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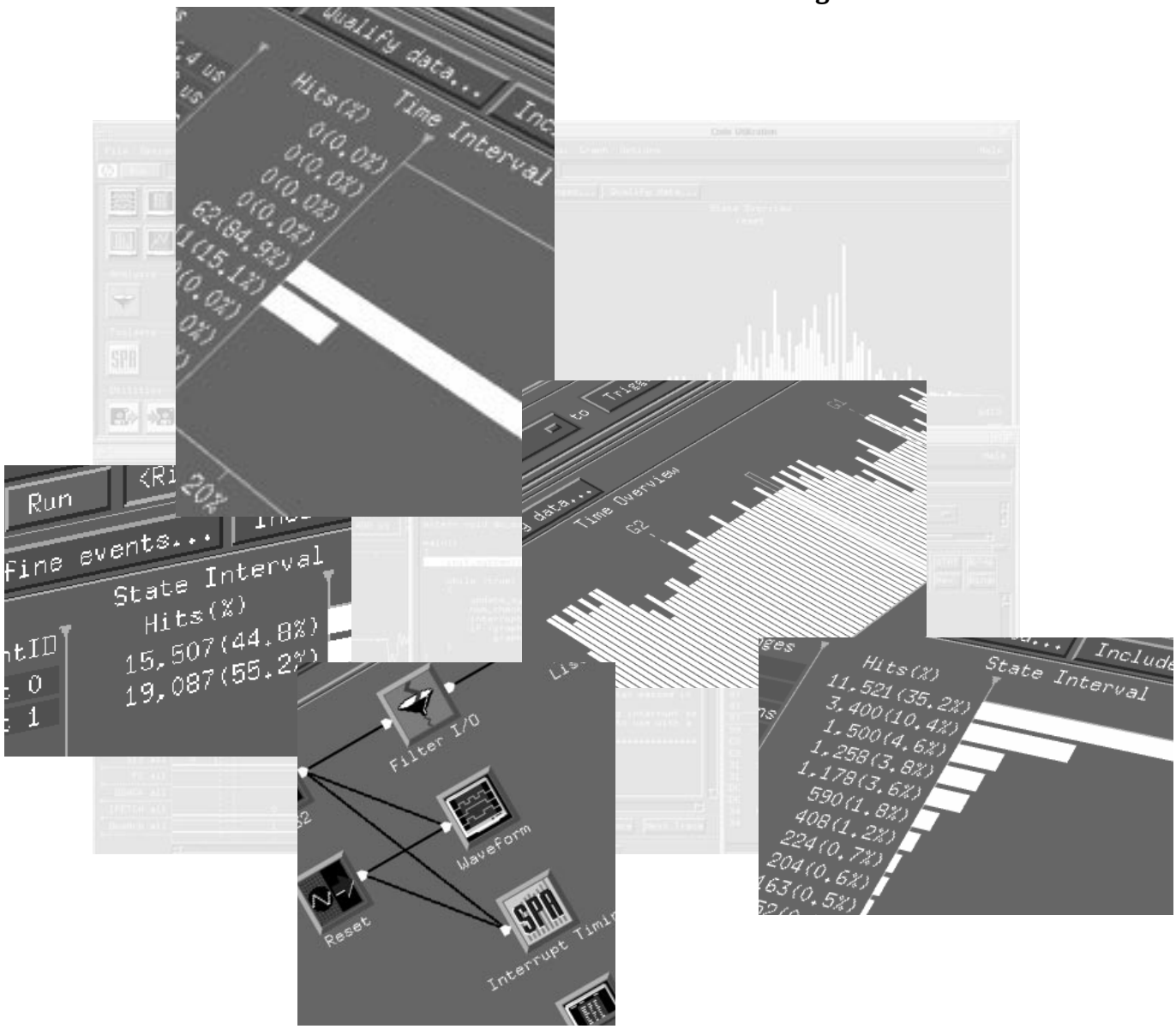
The HP B4600A System Performance Analysis Tool Set

For the HP 16505A Prototype Analyzer

System Performance Analysis for the Entire Design Team



Meet Your Time to Market and Price/Performance Goals

The success of your digital system depends upon three factors—functionality, time-to-market and the price/performance ratio. To meet your market window, you must spend your time on the most important performance problems, especially as your product nears release. To isolate and fix those problems, you need to evaluate the entire system—both hardware and software.

