in a client group is deleted when its TCP connection terminates.

4.3. Notifications

This MIB defines four notifications related to a tn3270eRtDataEntry. If the associated tn3270eRtCollCtlType object's traps(5) bit is set to 1, then the tn3270RtCollStart and tn3270RtCollEnd notifications are generated when, respectively, the tn3270eRtDataEntry is created and deleted. If, in addition, this tn3270eRtCollCtlType object's average(3) bit is set to 1, then the the tn3270eRtExceeded and tn3270eRtOkay notifications are generated when the conditions they report occur.

The following notifications are defined by this MIB:

- o tn3270eRtExceeded - The purpose of this notification is to signal that a performance problem has been detected. If average(3) response time data is being collected, then this notification is generated whenever (1) an average response time is first found, on a collection interval boundary, to

have exceeded the high threshold tn3270eRtCollCtlThreshHigh specified for the client group, AND (2) the sample on which the average is based is determined to have been a significant one, via the significance algorithm described earlier. This notification is not generated again for a tn3270eRtDataEntry until an average response time falling below the low threshold tn3270eRtCollCtlThreshLow specified for the client group has occurred for the entry.

- o tn3270eRtOkay - The purpose of this notification is to signal that a previously reported performance problem has been resolved. If average(3) response time data is being collected, then this notification is generated whenever (1) a tn3270eRtExceeded notification has already been generated, AND

Expires March 1998

[Page 23]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

(2) an average response time is first found, on a collection interval boundary, to have fallen below the low threshold tn3270eRtCollCtlThreshLow specified for the client group. This notification is not generated again for a tn3270eRtDataEntry until an average response time exceeding the high threshold tn3270eRtCollCtlThreshHigh specified for the client group has occurred for the entry.

Taken together, the two preceding notifications serve to minimize the generation of an excessive number of traps in the case of an average response time that oscillates about its high threshold.

- o tn3270eRtCollStart - This notification is generated whenever data collection begins for a client group, or when a new tn3270eRtDataEntry becomes active. The primary purpose of this notification is signal to a management application that a new client TCP session has been established, and to provide the IP-to-resource mapping for the session. This notification is not critical when average(3) data collection is not being performed for the client group.
- o tn3270eRtCollEnd - This notification is generated whenever a data collection ends. For an aggregate collection, this occurs when the corresponding tn3270eRtCollCtlEntry is deleted. For an individual collection, this occurs either when the tn3270eRtCollCtlEntry is deleted, or when the

client's TCP connection terminates. The purpose of this notification is to enable a management application to complete a monitoring function that it was performing, by returning final values for the collection's data objects.

5. Definitions

```
TN3270E-RT-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
    MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,  
    experimental, Counter32, BITS, Unsigned32,  
    Gauge32
```

```
        FROM SNMPv2-SMI
```

```
    RowStatus, DateAndTime, TimeStamp
```

```
        FROM SNMPv2-TC
```

```
    MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
```

```
        FROM SNMPv2-CONF
```

```
    Tn3270eAddrType, Tn3270eTAddress, tn3270eSrvrConfIndex,
```

```
    tn3270eResMapElementName, tn3270eResMapElementType
```

```
        FROM TN3270E-MIB
```

