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**Title**: Testing Experiences and Modifications to Mean Frame Burst Size (MFBS) Section of Performance Testing Baseline Text

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**Abstract**: Our testing experiences with MFBS are presented. Also, we updated the text of the MFBS section to be consistent with the other sections of the document. In particular, traffic characteristics for measurements have been added.

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**Notice**:


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In this contribution, we first present some of our measurement experiences with the maximum frame burst size (MFBS). Then, we explain the proposed changes to section 3.5 of the baseline text. As instructed in the April meeting, that part of the contribution

has three parts. In the first part, we describe the changes. The second part contains the proposed text and the third part shows the changes from the current baseline

## A. MFBS Measurement Tests

The baseline currently states that MFBS should be measured using a k-to-1 configuration, where the traffic from k input ports of a switch is sent to one output port. To see if different values of k will produce unexpectedly different results, we conducted a set of tests with k=2, 3, and 4, i.e., the 2-to-1, 3-to-1, and 4-to-1 configurations.

### Test Configuration and Methodology

Four virtual paths were set up inside the switch, for switching test traffic from four different input ports to a single output port (see Figure 1). Two of the input ports were 155 Mbps UTP ports, the other two were 155 Mbps OC-3 ports. The first UTP port also served as the output port for the tests.

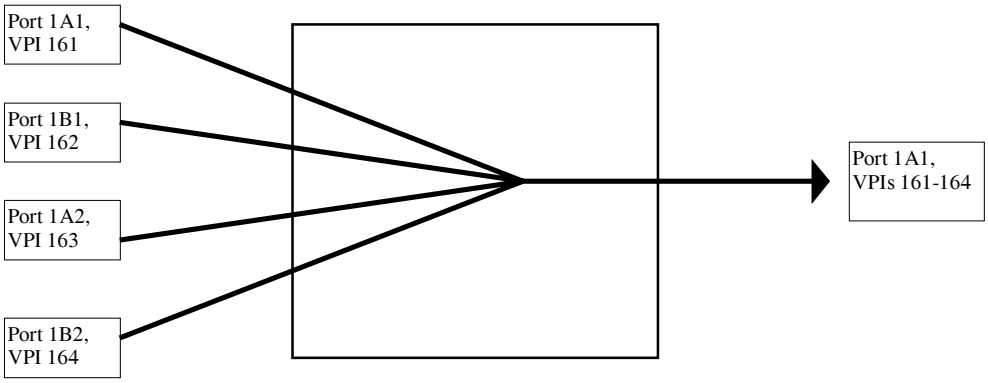


**Figure 1.** VPC configuration for the MFBS tests.

An ATM analyzer was used to generate the four traffic sources. Each source generator produced a burst of back-to-back cells, and was coordinated with the other generators to produce identical bursts starting at the same instant. The size of the bursts was increased until losses were observed.

### Results and Analysis

The maximum sizes of the bursts that could be sent over each link without losses, the Maximum Cell Burst Size (MCBS), are summarized in Table 1. Burst sizes were adjusted with a 100 cell granularity, so the precision is +/- 50 cells. Although we repeated the experiments several times, the results were same. There was no variation.

| Traffic configuration | MCBS (per source) |
|---|---|
| 2-to-1 | 9,050 cells |
| 3-to-1 | 4,650 cells |
| 4-to-1 | 3,050 cells |

**Table 1**. Measured MCBS per source.

The MCBS is the largest length of back-to-back cells that all sources may send simultaneously without loss. The ratio of the measured values is as expected, indicating that the MCBS for all k-to-1 configurations (where k = 2, 3,…) can be predicted from any single MCBS measurement where k is given. For example, in the 2-to-1 configuration, the results of this test imply the ability of the switch to buffer about 9,050 cells on that output port. That is, during each cell interval of the bursts, one cell can be transmitted by the switch, and one cell must be buffered. In the 3-to-1 configuration, one would expect the MCBS to be one-half of the MCBS from the 2-to-1 configuration. Whereas one cell can still be transmitted by the switch, it must now buffer *two* cells during each cell interval. Similarly, the 4-to-1 configuration would be expected to have a MCBS one-third of the 2-to-1 MCBS, as the switch must now buffer three cells during each cell interval.

