Cell Transfer Time Measurement using Parallel Cell & Traffic Generator and Analyzer

How to use the HP E4829B custom / UTOPIA level 1 implementation for Cell Transfer Time Variation Measurements

Product Note

Product Number
HP E4829B

Figure 1: HP E4829B Entry System

Introduction

Achieve Quality of Service in an ATM Switch requires tight control on the variation of cell transfer time for channels carrying voice data. When delay variation exceeds certain limits, the quality of voice sent to a user decreases. The designer's goal is to make transfer time variation small enough over the wide range of traffic load occurring at the switch fabric. Also the ATM forum recommends to evaluate the cell transfer time variation carefully [1].

Current developments deal with voice compression, which results in a new adaptation class called real-time variable bit rate (VBR-RT) to indicate that the adaptation process must guarantee defined end-to-end delay and delay jitter. This saves up to 60% of the bandwidth which other techniques such as TDM waste [2].

To make Cell Transfer Time Variation Measurements in a communication system dealing with ATM cells, the HP E4829B test system is able to map and extract Time Stamp information into and from the payload of ATM cells. It is able to do this measurement from parallel to parallel (UTOPIA) ports, either at the switch fabric ports or at the ATM layer device interfaces, as shown in figure 2.

Application:

Network Equipment Manufacturers:

For Hardware and Software engineers, designing ICs or Modules for ATM switches, or working in System Integration, the HP E4829B 'Parallel Cell & Traffic Generator and Analyzer', providing Cell Transfer Time Variation Measurement capability, is the basic tool for Evaluation of complex ATM designs at parallel interfaces (UTOPIA).

Component Test:

Semiconductor Manufacturers provide a large variety of off-the-shelf devices for the ATM industry. Besides Line Interface ASICs and ATM Layer controllers, chip and chip sets for the switch fabric itself becomes available.

To achieve the tough goals for 'Quality of Service' system wide, it is a must to characterize the individual chip or chip set already for the share of the overall cell transfer time variation budget.

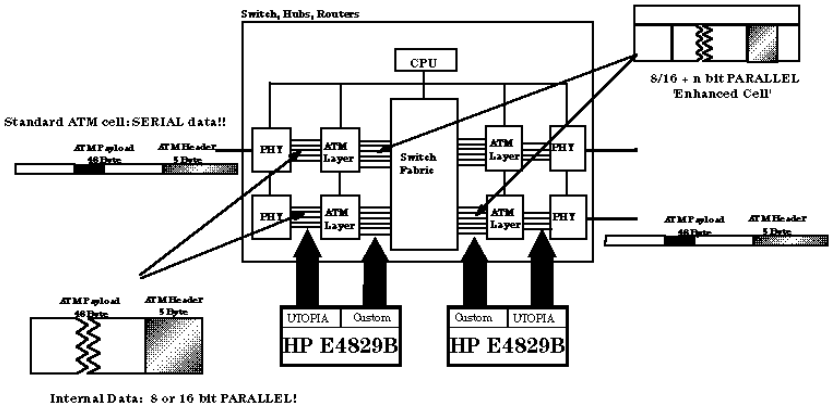

Figure 2: Block Diagram of an ATM Switch with the parallel interfaces shown where the HP E4829B connects to

How to Use

Cell Definition

The Time Stamp is a segment available when the cell structure is defined. Segment length is 32 bit fixed, which equals 4 bytes in ATM-8 or 2 words in ATM-16 application. The time stamp segment can be placed anywhere within the payload of the cell. Figure 3 shows a cell including a time stamp segment.

The definition of cells on Transmitter and Receiver is identical. On the Transmitter the time stamp segment is filled with bits resulting from the 32 bit wide time stamp counter at the point of time the cell will be generated. On the Receiver it defines the bytes/words, which are used for calculation of the Cell transfer time. The trigger cell can be used to specify other parameters too, to make the transfer time measurement only on certain cells (e.g. matching for a dedicated VPI/VCI) within the incoming cell stream.

