Sample Test Plan for Latency, Jitter, and Throughput

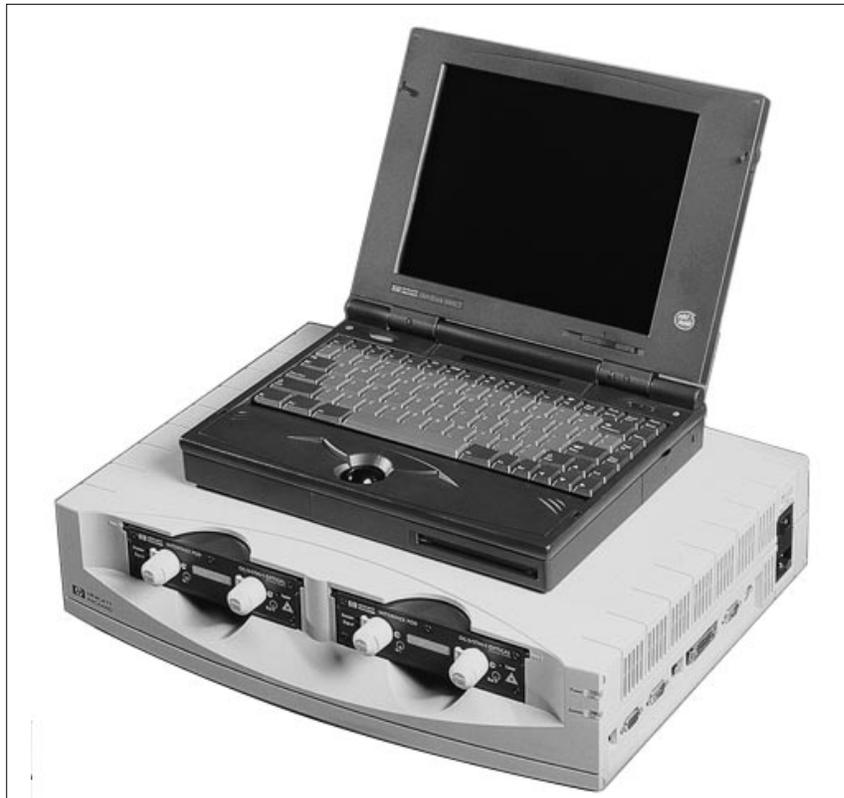## Using the HP E5200A Broadband Service Analyzer

Introduction

Latency, jitter, and throughput is one of the test categories described in the *Evaluating ATM Switch Performance* solution note. This solution note provides a sample test plan and expected results for this test category.

This solution note deals with PVC (Permanent Virtual Circuit) connections carrying CBR (Constant Bit Rate) or VBR (Variable Bit Rate) services. You can perform all the tests described in this paper using the HP E5200A Broadband Service Analyzer.

Latency, jitter, and throughput performance in an ATM switch are evaluated by measuring cell loss, cell delay, and cell delay variation under various conditions
• increasing bandwidth through the switch port
• enabling or disabling proprietary traffic management functions
• increasing total bandwidth across the switch fabric
• failing or removing other cards in the switch rack

HP E5200A Broadband Service Analyzer

Tx - the service analyzer generates test traffic

Rx - the service analyzer measures cell loss, cell delay, and cell delay variation through the ATM switch
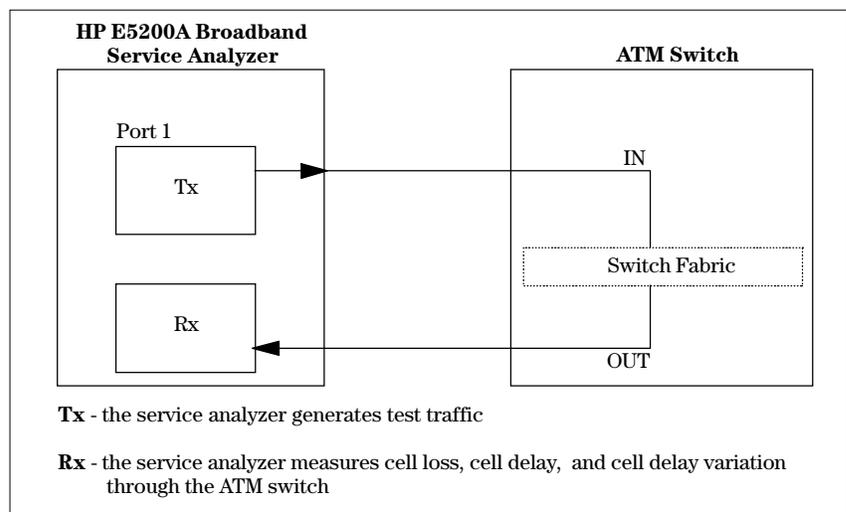
Testing for latency, jitter, and throughput

Latency, Jitter, & Throughput: Example Test Plan

Description

Measure cell delay, cell delay variation, and the maximum bandwidth without cell loss. Determine the amount of *headroom* per port (reserved bandwidth for network management and signaling traffic).

