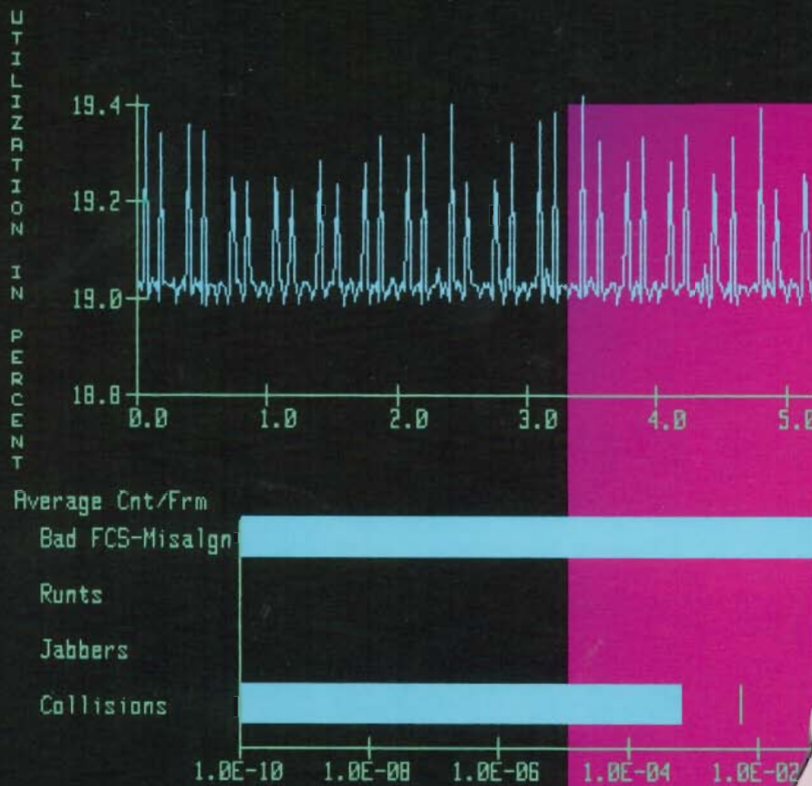


**Protocol and network  
performance analysis  
for Ethernet local area  
networks.**



**HP 4972A  
LAN protocol analyzer**

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*Solve networking  
problems faster with the  
HP 4972A.*



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## Protocol analysis

The use of local area networking is exploding as the many advantages of networked applications are realized.

With the large number of specialized vendors supplying these applications, a great number of protocols, algorithms and implementations interact to provide networked services. The potential for conflicts and incompatibilities is unavoidable in this complex environment, and problem resolution is often time-consuming.

The success of your business depends on reliable and efficient communication networks. Not only is it critical that network operability be maintained, but users also demand good response times from networked applications. In cost-sensitive organizations, systems must be configured for maximum utilization and interoperability, and routing problems and other throughput bottlenecks must be avoided.

A wide variety of tools is available to local area network managers. Third party network management systems provide valuable information on network topology and operability. Host-resident system diagnostics help solve some problems in the single-vendor environment.

Protocol analysis tools are needed for troubleshooting problems and resolving inefficiencies on large, multiple-vendor local area networks.

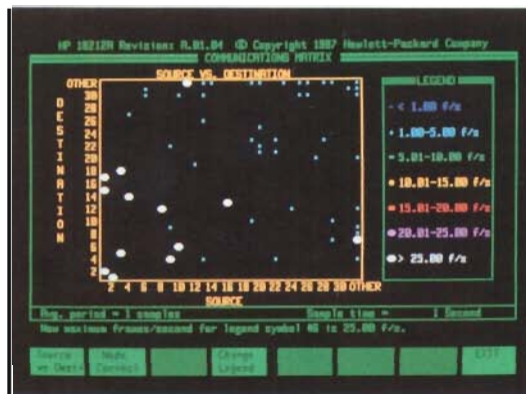
The HP 4972A resolves problems quickly, and provides fundamental information to

optimize networked systems and devices. The many powerful features of the HP 4972A may be used to:

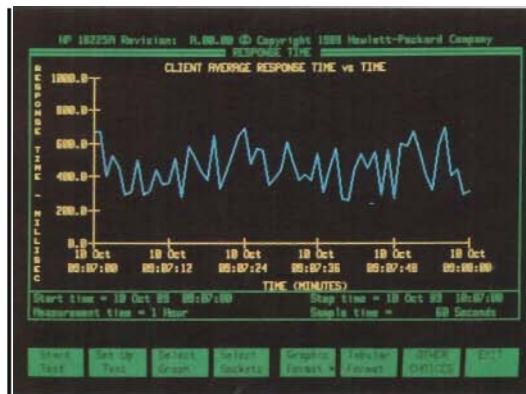
- quickly isolate causes of specific problems, and verify their solutions
- identify addressing problems and system incompatibilities
- analyze system behavior and performance
- characterize the usage and efficiency of network systems and devices
- fully test network products prior to installation on the network.