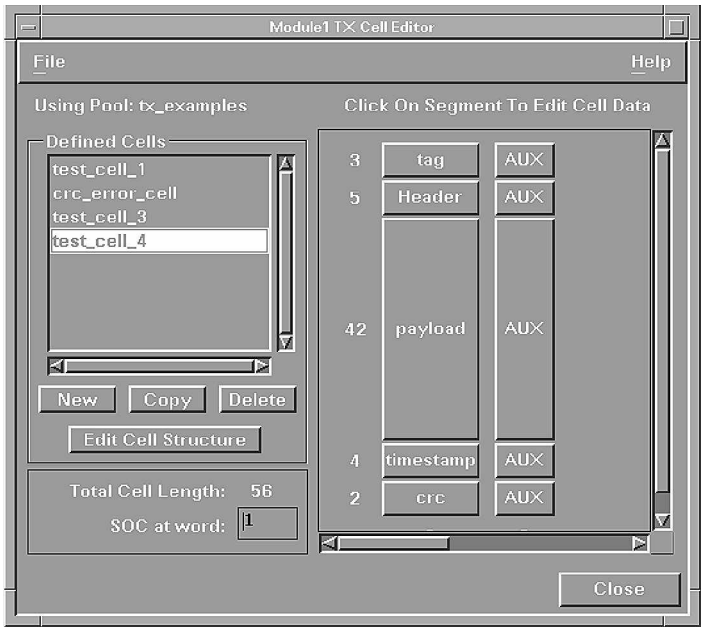

Figure 3: Cell Editor of the HP E4829B showing a Cell including a Time Stamp

Analysis:

To perform a Cell Transfer Time Variation measurement, the processing capabilities of the HP E4829B provide a new action called 'Measure time'. This forces the receiver to generate a time stamp when the cell arrives. The receiver time stamp is then compared with the time stamp extracted from the cell's payload. From that, the transfer time is calculated. To obtain valid measurements, the transmitter and the receiver queue paths are compensated and the time stamp counters are synchronized.

System shows cell transfer time variation by sorting the received cells in three categories: early, in time and late. The user has to provide the values for both limits. Figure 4 shows the principle, figure 5 shows the setup in the processing editor window.

Results

The Counter window, shown in figure 6, displays the results from a Cell Transfer Time Variation measurement. There are three counters, each assigned to one of the three categories: early, in time and late displaying the number of cells arrived according the given limits. The Counter window updates in user defined measurement intervals after the start of the Receiver.

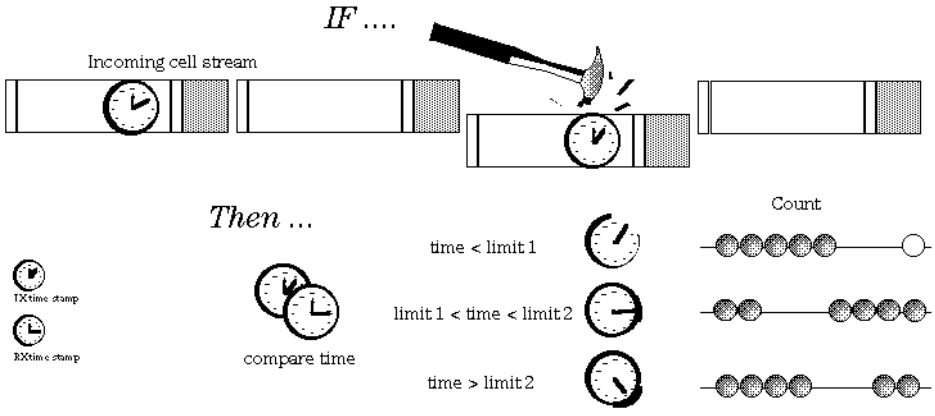

Figure 4: Principle of Cell Transfer Time Measurement

Implementation

Cell Transfer Time Variation measurements can be performed on the 8 and the 16 bit solution of the HP E 4829B.

To achieve this application, the HP E4829B includes the necessary features with Software Revision A.2.3.0.

Time stamp Segment:

- 32 bit fixed length:
  ATM-8 = 4 bytes,
  ATM-16 = 2 words
- can be placed anywhere in the payload of a cell, but not after a crc-10 segment, once per cell

Time Stamp Analysis:

- action: Compare Time
- Conditions: early (< limit 1),
  in time (> limit 1 < limit 2),
  late (> limit 2)
- upper and lower limit (limit 1, limit 2), range 0 to 40 sec, resolution 20 ns,
  both limits can be programmed to the same value

Synchronization:

Before starting a measurement, the time stamp generators of Transmitter and Receiver need to be synchronized. This is achieved with the 'Sync' command for TX and RX inside one module.