Expires March 1998

[Page 24]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

```
    Utf8String
```

```
        FROM SYSAPPL-MIB;
```

```
tn3270eRtMIB    MODULE-IDENTITY
```

```
    LAST-UPDATED "9709240000Z" -- September 24, 1997
```

```
    ORGANIZATION "TN3270E Working Group"
```

```
    CONTACT-INFO
```

```
        "Kenneth White (kennethw@vnet.ibm.com)
```

```
        IBM Corp. - Dept. BRQA/Bldg. 503/C117
```

```
        P.O. Box 12195
```

```
        3039 Cornwallis
```

```
        RTP, NC 27709-2195
```

```
        (919) 254-0102
```

```
        Robert Moore (remoore@us.ibm.com)
```

```
        IBM Corp. - Dept. BRQA/Bldg. 501/G114
```

```
        P.O. Box 12195
```

```
        3039 Cornwallis
```

```

RTP, NC 27709-2195
(919) 254-7507"
DESCRIPTION
    "This module defines a portion of the management information
    base (MIB) that enables monitoring of TN3270 and TN3270E
    clients' response times by a TN3270E server."
    ::= { experimental 81 }

-- Top level structure of the MIB

tn3270eRtNotifications    OBJECT IDENTIFIER ::= { tn3270eRtMIB 0 }
tn3270eRtObjects          OBJECT IDENTIFIER ::= { tn3270eRtMIB 1 }
tn3270eRtConformance     OBJECT IDENTIFIER ::= { tn3270eRtMIB 3 }

-- MIB Objects

-- Response Time Control Table

tn3270eRtCollCtlTable    OBJECT-TYPE
    SYNTAX                SEQUENCE OF Tn3270eRtCollCtlEntry
    MAX-ACCESS             not-accessible
    STATUS                 current
    DESCRIPTION
        "The response time monitoring collection control table, which
        allows a management application to control the types of
        response time data being collected, and the clients for which
        it is being collected.

        This table is indexed by tn3270eSrvrConfIndex, imported from
        the TN3270E-MIB, and by tn3270eRtCollCtlClientGroupName.

```

Expires March 1998

[Page 25]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

```

tn3270eSrvrConfIndex indicates within a host which TN3270E
server an entry applied to.

tn3270eRtCollCtlClientGroupName is equivalent to the
tn3270eClientGroupName index in the TN3270E-MIB; it identifies
the collection of IP clients for which response time data
is being collected. The particular IP clients making up the
collection are identified in the tn3270eClientGroupTable in
the TN3270E-MIB."
::= { tn3270eRtObjects 1}

```

```

tn3270eRtCollCtlEntry    OBJECT-TYPE
    SYNTAX                Tn3270eRtCollCtlEntry
    MAX-ACCESS             not-accessible
    STATUS                 current
    DESCRIPTION
        "Entry in the TN3270E response time monitoring collection
        control table. To handle the case of multiple TN3270E servers
        on the same host, the first index of this table is the
        tn3270eSrvrConfIndex from the TN3270E-MIB."
    INDEX {
        tn3270eSrvrConfIndex,          -- Server's index
        tn3270eRtCollCtlClientGroupName } -- What to collect on
    ::= { tn3270eRtCollCtlTable 1 }

Tn3270eRtCollCtlEntry ::= SEQUENCE {
    tn3270eRtCollCtlClientGroupName    Utf8String,
    tn3270eRtCollCtlType                BITS,
    tn3270eRtCollCtlSPeriod             Unsigned32,
    tn3270eRtCollCtlSPMult              Unsigned32,
    tn3270eRtCollCtlThreshHigh          Unsigned32,
    tn3270eRtCollCtlThreshLow           Unsigned32,
    tn3270eRtCollCtlIdleRate            Unsigned32,
    tn3270eRtCollCtlBucketBndry1        Unsigned32,
    tn3270eRtCollCtlBucketBndry2        Unsigned32,
    tn3270eRtCollCtlBucketBndry3        Unsigned32,
    tn3270eRtCollCtlBucketBndry4        Unsigned32,
    tn3270eRtCollCtlRowStatus            RowStatus }

tn3270eRtCollCtlClientGroupName OBJECT-TYPE
    SYNTAX                Utf8String (SIZE(1..24))
    MAX-ACCESS             not-accessible
    STATUS                 current
    DESCRIPTION
        "The name of a client group. Membership in a client group is
        specified via the TN3270E-MIB's tn3270eClientGroupTable.
        The index for that table, tn3270eClientGroupName, is
        equivalent to this object; it was not imported because

```

```
::= { tn3270eRtCollCtlEntry 1 }
```

```
tn3270eRtCollCtlType OBJECT-TYPE
```

```
SYNTAX      BITS {
                aggregate(0),
                excludeIpComponent(1),
                ddr(2),
                average(3),
                buckets(4),
                traps(5)
            }
```

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

```
STATUS      current
```

```
DESCRIPTION
```

"This object controls what types of response time data to collect, whether to summarize the data across the members of a client group or keep it individually, whether to introduce dynamic definite responses, and whether to generate traps.