Complex problems, involving many different protocols and operations, are resolved quickly with the broad range of functionality provided on the HP 4972A. Features of the analyzer include:

- comprehensive performance analysis (statistical) measurements
- protocol interpreters for protocols most common on Ethernet networks
- simultaneous transmit and receive capability
- flexibility for programming custom tests.



Graphic representation of network behavior helps uncover problems and inefficiencies. This matrix illustrates the flow of network traffic.

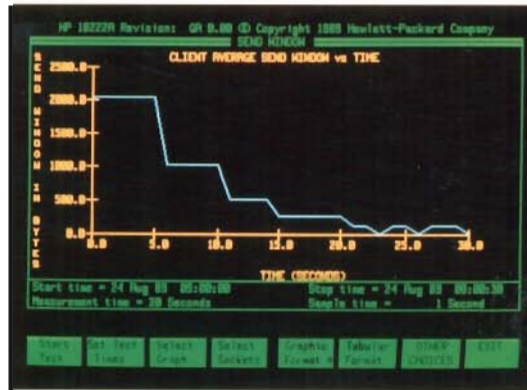


Response time measurements instantly yield clues that expedite problem isolation and suggest network improvements.

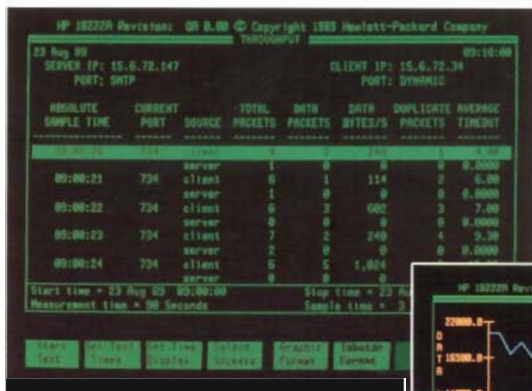


## Managing TCP/IP and DECnet networks

Network performance analysis measurements on the HP 4972A for TCP/IP and DECnet make the underlying working of your network readily apparent. Optimizing system configuration for maximum efficiency of networked applications, recognizing marginal operating conditions, and evaluating network products are all easily accomplished when these tools are employed.

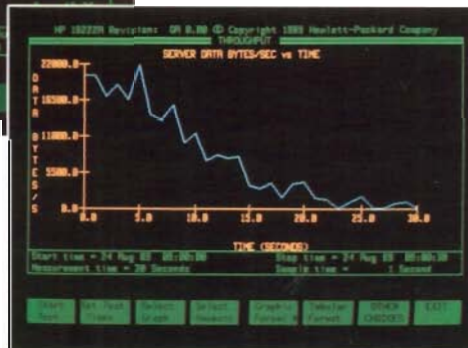


Graphic depiction of send window values provides an instantaneous view of the dynamically variable flow control behavior between TCP/IP-based systems.



True end-to-end throughput measurements—encompassing all factors, including retransmissions and delays—are available in both graphic and tabular formats.

Understanding the behavior of networked applications is facilitated by the HP 4972A's performance analysis measurements. Specific conversations are isolated and the frames are analyzed for connection statistics on end-to-end parameters. This forms the basis for intelligent decisions that will maximize network resources, as well as the productivity of its users.



Stimulus-response and custom tests provide unmatched flexibility and powerful capability through the softkey-driven programming menu on the HP 4972A. A test library, including many programs for solving common networking problems, is included to get you started.

```

Block 1: ***Send_Request_to_each_node_in_list_and_check_for_responses***
Start timer Duration
and then
Send message Req_Sys_ID_Req to next node; if all sent go to block 5
and then
When frame matches Request_Sys_ID then go to block 2

Block 2: ***Look_for_nodes_response_time_out_in_5_seconds***
and then
Start timer ID_Resp
and then
When frame matches Response_Sys_ID
and current node address then go to block 3
else when timer ID_Resp exceeds 5 seconds then go to block 4

Block 3: ***Response_received--record_in_Node_List
Increment counter #Pos_Res
and then
Stop timer ID_Resp
Editing Req_Sys_ID
    
```

This program from the utility disk identifies active stations on DECnet networks.

```

#? Elapsed 00:04:15.25 Len 60 Filters 1XW... No error
Elbers Dat AB-00-00-02-00-00 Src AB-00-04-00-04-70 Type DECMOP_REM_CONS
MOPRC Message Type System ID Reserved 00 Receipt Number 0
# Other Info #
# Info Type Maintenance Version Info Length 3
# Version 3 SCC Number 0
# User SCC Number 0
# Info Type Functions Info Length 2
# Loop Yes Dump No
# Primary Loader No Multi-Block Loader No
# Boot No Console Carrier No
# Data Link Copeters Yes Console Carrier Reservation No
# Bits 8-15 0
# Info Type Hardware Address Info Length 6
# Hardware Addr (0-04-2E-04-A0-09
# Info Type Communication twice Info Length 2
# Device Type DEQNA Q-bus CSMA/CD communication
# Info Type Data Link Info Length
# Data Link ethernet/802.3
# Info Type Software ID Info Length
# Software ID
# Form Standard Operating System
# Remaining Bytes in Entry
    
```

Balancing resources of devices and systems across a network minimizes equipment requirements and improves performance for all users. Network congestion, and resulting poor response times, may be alleviated by modifying network topology or configuring local servers.