Configuration

1. Connect the service analyzer port (Tx/Rx) to a switch port (IN/OUT).

2. Configure PVCs between pairs of switch ports and connect cables as shown in the diagram.
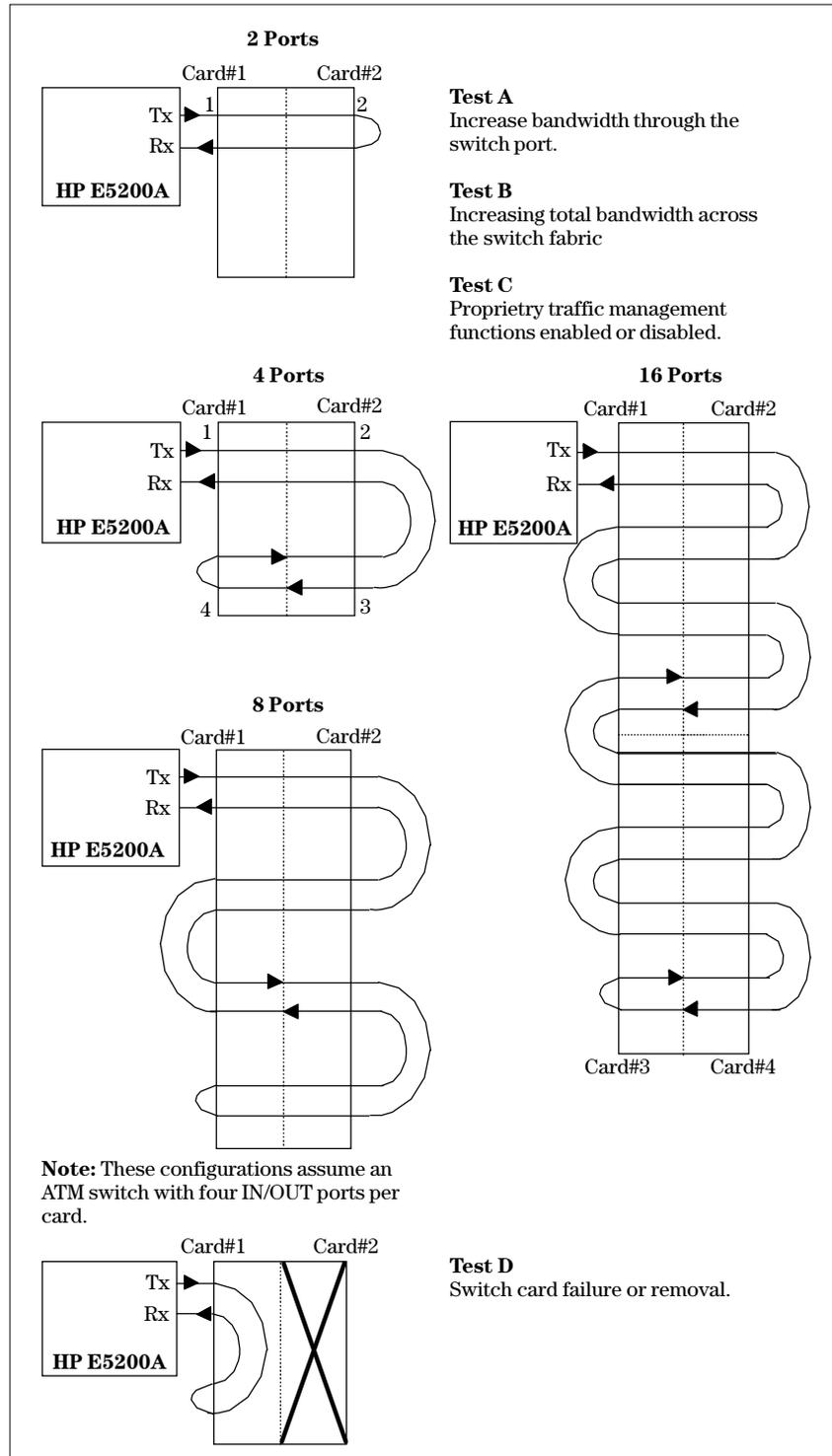
Test Equipment

HP E5200A Broadband Service Analyzer with a single interface pod.

Test Procedure

Test A

For the 2-Ports configuration shown, on page 2, measure cell loss, cell delay, and cell delay variation with increasing traffic bandwidth generated by the service analyzer. For example, 10%, 20%...100% of MAXBW or until cell loss occurs at CLOSBW, where

- **MAXBW** is the maximum possible cell bandwidth that a particular physical interface can carry (for example OC-3, MAXBW = 149.76 Mb/s).