- | | |
|-----------------------|---|
| aggregate(0) | - Aggregate response time data for the client group as a whole. If this bit is set to 0, then maintain response time data separately for each member of the client group. |
| excludeIpComponent(1) | - Do not include the IP-network component in any response times. |
| ddr(2) | - Enable dynamic definite response. |
| average(3) | - Produce an average response time based on a specified collection interval. |
| buckets(4) | - Maintain tn3270eRtDataBucket values in a corresponding tn3270eRtDataEntry, based on the bucket boundaries specified in the tn3270eRtDataBucketBndry objects. |
| traps(5) | - generate the traps specified in this MIB module. The tn3270eRtExceeded and tn3270eRtOkay are generated only if average(3) is also specified." |

```
::= { tn3270eRtCollCtlEntry 2 }
```

```
tn3270eRtCollCtlSPeriod OBJECT-TYPE
```

```
SYNTAX      Unsigned32 -- 15 second minimum to 24 hour max
```

```
UNITS       "seconds"
```

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

```
STATUS      current
```

DESCRIPTION

"The number of seconds that defines the sample period.
The actual interval is defined as tn3270eRtCollCtlSPeriod
times tn3270eRtCollCtlSPMult.

The value of this object is used only if the corresponding
tn3270eRtCollCtlType has the average(3) setting."

DEFVAL {20} -- 20 seconds
::= { tn3270eRtCollCtlEntry 3 }

tn3270eRtCollCtlSPMult OBJECT-TYPE

SYNTAX Unsigned32 -- should be > 1

UNITS "count"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The sample period multiplier; this value is multiplied by the
sample period, tn3270eRtCollCtlSPeriod, to determine the
collection interval.

The value of this object is used only if the corresponding
tn3270eRtCollCtlType has the average(3) setting."

DEFVAL { 30 } -- yields an interval of 10 minutes when
 -- used with the default SPeriod value
::= { tn3270eRtCollCtlEntry 4 }

tn3270eRtCollCtlThreshHigh OBJECT-TYPE

SYNTAX Unsigned32

UNITS "seconds"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The threshold for generating a tn3270eRtExceeded notification,
signalling that a monitored total response time has exceeded the
specified limit. A value of zero for this object suppresses
generation of this notification. The value of this object is
used only if the corresponding tn3270eRtCollCtlType has
average(3) and traps(5) selected."

::= { tn3270eRtCollCtlEntry 5 }

tn3270eRtCollCtlThreshLow OBJECT-TYPE

SYNTAX Unsigned32

UNITS "seconds"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The threshold for generating a tn3270eRtOkay notification, signalling that a monitored total response time has fallen below

Expires March 1998

[Page 28]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

the specified limit. A value of zero for this object suppresses generation of this notification. The value of this object is used only if the corresponding tn3270eRtCollCtlType has average(3) and traps(5) selected."
::= { tn3270eRtCollCtlEntry 6 }

tn3270eRtCollCtlIdleRate OBJECT-TYPE

SYNTAX Unsigned32
UNITS "transaction count"
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"The value of this object is used to determine whether a sample that yields an average response time exceeding the value of tn3270eRtCollCtlThreshHigh was a statistically valid one. If the following statement is true, then the sample was statistically valid, and so a tn3270eRtExceeded notification should be generated:

$$\text{AvgTransCount} * ((\text{AvgRt}/\text{ThreshHigh} - 1) ** 2) < \text{IdleRate}$$

This comparison is done only if the corresponding tn3270eRtCollCtlType has average(3) and traps(5) selected."

DEFVAL { 1 }

::= { tn3270eRtCollCtlEntry 7 }

tn3270eRtCollCtlBucketBndry1 OBJECT-TYPE

SYNTAX Unsigned32
UNITS "tenths of seconds"
MAX-ACCESS read-create
STATUS current

DESCRIPTION

"The value of this object defines the range of transaction response times counted in the Tn3270eRtDataBucket1 object: those less than or equal to this value."

DEFVAL { 10 }

::= { tn3270eRtCollCtlEntry 8 }

tn3270eRtCollCtlBucketBndry2 OBJECT-TYPE

SYNTAX Unsigned32

UNITS "tenths of seconds"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object, together with that of the tn3270eRtCollCtlBucketBndry1 object, defines the range of transaction response times counted in the Tn3270eRtDataBucket2 object: those greater than the value of the

Expires March 1998

[Page 29]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

tn3270eRtCollCtlBucketBndry1 object, and less than or equal to the value of this object."

