HP E2972A PCI Performance Analyzer

Technical Specifications Preliminary

HP E2920 Computer Verification Tools, PCI Series

Part of the HP E2920 PCI Series of Computer Verification Tools, the HP E2972A PCI Performance Analyzer is a comprehensive tool which measures PCI bus performance. Allowing real-time measurement and in-depth post-processing, it can perform high quality measurements of PCI-based systems and cards. Results can be easily compared and communicated by using the extensive performance measurement metrics. In comparison with running software benchmarks, which detail how a user application will perform on a system, the HP E2972A provides an "inside view", instructing design engineers how to optimize PCI systems, cards or chip sets.

Optimize system performance

By following the recommended PCI performance measurement metrics, system integrators can easily select the best PCI cards and components, detect and locate PCI performance bottlenecks, and balance BIOS settings so that the overall performance of the system is optimized.

Optimize PCI System Components

For PCI chip, card and system designers, the HP E2972A is designed to verify, optimize and document PCI performance. Therefore, the HP E2972A uses a hierarchical approach to analyze real-time and post-processing performance measurements (see figure 1). This means that the HP E2972A moves swiftly from high-level throughput numbers to, for example, PCI command usage and latency measurements, as required. It is therefore simple to identify design issues and analyze their causes. Overall, this approach reduces the effort

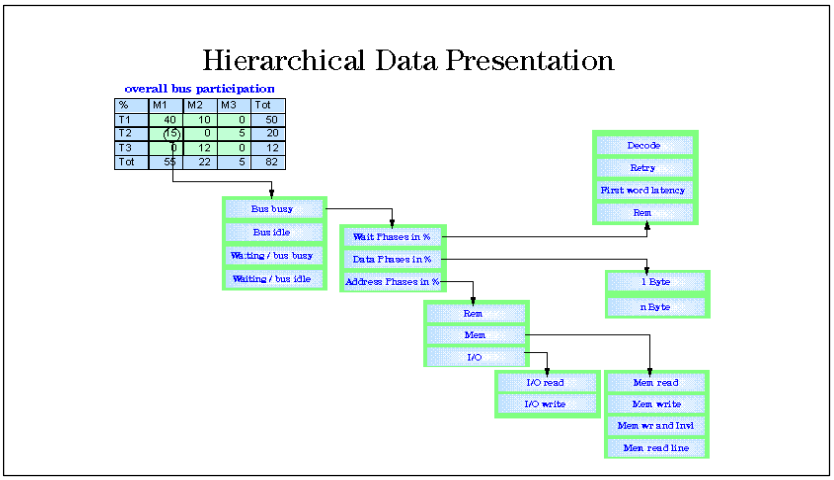

Figure 1. Hierarchical Representation

Key Features

- In-depth performance analysis through post-processing.
- 1 M sample trace memory.
- Differential storage qualifier to optimize trace memory usage.
- Four real-time counters with virtual infinite counter depth.
- Latency measurement.
- First word latency of split transaction (PCI spec 2.1).
- Activity lister with time stamp.
- Reveals target, master and arbiter contribution to performance measurement results.
- Measures overall traffic and selective for master/target pair.
- Report generation.

required to reveal design problems.

Real-Time Measurement And Post-Processing

The HP E2972A carries out real-time performance measurements and concurrently takes a bus snapshot for exhaustive analysis. So, while monitoring performance over seconds or hours, a valid sample is taken for closer analysis so that performance issues can be identified.

Real-Time Measurements

The HP E2972A can perform six basic real-time measurements:

- PCI throughput,
- PCI utilization,
- PCI efficiency,
- average burst length,
- retry rate,
- event counting.

Each measurement can be specified for the complete PCI bus, a single master or a single target. The master or target is selected for measurement by either connecting the GNT# line or by setting the address range. Measurements can be started and stopped by customer-specified bus patterns, and two measurements can be performed simultaneously.

Real-time measurements are presented graphically, either as a cumulative bar chart or as a trend chart. A tabular representation is also part of the report file. The update rate can be selected by the customer from a range of 1 s to 120 s.

Post-Processed Data Analysis

The HP E2972A allows an in-depth performance analysis of sampled PCI transactions by using the HP E2925A 1 M/performance option to acquire data. To optimize the 1 M of trace memory, the differential storage qualifier is used to select the data needed for the performance measurement. This is carried out by choosing:

- address phases,
- data phases,
- retries,
- wait phases with IRDY or TRDY toggles,
- selected GNT# line toggles,
- selected REQ# line toggles.

The HP E2972A then analyzes the acquired data for the following.