An optimized digital system requires a balance of hardware and software performance. A system with the fastest microprocessor will be inefficient if the system bus performance is low. Software that does not fully use the potential of the hardware will significantly reduce the system's price/performance ratio.

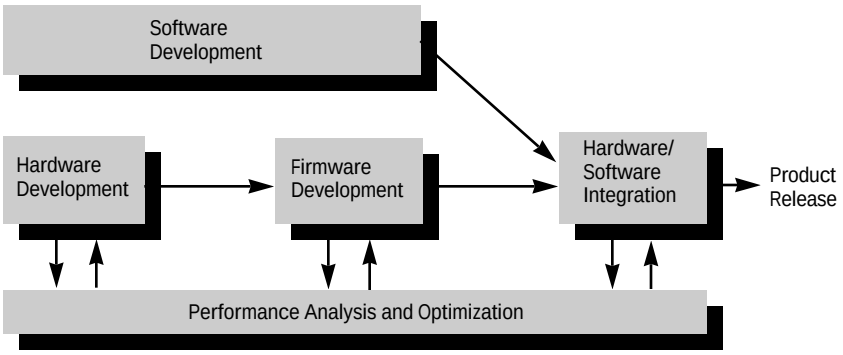


Figure 1. Shortening a product's time-to-market requires evaluating both hardware and software during each phase of development.

Profile Your System's Performance—From Signals to High-Level Source Code (Such as C, ADA, etc.)

The HP B4600A system performance analysis (SPA) tool set for the HP 16505A prototype analyzer is designed to profile the entire system at all levels of abstraction—from signals to high-level source code—to clearly identify and optimize the components that affect the global behavior of your system.

The HP B4600A SPA tool set can be used during the entire prototyping phase of product design because it is based on the same HP 16500B measurement tools you already use. Adding SPA is as simple as dragging and dropping an icon. In addition to performance analysis, it can be used at any time to test and document characteristics such as memory coverage and response time.

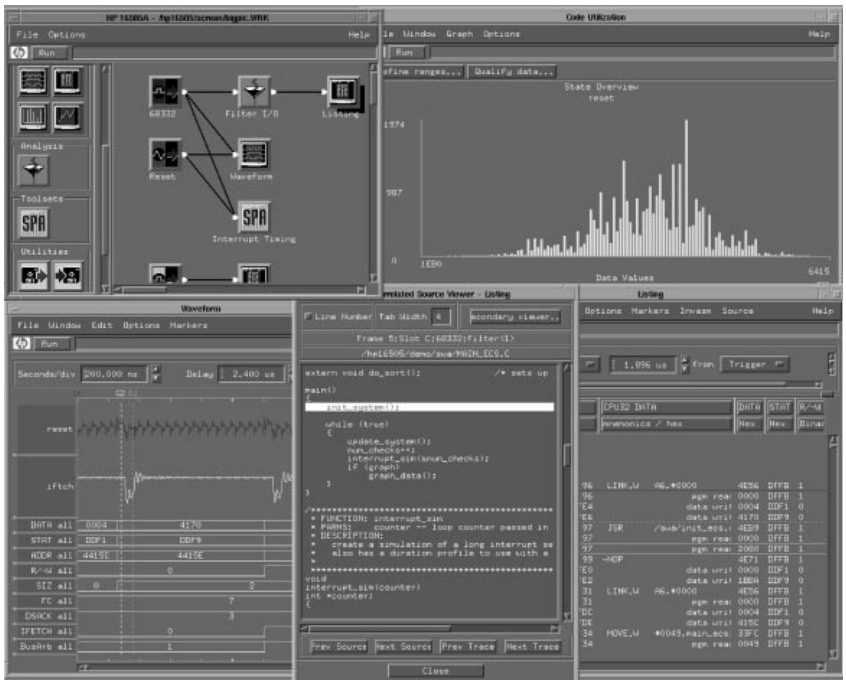


Figure 2.
You can simultaneously display multiple views of your prototype system with the HP 16505A prototype analyzer.

A Tool for the Entire Design Team

Each member of a digital design team has unique performance-measurement needs. All of these measurements are made on the same target system. Communication problems may arise when team members attempt to compare results obtained from different analysis tools. That's why the HP B4600A offers a variety of statistical views of the same real-time data.