DEFVAL { 20 }

::= { tn3270eRtCollCtlEntry 9 }

tn3270eRtCollCtlBucketBndry3 OBJECT-TYPE

SYNTAX Unsigned32

UNITS "tenths of seconds"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object, together with that of the tn3270eRtCollCtlBucketBndry2 object, defines the range of transaction response times counted in the Tn3270eRtDataBucket3 object: those greater than the value of the tn3270eRtCollCtlBucketBndry2 object, and less than or equal to the value of this object."

DEFVAL { 50 }

::= { tn3270eRtCollCtlEntry 10 }

tn3270eRtCollCtlBucketBndry4 OBJECT-TYPE

SYNTAX Unsigned32

UNITS "tenths of seconds"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object, together with that of the tn3270eRtCollCtlBucketBndry3 object, defines the range of transaction response times counted in the Tn3270eRtDataBucket4

object: those greater than the value of the
tn3270eRtCollCtlBucketBndry3 object, and less than or equal to
the value of this object.

The value of this object also defines the range of transaction
response times counted in the Tn3270eRtDataBucket5 object:
those greater than the value of this object."

DEFVAL { 100 }

::= { tn3270eRtCollCtlEntry 11 }

tn3270eRtCollCtlRowStatus OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object allows entries to be created and deleted
in the tn3270eRtCollCtlTable. An entry in this table
is deleted by setting this object to destroy(6).
Deleting an entry in this table has the side-effect

Expires March 1998

[Page 30]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

of removing all entries from the tn3270eRtDataTable
that are associated with the entry being deleted."
::= { tn3270eRtCollCtlEntry 12 }

-- TN3270E Response Time Data Table

tn3270eRtDataTable OBJECT-TYPE

SYNTAX SEQUENCE OF Tn3270eRtDataEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The response time data table. Entries in this table are
created based on entries in the tn3270eRtCollCtlTable."

::= { tn3270eRtObjects 2 }

tn3270eRtDataEntry OBJECT-TYPE

SYNTAX Tn3270eRtDataEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table is created based upon the tn3270eRtCollCtlTable. A single entry is created with a tn3270eRtDataClientAddrType of 'unknown(0)' and a null octet string value for tn3270eRtDataClientAddress when the corresponding tn3270eRtCollCtlType has aggregate(0) specified. When aggregate(0) is not specified, then a separate entry is created for each client.

Note that the following objects defined within an entry in this table can wrap:

```
tn3270eRtDataTotalRt
tn3270eRtDataTotalIpRt
tn3270eRtDataTransCount
tn3270eRtDataDrCount
tn3270eRtDataElapsRnTrpSq
tn3270eRtDataElapsIpRtSq
tn3270eRtDataBucket1
tn3270eRtDataBucket2
tn3270eRtDataBucket3
tn3270eRtDataBucket4
tn3270eRtDataBucket5"
```

```
INDEX {
  tn3270eSrvrConfIndex,          -- Server's local index
  tn3270eRtCollCtlClientGroupName, -- Target of data collection
  tn3270eRtDataClientAddrType,
  tn3270eRtDataClientAddress }
 ::= { tn3270eRtDataTable 1 }
```

Expires March 1998

[Page 31]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

```
Tn3270eRtDataEntry ::= SEQUENCE {
  tn3270eRtDataClientAddrType      Tn3270eAddrType,
  tn3270eRtDataClientAddress        Tn3270eTAddress,
  tn3270eRtDataDiscontinuityTime    TimeStamp,
  tn3270eRtDataAvgRt                Gauge32,
  tn3270eRtDataAvgIpRt              Gauge32,
  tn3270eRtDataAvgTransCount        Counter32,
  tn3270eRtDataIntTimeStamp         DateAndTime,
  tn3270eRtDataTotalRt              Counter32,
  tn3270eRtDataTotalIpRt            Counter32,
  tn3270eRtDataTransCount           Counter32,
  tn3270eRtDataDrCount              Counter32,
  tn3270eRtDataElapsRndTrpSq        Unsigned32,
```

tn3270eRtDataElapsIpRtSq	Unsigned32,
tn3270eRtDataBucket1	Counter32,
tn3270eRtDataBucket2	Counter32,
tn3270eRtDataBucket3	Counter32,
tn3270eRtDataBucket4	Counter32,
tn3270eRtDataBucket5	Counter32