Basic bus statistics

To obtain an overall picture of the PCI performance, the HP E2972A analyzes the PCI bus for:

- PCI throughput,
- PCI utilization,
- non-retry utilization,
- PCI efficiency,
- PCI non-retry efficiency,
- PCI data efficiency,
- retry overhead.

A bus efficiency chart provides an overview of how efficiently the traffic was handled between different bus agents.

Master Target Efficiency:

	Master 1	LAN	?	Avg
Video	80 %	8 %	0 %	50 %
Target 2	05 %	0 %	1 %	2 %
?	0 %	5 %	0 %	5 %
Avg	55 %	7 %	1 %	25 %

Figure 2. Bus Efficiency Table

Bus utilization

The bus utilization analysis shows how the PCI bus was used by:

- data transfer,
- overhead,
- retry.

A utilization chart shows how the bus was used by the different bus agents.

Interrupt latency

Interrupt latencies are evaluated in detail by measuring:

- average interrupt latency; individually for INT A, B, C, D.
- overall interrupt latency; calculates the interrupt latency as a weighted average of INT A, B, C and D.

An interrupt latency histogram shows the distribution of the individual interrupts over clock cycles.

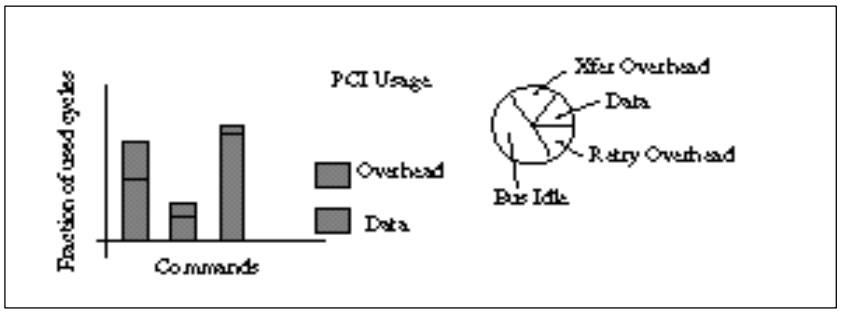

Figure 3. PCI Usage Chart of Selected Master/Target

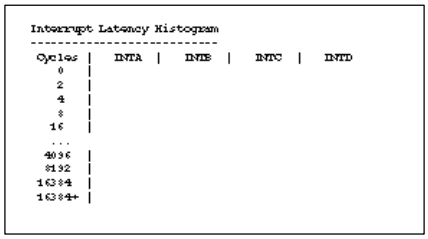

Figure 4. Interrupt Latency Histogram

Master/Target Performance

Post-processing allows the analysis of customer-selected master/target combinations so that specific master/target performance behavior can be analyzed in depth. By evaluating the critical agents using the real-time measurements and basic bus statistics, the in-depth master/target analysis provides an "inside view" of how to optimize single agents.

Master/target bus usage

The bus usage measurements show:

- master was waiting for GNT# but bus was idle.
- master was waiting for GNT# but bus was busy.
- bus occupation by selected master/target, split into retry overhead, transfer overhead and data phases.
- data phase statistics, showing the distribution of byte enable 1, 2, 3, or 4.
- average byte enable efficiency.
- average decode speed.

Wait cycle histogram

A wait cycle histogram shows wait cycles caused by the master and target, and this can help identify performance issues.

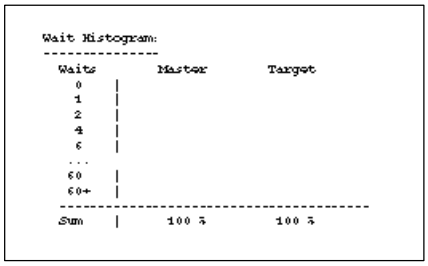

Figure 5. Wait Cycle Histogram

Command usage chart

The command usage chart lists the usage of different PCI commands so that performance issues caused by inefficient command usage are revealed.

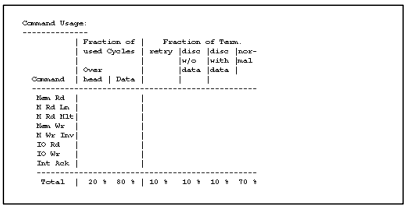

Figure 6. Command Usage Chart

Burst length distribution

As well as displaying the average overall burst length, this histogram also shows the distribution of burst length over PCI commands. Again, this provides an "inside view" into performance bottlenecks in PCI systems.