For a system containing more than one module, the 'Sync' is distributed via the VXI trigger lines on the VXI back plane. The selection of a trigger line is possible for each module.

External Clock:

Any external clock can be used for TX or RX. To achieve best measurement accuracy, the system software uses the given value for the applied frequency in the 'Timing/Interface' editor window to compensate internal pipeline delays.

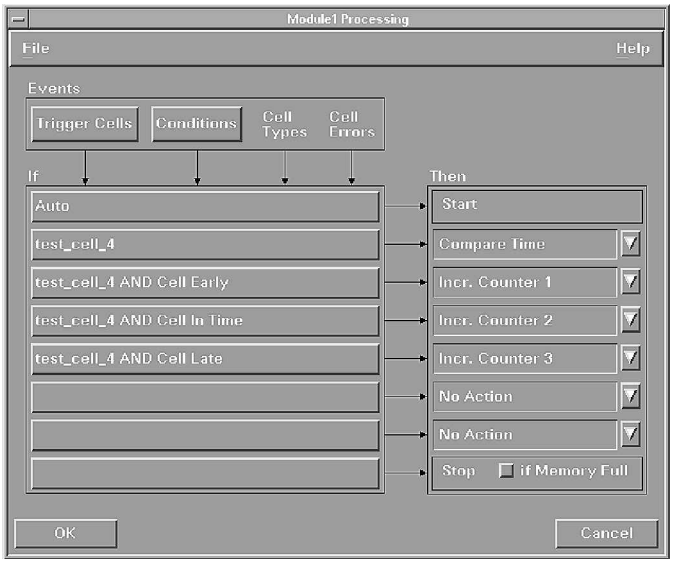

Figure 5: Processing Editor with Cell Tranfer Time Variation Measurement

Exit and Entry Event Time:

According ITU recommendation [3] the exit event time is when the first byte/word of a cell is transmitted at the outputs of the Transmitter Pod. The entry event time is when the last byte/word of a cell is received at the inputs of the Receiver Pod. As a consequence a transfer time measurement for a cell on an infinitesimally short media gives a value equal to the cell length. Internal path delays of the HP E4829B are compensated accordingly. If the handshake conditions avoid a cell transmission, the cell is buffered in the output queues. The duration from the possible exit to the real exit event is added to the cell transfer time through a DUT.

References

[1] ATM Forum, Introduction to ATM Forum Test Specifications, af-test-0022.00, Dec. 94

[2] TELECOMMUNICATIONS, International Edition, Jul. 96, Voice over ATM - A Winning Technology, page 49

[3] ITU-T Recommendation I.353, Chapter 2, General Definitions

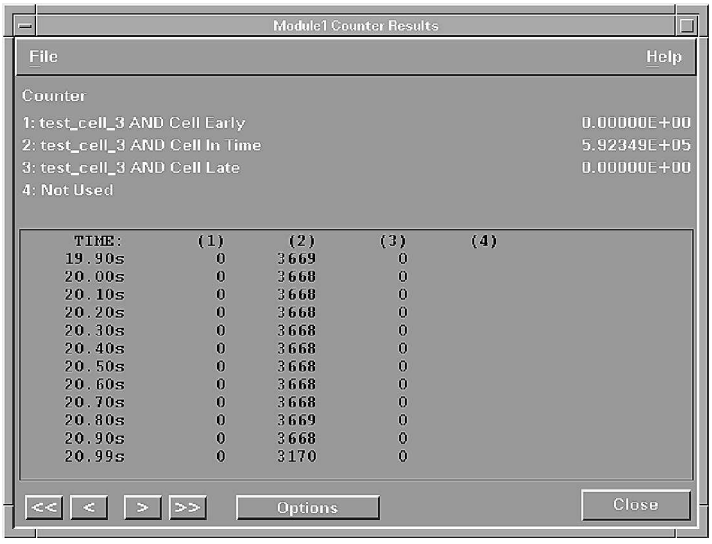

Figure 6: Results from the Cell Transfer Time Variation Measurement