}

tn3270eRtDataClientAddrType OBJECT-TYPE
 SYNTAX Tn3270eAddrType
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION
 "Indicates the type of address that following in the
 instance OID represented by tn3270eRtDataClientAddress."
 ::= { tn3270eRtDataEntry 1 }

tn3270eRtDataClientAddress OBJECT-TYPE
 SYNTAX Tn3270eTAddress
 MAX-ACCESS not-accessible
 STATUS current
 DESCRIPTION
 "Contains the IP address of the TN3270 client being
 monitored. A null octet string is used if the aggregate
 of the Client Group is being collected "
 ::= { tn3270eRtDataEntry 2 }

tn3270eRtDataDiscontinuityTime OBJECT-TYPE
 SYNTAX TimeStamp
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The value of sysUpTime on the most recent occasion at
 which any one or more of this entry's objects
 suffered a discontinuity. One possibility of this is

Expires March 1998

[Page 32]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

when a TN3270E Server is stopped and then restarted
 where local methods are used to setup collection
 policy (tn3270eRtCollCtlTable entries).

In order to prevent a TN3270E Server from caching this

object it is recommended that the TN3270E Server's
startup time be used as the objects initial value."
::= { tn3270eRtDataEntry 3 }

tn3270eRtDataAvgRt OBJECT-TYPE

SYNTAX Gauge32
UNITS "tenths of seconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The average total response time measured over the last
collection interval."
DEFVAL { 0 }
::= { tn3270eRtDataEntry 4 }

tn3270eRtDataAvgIpRt OBJECT-TYPE

SYNTAX Gauge32
UNITS "tenths of seconds"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The average IP response time measured over the last
collection interval."
DEFVAL { 0 }
::= { tn3270eRtDataEntry 5 }

tn3270eRtDataAvgTransCount OBJECT-TYPE

SYNTAX Counter32
UNITS "transactions"
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The sliding transaction count used for calculating the values
of the tn3270eRtDataAvgRt and tn3270eRtDataAvgIpRt objects.
The actual transaction count is available in the
tn3270eRtDataTransCount object."
::= { tn3270eRtDataEntry 6 }

tn3270eRtDataIntTimeStamp OBJECT-TYPE

SYNTAX DateAndTime
MAX-ACCESS read-only
STATUS current
DESCRIPTION

"The date and time of the last interval that tn3270eRtDataAvgRt, tn3270eRtDataAvgIpRt, and tn3270eRtDataAvgTransCount were calculated."

::= { tn3270eRtDataEntry 7 }

tn3270eRtDataTotalRt OBJECT-TYPE

SYNTAX Counter32

UNITS "tenths of seconds"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of the total response time collected."

::= { tn3270eRtDataEntry 8 }

tn3270eRtDataTotalIpRt OBJECT-TYPE

SYNTAX Counter32

UNITS "tenths of seconds"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of the total IP-network response time collected."

::= { tn3270eRtDataEntry 9 }

tn3270eRtDataTransCount OBJECT-TYPE

SYNTAX Counter32

UNITS "transactions"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of the total number of transactions detected."

::= { tn3270eRtDataEntry 10 }

tn3270eRtDataDrCount OBJECT-TYPE

SYNTAX Counter32

UNITS "transactions"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of the total number of definite responses detected."

::= { tn3270eRtDataEntry 11 }

tn3270eRtDataElapsRndTrpSq OBJECT-TYPE

SYNTAX Unsigned32

UNITS "tenths of seconds squared"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The sum of the elapsed round trip time squared. A sum of the

White, Moore TN3270E Response Time Collection MIB 29 September 1997

squares is keep in order to calculate a variance."

DEFVAL { 0 }

::= { tn3270eRtDataEntry 12 }

tn3270eRtDataElapsIpRtSq OBJECT-TYPE

SYNTAX Unsigned32

UNITS "tenths of seconds squared"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The sum of the elapsed IP round trip time squared. A sum of
the squares is keep in order to calculate a variance."

DEFVAL { 0 }

::= { tn3270eRtDataEntry 13 }

tn3270eRtDataBucket1 OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of the response times falling into bucket 1."