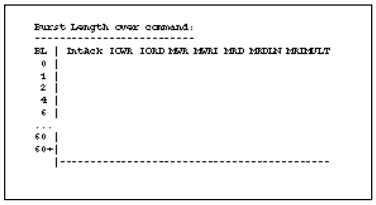

Figure 7. Burst Length Histogram

Master/target efficiency

A further important indication for PCI system performance is how efficiently a certain master/target pair uses the occupied bus time. Thus, the HP E2972A examines:

- master/target overall efficiency of transferred data,
- non-retry efficiency,
- efficiency over burst length.

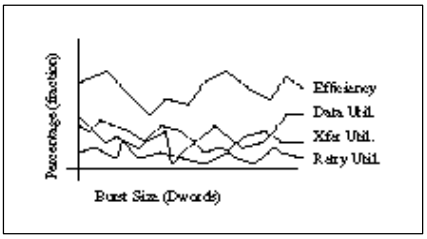

Figure 8. Efficiency Over Burst Length

Termination statistics

The PCI termination statistics indicate:

- average number of retries needed,
- termination by arbiter in favor of other bus agents,
- termination over burst length.

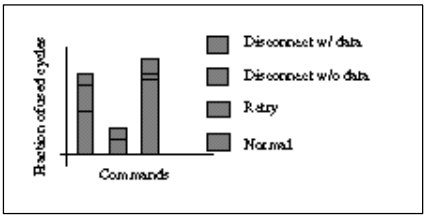

Figure 9. PCI Termination Chart

Latency distribution

This histogram shows the following (over clock cycles):

- first word latency,
- average latency,
- arbiter latency,
- bus access latency,
- first word retry.

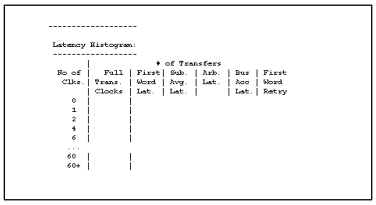

Figure 10. Latency Histogram

Report And Result ASCII File

All results are available as an ASCII report file for further analysis and customer post-processing.

Measurement And Resource Requirements

The HP E2972A Performance Analyzer requires the HP E2925A PCI Exerciser and Analyzer with deep trace memory and performance option 100 in order to acquire up to a 1 M sample for post-processing.

The GNT# and REQ# lines of the PCI bus must be connected to the HP E2925A option 100 trigger input lines so that the PCI bus master is recognizable for measurements, GNT#, and for latency measurements. The target is identified by the user-specified target decode address.

To operate the HP E2972A from an external host, the fast host interface HP E2925A option 002 is recommended.

System Requirements

To use the HP E2972A PCI Performance Analyzer, a PC with the following specifications is required.

PC: IBM-PC or 100 % compatible with recommended minimum 90 MHz Pentium CPU and CD-ROM drive.

Graphics: 800 x 600 required, recommended 1024 x 768 SVGA.

O/S: Windows 95 or Windows/NT rev. 3.51.

Memory: 16 MB minimum, 24 MB recommended (for complete HP E2920 series).

Hard disk: minimum 50 MB available disk space required, 100 MB recommended (for complete HP E2920 series).

Interfaces: for the HP E2972A, it is recommended that you use either the fast host interface HP E2925A option 002 of the PCI Exerciser and Analyzer Card, or that you access the card via PCI. Alternatively, an RS232 port can be used. A parallel port is required for the software ID module, supplied with the HP E2925A, to enable the software license.

Expansion slots: for the fast host interface HP E2925A option 002 of the PCI Exerciser and Analyzer Card, one ISA slot is required to host the bi-directional Centronics card.

Ordering Information

The HP E2972A includes:

- license to use the PCI Analyzer GUI software with a single PCI exerciser and analyzer card.
- software media (CD-ROM).

Note that if you want to simultaneously analyze more than one HP E2925A card using a single PC, you require the appropriate number of HP E2970A GUIs running on that PC, as well as sufficient fast host interface options (or RS232 ports) to connect to each card (unless you are connecting via PCI).

The HP E2972A requires:

- HP E2925A PCI Exerciser and Analyzer,
- HP E2925A option 100 1 M deep trace memory/performance board,
- HP E2925A option 002 fast host interface (recommended).

Related HP Literature

- HP E2925A 32 bit, 33 MHz PCI Exerciser and Analyzer, technical specifications, p/n 5965-4724E.
- HP E2970A PCI Analyzer Graphical User Interface for Windows 95/NT, p/n 5965-4726E.
- HP E2971A PCI Exerciser Graphical User Interface for Windows 95/NT, technical specifications, p/n 5965-4725E.
- HP E2974A Sub-System Tests, technical specifications, p/n 5965-8009E.

For more information:
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