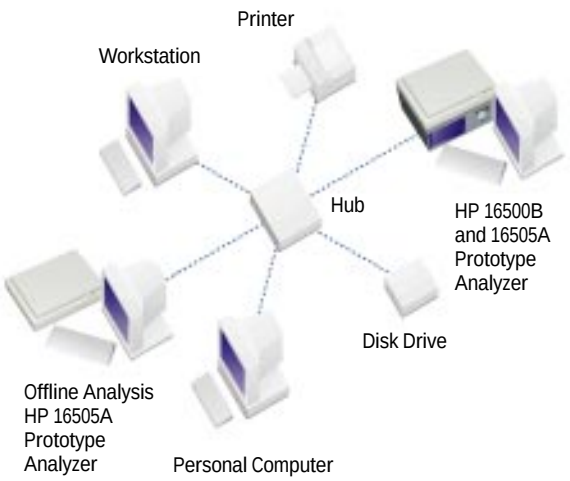


Figure 3. Networked measurement tools enable design team members to view data from the same target system.

Product Description

The HP B4600A SPA tool set is an optional software package for the HP 16505A prototype analyzer. The SPA tool set uses the full power of the HP 16505A and HP 16500B logic analysis system. All measurement modules supported by the HP 16505A can serve as data sources for the HP B4600A without modification.

The HP B4600A SPA tool set generates statistical representations of data captured by the measurement modules.

You can quickly converge on accurate measurements by using sample depths of up to 2 Mb/channel in a single trace, combined with accumulate mode. Combine deep trace analysis with powerful real-time triggering, storage qualification and post-process data filtering to focus on exactly the view you need.

You can analyze the performance of your entire system by simultaneously viewing multiple SPA windows. Each SPA window includes filtering capabilities that enable you to concentrate on a specific event.

Remotely access the SPA tool set from workstations, X-Terminals or PCs running X11 emulation software. Or use an SVGA monitor to locally control and view the measurements at your lab bench. Use your design tools via the standard network capabilities of the HP 16505A prototype analyzer such as FTP, NFS, Telnet and X-Windows client/server.

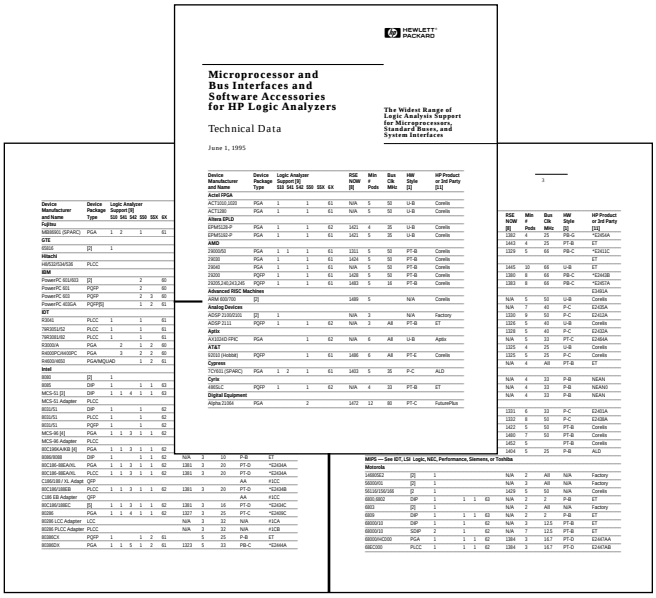
The HP B4600A SPA tool set software and documentation are pre-installed and locked in the HP 16505A. By placing an order for the HP B4600A, you can obtain a password that allows you to immediately use the HP B4600A. A free 21-day trial period lets you evaluate SPA or any tool set as your work schedule permits. To enable this demo period, start the HP 16505A prototype analyzer, then click on the License Management button in the Session Manager window. Type "demo" in the HP B4600A password field and select "Verify Passwords."

Figure 4. The HP B4600A SPA tool set uses the full power of the HP 16505A prototype analyzer and the HP 16500B logic analysis system.

Processor Support

HP offers a large selection of non-intrusive preprocessors that provide reliable, fast and convenient connections to over 200 microprocessors, microcontrollers and buses. See *Microprocessor and Bus Interfaces and Software Accessories for HP Logic Analyzers* technical data sheet (pub. no. 5963-2435E) for more information.