::= { tn3270eRtDataEntry 14 }

tn3270eRtDataBucket2 OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of the response times falling into bucket 2."

::= { tn3270eRtDataEntry 15 }

tn3270eRtDataBucket3 OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A count of the response times falling into bucket 3."

::= { tn3270eRtDataEntry 16 }

tn3270eRtDataBucket4 OBJECT-TYPE


```

SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "A count of the response times falling into bucket 4."
 ::= { tn3270eRtDataEntry 17 }

```

tn3270eRtDataBucket5 OBJECT-TYPE

Expires March 1998

[Page 35]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

```

SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "A count of the response times falling into bucket 5."
 ::= { tn3270eRtDataEntry 18 }

```

-- Notifications

```

tn3270eRtExceeded NOTIFICATION-TYPE
    OBJECTS {
        tn3270eSrvrConfIndex,          -- server's local index
        tn3270eRtCollCtlClientGroupName, -- target of data collection
        tn3270eRtDataClientAddrType,
        tn3270eRtDataClientAddress,
        tn3270eRtDataIntTimeStamp,
        tn3270eRtDataAvgRt,
        tn3270eRtDataAvgIpRt,
        tn3270eRtDataAvgTransCount
    }
    STATUS current
    DESCRIPTION
        "This notification is generated when the average response time,
        tn3270eRtDataAvgRt, exceeds tn3270eRtCollCtlThresholdHigh at
        the end of a collection interval specified by
        tn3270eCollCtlSPeriod times tn3270eCollCtlSPMult. Note that
        the corresponding tn3270eCollCtlType must have traps(5) and
        average(3) set for this notification to be generated. In
        addition, tn3270eRtDataAvgTransCount,
        tn3270eRtCollCtlThreshHigh and tn3270eRtDataAvgRt are
        algorithmically compared to tn3270eRtCollCtlIdleRate for
        determination if this will be suppressed."

```

```
::= { tn3270eRtNotifications 1 }
```

tn3270eRtOkay NOTIFICATION-TYPE

OBJECTS {

```
    tn3270eSrvrConfIndex,          -- server's local index
    tn3270eRtCollCtlClientGroupName, -- target of data collection
    tn3270eRtDataClientAddrType,
    tn3270eRtDataClientAddress, -- IP Address or null octet string
    tn3270eRtDataIntTimeStamp,
    tn3270eRtDataAvgRt,
    tn3270eRtDataAvgIpRt,
    tn3270eRtDataAvgTransCount
```

}

STATUS current

DESCRIPTION

"This notification is generated when the average response time,

Expires March 1998

[Page 36]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

tn3270eRtDataAvgRt, falls below tn3270eRtCollCtlThresholdLow at the end of a collection interval specified by tn3270eCollCtlSPeriod times tn3270eCollCtlSPMult, after a tn3270eRtExceeded notification was generated. Note that the corresponding tn3270eCollCtlType must have traps(5) and average(3) set for this notification to be generated."

```
::= { tn3270eRtNotifications 2 }
```

tn3270eRtCollStart NOTIFICATION-TYPE

OBJECTS {

```
    tn3270eSrvrConfIndex,          -- server's local index
    tn3270eRtCollCtlClientGroupName, -- Data collection target
    tn3270eRtDataClientAddrType,
    tn3270eRtDataClientAddress, -- IP Address or null octet string
    tn3270eResMapElementName,      -- IDs LU or printer association
    tn3270eResMapElementType      -- type of resource
```

}

STATUS current

DESCRIPTION

"This notification is generated when response time data collection is enabled for a member of a client group. In order for this notification to occur the corresponding tn3270eRtCollCtlType must have traps(5) selected. The objects tn3270eResMapElementName and tn3270eResMapElementType contains

```
valid values only if tn3270eRtDataClientAddress contains a
valid IP address (rather than the null octet string)."
::= { tn3270eRtNotifications 3 }
```

```
tn3270eRtCollEnd    NOTIFICATION-TYPE
OBJECTS {
    tn3270eSrvrConfIndex,          -- server's local index
    tn3270eRtCollCtlClientGroupName, -- data collection target
    tn3270eRtDataClientAddrType,
    tn3270eRtDataClientAddress,
    tn3270eRtDataDiscontinuityTime,
    tn3270eRtDataAvgRt,
    tn3270eRtDataAvgIpRt,
    tn3270eRtDataAvgTransCount,
    tn3270eRtDataIntTimeStamp,
    tn3270eRtDataTotalRt,
    tn3270eRtDataTotalIpRt,
    tn3270eRtDataTransCount,
    tn3270eRtDataDrCount,
    tn3270eRtDataElapsRndTrpSq,
    tn3270eRtDataElapsIpRtSq,
    tn3270eRtDataBucket1,
    tn3270eRtDataBucket2,
    tn3270eRtDataBucket3,
```