The Maximum Frame Burst Size (MFBS) is the number of complete frames of a given size (including the AAL overhead) that can fit within the bounds of the MCBS. It is expressed as a total number of data octets. The MFBS values from this test (assuming no AAL overhead) are summarized in Table 2. Again, MFBS for various values of k and frame sizes can be computed from one test. Therefore, we conclude that it is not necessary to repeat the experiment for various values of k.

| Traffic configuration | 64B frames | 1518B frames | 9188B frames | 64kB frames |
|---|---|---|---|---|
| 2-to-1 | 434,368B | 434,148B | 431,836B | 393,216B |
| 3-to-1 | 223,168B | 223,146B | 220,512B | 196,608B |
| 4-to-1 | 146,368B | 145,728B | 137,820B | 131,072B |

**Table 2**. MFBS values for the each configuration and frame size.

## B. Explanations of Changes in "MAXIMUM FRAME BURST SIZE"

The proposed new text is given in the next Section C. The changes are as follows:

a. 3.5.1 - Minor editorial changes
b. 3.5.2 - The second paragraph is removed. It is included in the Subsection 3.5.5.
c. 3.5.3 - Since our measurements indicate that there are no significant variations in MFBS, we no longer require repetitions of experiments or calculation of an average value.
d. 3.5.4. - This paragraph includes and extends topics from the old 3.5.4. It includes the measurement procedure and calculation of MFBS.
e. 3.5.5 - Improved description of reporting of measurement results.

## C. Revised Text

### 3.5. MAXIMUM FRAME BURST SIZE

#### 3.5.1 Definition

Given a number of sources transmitting to a single destination, the Maximum Frame Burst Size (MFBS) is the maximum number of frames that each of the source end systems can send at the peak rate through a system under test without incurring any loss. MFBS measures the data buffering capability of the SUT and its ability to handle back-to-back frames.

Many applications and transport layer protocol drivers often present a burst of frames to the AAL for transmission. For such applications, Maximum Frame Burst Size provides a useful indication of the switch's ability to handle these bursts.

This metric is particularly relevant to the UBR service category since UBR sources are always allowed to send a burst at the peak rate. ABR sources may be throttled down to a lower rate if a switch runs out of buffer.

#### 3.5.2 Units

MFBS should be expressed in octets of AAL payload field. This is preferred over number of frames or cells. The former requires specifying the frame size and the latter is not very meaningful for a frame-level metric. Also, number of cells has to be converted to octets for use by AAL users.

#### 3.5.3 Statistical Variations

There is no need for obtaining more than one sample for MFBS. Consequently, there is no need for calculation of the means and/or standard deviations.

### 3.5.4 Measurement Procedure and MFBS Calculation

The MFBS is measured with a k-to-1 connection configuration as specified in Section 3.1.5. Thus, k VCCs (or VPCs) are established through the SUT. All k+1 links are of the same rate.

The measurement procedure may require a number of tests. Each test includes simultaneous generation of fixed length bursts of back-to-back cells through all k VCCs (or VPCs) and counting of all cells transmitted by the SUT. If there is no loss of cells, the length of bursts is increased, but if there is a loss, the length of bursts is decreased. In both cases, the next test is performed with the new burst length. The procedure is finished when the maximum cell burst size (MCBS) is found. MCBS is the maximum burst length for which there is no cell loss.

Tests are conducted without any background traffic.

Given MCBS, one can calculate the maximum integral number of back-to-back frames of a given size, which can be sent into the SUT of the given connection configuration and delivered by the SUT without any loss. This integral number then converted to octets of AAL payload field to obtain the Maximum Frame Burst Size (MFBS)

### 3.5.5 Reporting Results

Reported results should include a detailed description of the SUT, such as the number of ports, rate of each port, number of ports per network module, number of network modules, number of network modules per fabric, number of fabrics, the software version and any other relevant information.