HP B4600A SPA tool set measurements do not require any change in your software generation process. No modification or recompilation of your source code is required.



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Microprocessor and Bus Interfaces and Software Accessories for HP Logic Analyzers

Technical Data

June 1, 1995

The Widest Range of Logic Analysis Support for Microprocessors, Standard Buses, and System Interfaces

Figure 5. Information about current microprocessor and bus interface connections is available through your local HP sales office.

A Complete Environment for Digital Measurements

Performance measurements and software debugging tools are tightly coupled in the HP B4600A. All HP B4600A SPA tool set measurements can be made in conjunction with other prototype analyzer tools, including:

- Source-referenced trace listings using the HP B4620A software analyzer
- Inverse-assembly listings
- Processor run control
- Bus analysis
- Timing analysis
- Analog measurements

The modular nature of the HP 16500B/16505A allows multiple, simultaneous measurements of many parts of your system, including multiple processors and buses.

Figure 6. Easily connect to your target system with an HP preprocessor for your specific microprocessor or bus.

HP B4600A SPA Windows for Software Measurements

The HP B4600A SPA tool set provides non-intrusive measurements of embedded code execution with full symbolic capabilities. Use the SPA tool set to analyze single or multiple-processor systems based on CISC, RISC or DSP architectures.

The HP B4600A SPA tool set provides answers to the following questions :

Performance
- What functions are most often executed by the processor?
- What functions are never executed?
- What is the relative workload of each processor in a multiple-processor system?

Responsiveness
- What is the minimum, maximum, and average execution time of a function (including calls)?
- How many interrupts does the system receive per consecutive time slice?
- What is the response time of my system to an external event?

Coverage
- Do my test suites provide thorough coverage of my application?
- Is this function or variable accessed by the application?

Debug
- Does this pointer address the right memory buffer?
- How does the system react when it receives too many simultaneous interrupts?

System Parameters
- Is the stack size adequate?
- Is the cache size adequate?

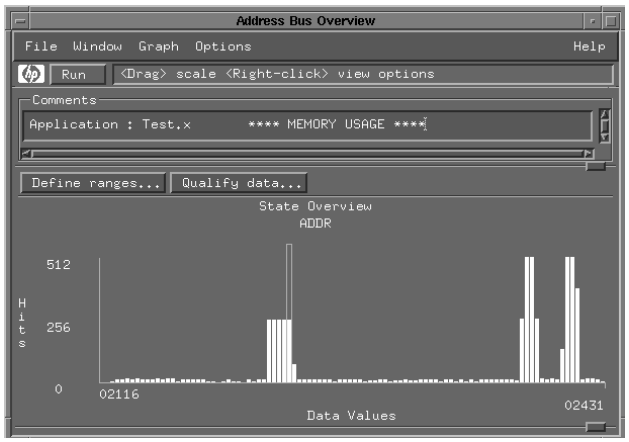

Figure 7. State Overview

Use the State Overview Tool to Isolate Defects Fast

The State Overview tool (figure 7) interprets the trace data and displays the number of accesses for each memory location. Use this tool as the first step of the analysis or optimization process.

You can easily pinpoint regions of high memory activity. This provides the raw information you need to determine which routines or operations are responsible for throughput bottlenecks.

Because this tool can detect whether memory locations are accessed, it will allow you to measure memory coverage or stack usage. You will also be able to quickly detect which peripherals are most frequently used.

The State Overview interface, combined with the HP 16505A prototype analyzer's filtering tools, helps you isolate defects, such as invalid pointers.

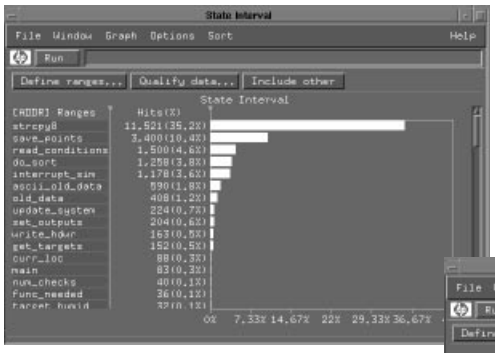

Figure 8.
State Interval

Monitor CPU Work Load with the State Interval Tool

The State Interval tool (figure 8) rapidly profiles functions that are using the most CPU cycles. There is no limit to the number of function names that can be viewed simultaneously. The profile helps you prioritize functions that are candidates for duration measurements using the Time Interval tool (see figure 9).