Expires March 1998

[Page 37]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

```
    tn3270eRtDataBucket4,
    tn3270eRtDataBucket5
}
STATUS current
DESCRIPTION
    "This notification is generated when a tn3270eRtDataEntry is
    deleted after being active (actual data collected), in order to
    enable a management application monitoring a tn3270eRtDataTable
    entry to end get the entry's final values. Note that the
    corresponding tn3270eCollCtlType must have traps(5) set for this
    notification to be generated."
::= { tn3270eRtNotifications 4 }
```

-- Conformance Statement

```
tn3270eRtGroups      OBJECT IDENTIFIER ::= { tn3270eRtConformance 1 }
```

```
tn3270eRtCompliances  OBJECT IDENTIFIER ::= { tn3270eRtConformance 2 }
```

```
-- Compliance statements
```

```
tn3270eRtCompliance      MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION
    "The compliance statement for agents that support the
    TN327E-RT-MIB "
  MODULE -- this module
    MANDATORY-GROUPS { tn3270eRtGroup, tn3270eRtNotGroup }
  OBJECT tn3270eRtCollCtlSPeriod
    MIN-ACCESS read-only
    DESCRIPTION
      "The agent is not required to allow the user to change
      the default value of this object and is allowed
      to use a different default."
    ::= {tn3270eRtCompliances 1 }
```

```
-- Group definitions
```

```
tn3270eRtGroup            OBJECT-GROUP
  OBJECTS {
    tn3270eRtCollCtlType,
    tn3270eRtCollCtlSPeriod,
    tn3270eRtCollCtlSPMult,
    tn3270eRtCollCtlThreshHigh,
    tn3270eRtCollCtlThreshLow,
    tn3270eRtCollCtlIdleRate,
    tn3270eRtCollCtlBucketBndry1,
    tn3270eRtCollCtlBucketBndry2,
    tn3270eRtCollCtlBucketBndry3,
```

Expires March 1998

[Page 38]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

```
tn3270eRtCollCtlBucketBndry4,
tn3270eRtCollCtlRowStatus,
tn3270eRtDataDiscontinuityTime,
tn3270eRtDataAvgRt,
tn3270eRtDataAvgIpRt,
tn3270eRtDataAvgTransCount,
tn3270eRtDataIntTimeStamp,
tn3270eRtDataTotalRt,
```

```

        tn3270eRtDataTotalIpRt,
        tn3270eRtDataTransCount,
        tn3270eRtDataDrCount,
        tn3270eRtDataElapsRndTrpSq,
        tn3270eRtDataElapsIpRtSq,
        tn3270eRtDataBucket1,
        tn3270eRtDataBucket2,
        tn3270eRtDataBucket3,
        tn3270eRtDataBucket4,
        tn3270eRtDataBucket5 }
STATUS    current
DESCRIPTION
    "This group is mandatory for all host supporting the
      TN3270E-RT-MIB. "
 ::= { tn3270eRtGroups 1 }

tn3270eRtNotGroup      NOTIFICATION-GROUP
NOTIFICATIONS {
    tn3270eRtExceeded,
    tn3270eRtOkay,
    tn3270eRtCollStart,
    tn3270eRtCollEnd
}
STATUS    current
DESCRIPTION
    "The notifications which must be supported when the
      TN3270E-RT-MIB is implemented. "
 ::= { tn3270eRtGroups 2 }

END

```

6. Security Considerations

Certain management information defined in this MIB may be considered sensitive in some network environments. Therefore, authentication of received SNMP requests and controlled access to management information should be employed in such environments. The method for this authentication is a function of the SNMP Administrative Framework, and has not been expanded by this MIB.