- **CLOSBW** = MAXBW - HEADROOM, where HEADROOM is the amount of bandwidth used for traffic management and network management signaling.

Test A
Increase bandwidth through the switch port.

Test B
Increasing total bandwidth across the switch fabric

Test C
Proprietry traffic management functions enabled or disabled.

Note: These configurations assume an ATM switch with four IN/OUT ports per card.

Test D
Switch card failure or removal.

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Test B

Increase the total bandwidth across the switch fabric. Repeat Test A with different numbers of switch ports. For example 4, 8, 16, or more ATM switch ports as shown on page 2.

Note: The *cell delay per port,* shown in the adjacent table, is equivalent to the cell delay introduced by each traversal of the switch fabric.

Test C

Repeat Tests A and B with traffic management off or on.

Note: Some ATM switches use proprietary traffic management functions to optimize characteristics such as QoS and congestion management.

Test D

Repeat Tests A and B while plugging in and out another switch card. Is the ATM switch backplane affected by the removal of another switch card?

Note: Some ATM switches provide *hot swap* capability for the switch cards.

For more information about SMARTtests, refer to the HP E5200A Broadband Service Analyzer *User* online help.

Expected Results: Latency, Jitter, and Throughput

Test A - For 2 ATM switch ports, with increasing transmit bandwidth

Measurement	Expected Result
Cell Loss	No cell loss until transmit bandwidth exceeds CLOSBW (typical HEADROOM required for signaling is 1 to 10 kb/s).
Cell Delay Per Port	Constant (typically 10 to 100 ms per port) until transmit bandwidth exceeds CLOSBW.
Cell Delay Variation Per Port	Constant (typically 1 to 10 µs per port).

Test B - For transmit bandwidth less than CLOSBW, repeat Test A with an increasing number of ATM switch ports

Measurement	Expected Result
Cell Loss	No cell loss for any number of ports.
Cell Delay Per Port	Constant (typically 10 to 100 ms per port) for any number of ports.
Cell Delay Variation Per Port	Constant (typically 1 to 10 µs per port) for any number of ports.

Test C - ATM switch traffic management off and on (repeat Tests A and B)

Measurement	Expected Result
Cell Loss	Extra bandwidth might be required for traffic management signaling (required HEADROOM might be increased).
Cell Delay Per Port	This might change slightly due to the way traffic management controls the input and output buffers in the ATM switch. **Note:** In some cases, traffic management functions designed to improve overall QoS or congestion management, might actually increase the cell delay.
Cell Delay Variation Per Port	This might change slightly due to the way traffic management controls the input and output buffers in the ATM switch.

Test D - Removal of another ATM switch card procedure (Repeat Tests A and B)

Measurement	Expected Result
Cell Loss	No cell loss.
Cell Delay Per Port	No change.
Cell Delay Variation Per Port	No change.

Test Equipment Features

Use the following features of the HP E5200A Broadband Service Analyzer to test latency, jitter, and throughput switch performance.

- **Cell delay SMARTtest** Use the cell delay SMARTtest to obtain *Cell Delay Max.*, *Mean*, *Min.*, and *Cell Delay Variation*. Use the default pass/fail *Criteria* for the cell delay SMARTtest.

- **Cell loss SMARTtest** Use the cell loss SMARTtest to obtain *Cell Loss*, *Cell Error, and Cell Misinsertion* counts. Use the default pass/fail *Criteria* for the cell loss SMARTtest. Configure the traffic options to change the bandwidth and select the traffic profile for the SMARTtests.

- The **constant** profile represents a CBR service such as voice or video. CBR traffic is usually sensitive to cell delay and cell delay variation.

- The **burst** profile represents a VBR service such as LAN traffic. VBR traffic is usually sensitive to cell loss. Use the *Bandwidth* parameter to set the PCR (Peak Cell Rate). Use the *Gap* and *Length* parameters to set the *Mean Bandwidth* and the SCR (Sustained Cell Rate).

For more information about SMARTtests, refer to the HP E5200A Broadband Service Analyzer *User* online help.

Conclusions

This solution note provides examples of the types of parameters that you can vary as the service analyzer measures cell loss and cell delay through an ATM switch. These tests enable you to evaluate latency, jitter, and throughput performance of an ATM switch.

For information on evaluating other ATM switch characteristics, refer to the *Sample Test Plan* solution notes for
- switch statistics
  (P/N 5965-6204E)
- traffic management
  (P/N 5965-6206E)

Other solution notes in this series deal with the end-to-end testing requirements for ATM networks including topics such as Quality of Service (QoS).