A symbol-navigation utility enables you to quickly select function or variable names from very large symbol files that are created by complex software projects. Your selections automatically configure the State Interval tool. You can sort and display symbols by function, by variable, or both. To help simplify your display, you can delete all functions below a selected point with a single mouse click.

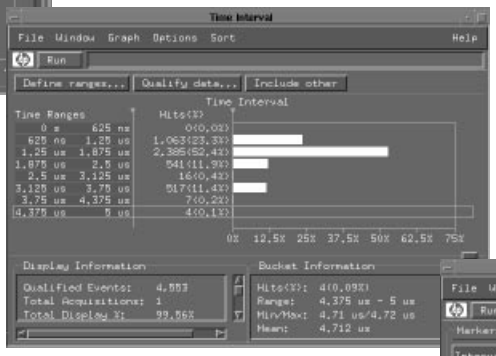

Figure 9.
Time Interval

Optimize Execution Times with the Time Interval Tool

The Time Interval tool (figure 9) displays a distribution of the execution time of functions or of the time between two user-defined events. The results help you determine the best and worst execution scenarios so you can decide if optimization is needed.

Because time interval measurements often depend upon hardware-software interaction, the event definition can be a combination of symbolics and hardware events. Triggering and data qualification can be used to define the specific hardware context in which the measurement will be made.

Data is displayed as histograms, which may be exported to your host computer either as histograms or as tabular-formatted text files.

Figure 10.
Time Overview

Understand How Interrupts Affect Your System with the Time Overview Tool

Elusive system crashes are often caused by too many interrupts occurring over a short period of time. If the software cannot handle all simultaneous service requests, the system may exhibit random defects — while leaving no clues as to their cause. In this situation, you need a tool that can measure and display interrupt loading.

The Time Overview tool (figure 10) provides the means to measure the occurrence rate of any event, including interrupts, over time. This helps you visualize your system's loading as you vary test conditions. You can define both the event and the time period in which the events are counted.

HP B4600A SPA Windows for Hardware Measurements

The HP B4600A SPA tool set provides analysis and characterization of hardware components ranging from individual analog signals through complex system buses.

The HP B4600A SPA tool set helps you answer questions like these:

Analog and Timing Measurements
- What is the setup/hold time of this signal or group of signals?
- Is the distribution of voltages of this analog signal acceptable?
- Is this signal spending too much time in the switching region?

Bus Measurements
- What bus states occur most often?
- What is the bus loading?
- How does the bus affect overall system performance?
- How much time is spent in bus arbitration?
- What is the histogram of bus transfer times?

Processor/Cache Measurements
- Which processor bus states occur most often?
- Which peripherals are used most often?
- What is the profile of processor load sharing in a multiple-processor system?
- How does the cache size affect system performance?

Bus Stability Analysis

You are often required to measure the correlation between a signal (such as a strobe or an edge) and the presence of valid, stable information on a bus (or a label with one or more channels).

The HP B4600A SPA tool set recognizes stable or unstable events (figure 11). The stability of a bus is defined by two or more consecutive acquisitions of the same data value on this bus, independent of its data value. For example, if you analyze a microprocessor's access to a RAM, you want to be sure that the data is stable when it is strobed. In this context, the HP B4600A helps you to characterize areas of stability or instability for this bus.

This powerful feature allows you to define new search criteria:
- Enter or exit an unstable bus condition
- Enter or exit a stable bus condition
- Focus on each bus transition
- Search the stability (or instability) condition coupled with time constraints (i.e., stability within a defined time range or outside of a defined time range).

All search criteria, stability, transition, value, and value ranges can be used everywhere in the SPA environment.

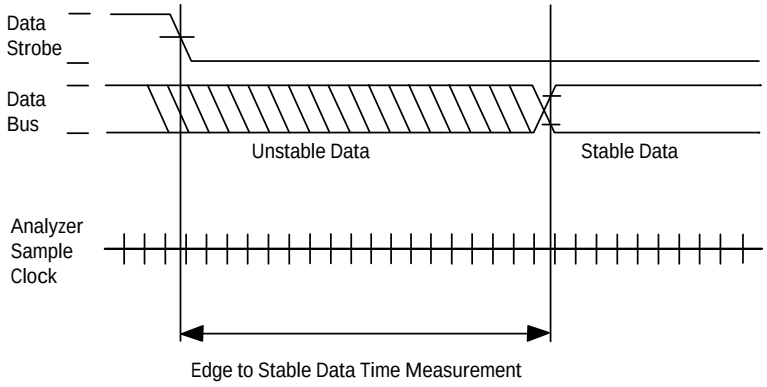

Figure 11. Data bus stability is defined by consecutive samples of the same data value.