Expires March 1998

[Page 39]~

Several objects in this MIB allow write access or provide for remote creation. Allowing this support in a non-secure environment can have a negative effect on network operations. It is recommended that implementers seriously consider whether set operations should be allowed without providing, at a minimum, authentication of request origin. It is recommended that without such support that the following objects be implemented as read-only:

- o tn3270eRtCollCtlType
- o tn3270eRtCollSPeriod
- o tn3270eRtCollSPMult
- o tn3270eRtCollCtlThreshHigh
- o tn3270eRtCollCtlThreshLow
- o tn3270eRtCollCtlIdleRate
- o tn3270eRtCollCtlBucketBndry1
- o tn3270eRtCollCtlBucketBndry2
- o tn3270eRtCollCtlBucketBndry3
- o tn3270eRtCollCtlBucketBndry4

The following object should either be implemented as read-only or not implemented when security is an issue as previously discussed:

- o tn3270eRtCollCtlRowStatus

The administrative method to use to create and manage the tn3270eRtCollCtlTable when SET support is not allowed is outside of the scope of this memo.

7. Acknowledgments

This document is a product of the TN3270E Working Group. Special thanks is due to Derek Bolton and Michael Boe of Cisco Systems for their numerous comments and suggestions for improving the structure of this MIB.

8. References

- [1] SNMPv2 Working Group, Case, J., McCloghrie, K., Rose, M., and Waldbusser S., "Structure of Management Information for version 2 of the Simple Network Management Protocol (SNMPv2)", [RFC 1902](#), January 1996.
- [2] Network Working Group, Postel, J., and Reynolds, J., "Telnet Protocol Specification", [RFC 854](#), May 1983.

- [3] Network Working Group, Postel, J., and Reynolds, J., "Telnet Timing Mark Option", [RFC 860](#), May 1983.
- [4] Network Working Group and Rekhter J., "Telnet 3270 Regime Option", [RFC 1041](#), January 1988.
- [5] McCloghrie, K., and M. Rose, Editors, "Management Information Base for Network Management of TCP/IP-based internets: MIB-II", STD 17, [RFC 1213](#), Hughes LAN Systems, Performance Systems International, March 1991.
- [6] SNMPv2 Working Group, Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Textual Conventions for version 2 of the Simple Network Management Protocol (SNMPv2)", [RFC 1903](#), January 1996.
- [7] SNMPv2 Working Group, Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Protocol Operations for version 2 of the Simple Network Management Protocol (SNMPv2)", [RFC 1905](#), January 1996.
- [8] SNMPv2 Working Group, Case, J., McCloghrie, K., Rose, M., and S. Waldbusser, "Conformance Statements for version 2 of the Simple Network Management Protocol (SNMPv2)", [RFC 1904](#), January 1996.
- [9] Case, J., M. Fedor, M. Schoffstall, J. Davin, "Simple Network Management Protocol", [RFC 1157](#), SNMP Research, Performance Systems International, MIT Laboratory for Computer Science, May 1990.
- [10] IETF TN3270E Working Group and White, K., "Base Definitions of Managed Objects for TN3270E Using SMIV2", Internet-Draft Work in progress, June 1997.
- [11] Network Working Group, and Kelly, B., "TN3270 Enhancements", [RFC 1647](#), July 1994.
- [12] IBM, International Technical Support Centers, "Response Time Data Gathering", GG24-3212-01, November 1990.

[13] Krupczak, Cheryl, Saperia, Jonathan, "Definitions of System-Level

Expires March 1998

[Page 41]~

White, Moore TN3270E Response Time Collection MIB 29 September 1997

Managed Objects for Applications", April 15, 1997.

9. Authors' Addresses

Kenneth D. White
Dept. BRQA/Bldg. 503/C117
IBM Corporation
P.O.Box 12195
3039 Cornwallis
Research Triangle Park, NC 27709, USA
Phone: +1-919-254-0102
E-mail: kennethw@vnet.ibm.com

Robert Moore
Dept. BRQA/Bldg. 501/G114
IBM Corporation
P.O.Box 12195
3039 Cornwallis
Research Triangle Park, NC 27709, USA
Phone: +1-919-254-7507
E-mail: remoore@us.ibm.com

Expires March 1998

[Page 42]~