The value for MFBS is reported for each link rate supported by the SUT along with traffic characteristics. The list of traffic characteristics and their possible values are as follows:

- type of VCCs: permanent virtual path connections, switched virtual path connections, **permanent virtual channel connections**, switch virtual channel connections;
- VCCs established: between ports inside a network module, **between ports on different network modules**, between ports on different fabrics, some combination of previous cases;
- connection configuration: 2-to-1;
- frame length: **64 B**, **1518 B**, **9188 B**, **64 kB**;

Values in bold indicate traffic characteristics for which measurement tests must be performed and for which MFBS values must be reported.

## D. Differences Between the Revised and the Old Text

### 3.5. MAXIMUM FRAME BURST SIZE ~~(MFBS)~~

#### 3.5.1 Definition

The Maximum Frame Burst Size (MFBS) is the maximum number of frames that each of the source end systems can send at the peak rate through a system under test without incurring any ~~loss.~~
loss. MFBS measures the data buffering capability of the SUT and its ability to handle back-to-back frames.

Many applications and transport layer protocol drivers often present a burst of frames to the AAL for transmission. For such applications, Maximum Frame Burst Size provides ~~an useful indication.~~a useful indication of the switch's ability to handle these bursts.

This metric is particularly relevant to the UBR service category since~~the~~ UBR sources are always allowed to send a burst at peak rate. ABR sources may be throttled down to a lower rate if a switch runs out of buffer.

#### 3.5.2 Units

MFBS should be expressed in octets of AAL payload field. This is preferred over number of frames or cells. The former requires specifying the frame size and the latter is not very meaningful for a frame-level metric. Also, number of cells has to be converted to octets for use by AAL users.
~~It may be useful to indicate the frame size for which MFBS has been measured. If MFBS is found to be highly variable with frame size, a number of common AAL payload field sizes such as 64 octets, 536 octets, 1518 octets, and 9188 octets may be used (exact sizes are for further study).~~

#### 3.5.3 Statistical Variations
~~The number of frames sent in the burst is increased successively until a loss is observed on any VC. The maximum number of frames that can be sent without loss are reported as MFBS. The tests should be repeated NRT times. The average of NRT repetitions is reported as the MFBS for the system under test.~~

#### ~~3.5.4 Traffic Patterns~~
~~The MFBS is measured for n-to-1 traffic pattern specified in Section 3.1.4. Optionally, it can be measured for other traffic patterns also. The value obtained for n-to-1 pattern is expected to be smaller than that for other patterns.~~

~~**3.5.5 Guidelines For Using This Metric**~~

~~To be specified.~~

There is no need for obtaining more than one sample for MFBS. Consequently, there is no need for calculation of the means and/or standard deviations.

## 3.5.4 Measurement Procedure and MFBS Calculation

The MFBS is measured with a k-to-1 connection configuration as specified in Section 3.1.5. Thus, k VCCs (or VPCs) are established through the SUT. All k+1 links are of the same rate.

The measurement procedure may require a number of tests. Each test includes simultaneous generation of fixed length bursts of back-to-back cells through all k VCCs (or VPCs) and counting of all cells transmitted by the SUT. If there is no loss of cells, the length of bursts is increased, but if there is a loss, the length of bursts is decreased. In both cases, the next test is performed with the new burst length. The procedure is finished when the maximum cell burst size (MCBS) is found. MCBS is the maximum burst length for which there is no cell loss.

Tests are conducted without any background traffic.

Given MCBS, one can calculate the maximum integral number of back-to-back frames of a given size, which can be sent into the SUT of the given connection configuration and delivered by the SUT without any loss. This integral number then converted to octets of AAL payload field to obtain the Maximum Frame Burst Size (MFBS)

## 3.5.5 Reporting Results

Reported results should include a detailed description of the SUT, such as the number of ports, rate of each port, number of ports per network module, number of network modules, number of network modules per fabric, number of fabrics, the software version and any other relevant information.

The value for MFBS is reported for each link rate supported by the SUT along with traffic characteristics. The list of traffic characteristics and their possible values are as follows:

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- connection configuration: 2-to-1;
- frame length: **64 B**, **1518 B**, **9188 B**, **64 kB**;

Values in bold indicate traffic characteristics for which measurement tests must be performed and for which MFBS values must be reported.