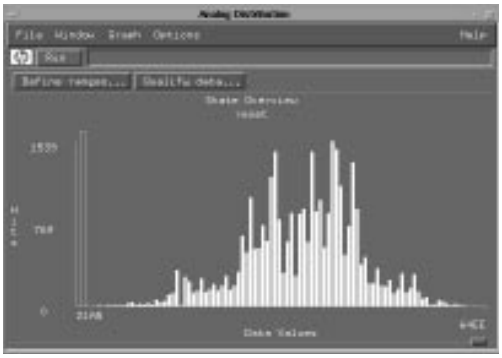

Figure 12.
State Overview

See Which Events Occur Most Frequently Using the State Overview Tool

The State Overview tool (figure 12) helps you quickly identify the most frequent events that occur during a measurement. It does this by counting and displaying each identical value recorded in the trace.

For bus analysis, the State Overview tool displays a distribution of hits for each possible bus state. The overview enables you to quickly determine which bus states occur most frequently.

If the trace is recorded with an oscilloscope, the State Overview tool displays a distribution of voltages for the signal. The shape of the distribution can tell you whether a digital signal is spending too much time in the switching region, or it can help you evaluate the linearity of the output of a digital-to-analog converter.

Determine which memory regions or I/O addresses are most frequently accessed when the State Overview tool is applied to a microprocessor's address, data or status buses. The State Overview tool's built-in qualification and zoom functions help you to narrow in on an area of interest.

Figure 13.
State Interval

Monitor Bus Activity with the State Interval Tool

The State Interval tool (figure 13) provides a histogram based on the occurrence level of events in a measurement. These events are defined as patterns or ranges associated with any set of data (labels) that are included in the trace. There is no limit to the number of events that can be simultaneously defined and displayed. The events can be sorted alphabetically or by number of hits.

Use this tool to show the share of the workload that each processor in a multiple-processor system carries, or to determine if the system is balanced. Bus measurements such as headroom analysis can be made by examining the ratio of active to idle status states.

Computer systems take advantage of cache memory to improve performance. The optimal system price/performance ratio depends on the size of the cache. The analysis of cache hits and misses can be made using the State Interval tool and definitions for the states corresponding to each.

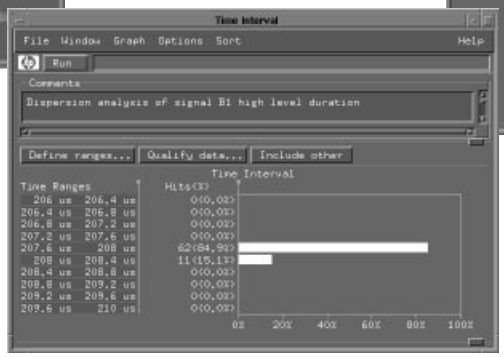

Figure 14.
Time Interval

Verify Signal Timing Specifications Using the Time Interval Tool

The Time Interval tool (figure 14) measures the distribution of time between two user-defined events. The tool can be used to measure setup and hold times, the jitter between two edges or the variation between two bus states.

Use Accumulate Mode to analyze the behavior of your system over a long period of time. Statistics such as the maximum time, minimum time, standard deviation and mean help you to document system behavior.

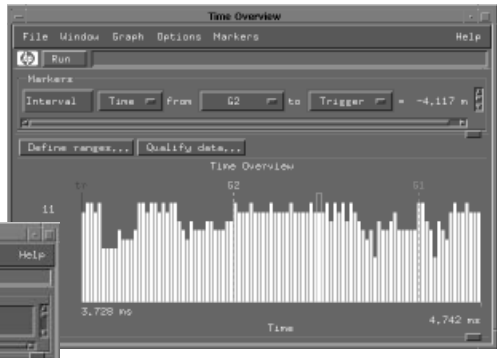

Figure 15.
Time Overview

Analyze Signal Stability with the Time Overview Tool

Use the Time Overview tool (figure 15) to view the variation of frequency of events. The Time Overview tool presents a record of the rate at which user-defined events occur over a period of time. You can define the width of the time buckets and number of time buckets based on the frequency of events you expect.

For example, embedded systems manage the flow of data to and from physical sensors. Problems can occur if the system does not frequently acquire data from the sensor. By defining an event that corresponds to the sensor's address space, you will get an image of the flow of data between the sensor and the processor.

Product Characteristics

Data Sources

All measurement modules (state and timing analyzers and oscilloscopes) supported by the HP 16505A serve as data sources for the HP B4600A without modification. The particular measurement module used determines time resolution and accuracy. Sample rate, channel count, memory depth and triggering can all be controlled by the user independent of the HP B4600A SPA tool set.

Performance Measurement Characteristics

SPA Tools	State Interval Display	Time Interval Display	Time Overview Display	State Overview Display
Maximum Number of Events	No theoretical limit Up to 10,000 events tested with a standard HP 16505A configuration		Number of events limited by the size of the window	
Supplemental Information	Number of hits	Minimum time Maximum time Average time Standard deviation	Number of hits Time bucket width	Number of hits State bucket width
Display Modes	Sort by number of hits Sort by event name	Sort by time Sort by event name	Autoscale Zoom	
Accumulate Mode	No theoretical limit to the number of acquisitions in Accumulate Mode. Any modification of the display will cause the display to revert back to the last data acquisition.			

Off-line Analysis and Post-processing

All measurements can be saved using the HP 16505A File Out tool. Data can be recalled at any time for later analysis using any SPA or other tool. Performance measurements can be exported to your host computer as histograms or as tabular-formatted text files.

Object File Format Compatibility

Most compiler file formats are supported. For the most current information, please contact your HP sales engineer.

- HP/MRI IEEE695, Intel OMF86, Intel OMF286, Intel OMF386 (which supports the Intel80486 and Pentium® Language Systems), ELF/DWARF (V1.10), Ti_COFF.

- If your language system does not generate output in one of the listed formats, a generic ASCII file format is also supported.

Ordering Information

Required System Components

- HP 16505A prototype analyzer with system code version R1.20 (or greater)
- HP 16500B logic analysis system mainframe
- Any 16500-series measurement module supported in the HP 16505A environment

Processor Support

Any preprocessor listed in the technical data sheet *Microprocessor and Bus Interfaces for HP Logic Analyzers* (pub. no. 5963-2435E.)

Ordering and Shipment

When the HP B4600A tool set is ordered simultaneously with the HP 16505A, the HP B4600A is shipped installed and ready to run.

HP Model Number	Description
HP B4600A	System Performance Analysis (SPA) Software Proof-of-receipt is provided by the SW Entitlement Certificate.
Option 0D4	Do not install tool set on an HP 16505A (Instructs factory to ship tool set separately from any HP 16505A systems on the order)

HP B4600A System Performance Analysis Tool Set Licensing Information

License Policy

The HP 16505A prototype analyzer tool set software is licensed for single-unit use only. Licenses are valid for the life of the tool set. Software updates do not affect the license.

Nodelock Mode

Tool set licenses are shipped or first installed in nodelock mode. Nodelock mode allows use of the tool set license only on the node (HP 16505A prototype analyzer) on which it is installed. Tool sets ordered with an HP 16505A prototype analyzer will be installed with a permanent password and are ready to run. For tool sets purchased as upgrades to existing prototype analyzers, you must contact the HP Password Center via e-mail, fax or phone to obtain a password. Password turn-around time is generally the next business day.

Temporary Licenses

A single temporary license is available for any tool set type not previously licensed on a node. The temporary license is valid for 21 calendar days from first entry of the password in the License Management window. The temporary password for any node on any tool set is “demo”.

License Management

Licenses are managed from the License Management window under the Session Manager. License management does not require Unix® expertise. Licenses are reserved at the start of a measurement session. They remain in use until the measurement session is terminated.

Password Backup

Passwords can be backed up to a floppy disk or network file.

For more information on Hewlett-Packard Test & Measurement products, applications or services please call your local Hewlett-Packard sales offices. A current listing is available via Web through Access HP at http://www.hp.com. If you do not have access to the internet, please contact one of the HP centers listed below and they will direct you to your nearest HP representative.

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