HP 18222A Revision: 0A 0.00 © Copyright 1988 Hewlett-Packard Company  
IP ADDRESS LIST STATISTICS

23 Aug 89 09:38:43

Node #	Node Name or Address	Dir	Sample	Total	KByte	Avg	Last	Transmission
1	SPICE_SERVER	RCV	134	0,136	589	64	23 Aug 09:28:12	
2	SPICE_SERVER	XMT	134	0,136	667	64	23 Aug 09:28:12	
3	MRSTR_JEFF	RCV	534	32,639	5,116	161		
4	PC_BARDANA	XMT	0	0	0	0		
5	MRSTR_BILL	RCV	335	20,339	1,159	58		
6	MRSTR_BILL	XMT	281	12,284	489	41	23 Aug 09:28:12	
7	MKTG_SERVER2	RCV	0	0	0	0		
8	MKTG_SERVER2	XMT	281	12,283	810	68		
9	MKTG_SERVER2	RCV	134	0,136	589	64	23 Aug 09:28:12	

Start time = 23 Aug 89 09:27:11 Stop time = 23 Aug 89 09:28:12  
Measurement time = 61 Seconds Sample time = 1 Second  
Data collected for 9 nodes.

The busiest systems on the network are identified by these statistics on network layer addresses. Results may also be tabulated only on frames through a particular gateway or router.

Downtime is minimized when network inefficiencies are discovered promptly. The HP 4972A helps make less than optimal configurations and implementation anomalies apparent before the network is rendered useless and panic sets in.

HP 18225A Revision: 0A 0.00 © Copyright 1988 Hewlett-Packard Company  
DECNET DAP4/ASP MESSAGES

10 Oct 89 9:21:54

TOTAL DEC FRAMES = 2,864 TOTAL NonDEC FRAMES = 89

DAP4 Fms: 75.87 % MOP Fms: 6.71 % LAT Fms: 17.42 % OTHER DEC: 0 %

DAP4 MESSAGES: (% of DECNET Frames)		NSP MESSAGES: (% of DECNET Frames)	
NSP Short Format	1.27 %	Data Segment	9.71 %
NSP Long Format	12.68 %	Interrupt	0 %
Ethernet Router Hello	0 %	Link Service	0.80 %
Ethernet Endnode Hello	0 %	Data Acknowledgement	1.83 %
Level 1 Routing	47.33 %	Other Data Act	0 %
Level 2 Routing	14.67 %	Connect Act	0.65 %
		No Operation	0 %
		Connect Initiate	0.74 %
		Connect Confirm	0.72 %
		Disconnect Initiate	0.45 %
		Disconnect Confirm	0.49 %

Start time = 10 Oct 89 08:54:00 Stop time = 10 Oct 89 08:59:00  
Measurement time = 5 Minutes Sample time = 1 Second

This measurement from the DECNET network performance analysis application indicates a disproportionate number of routing messages, warranting further investigation.

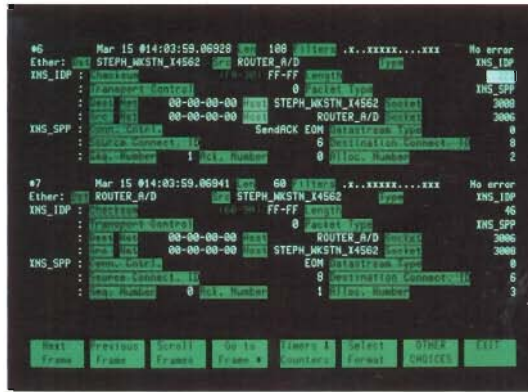


Optimize performance of a TCP/IP or DECNET network with powerful upper layer statistics.

## Solving problems and avoiding bottlenecks

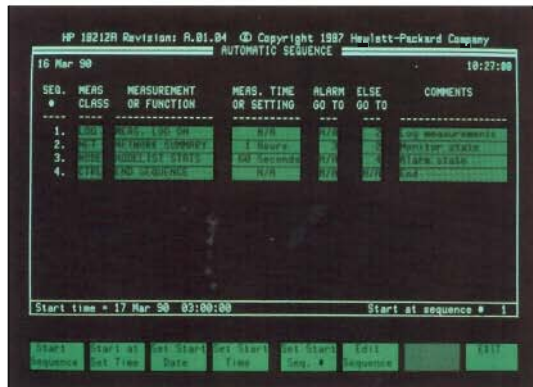
Protocol interpreter applications for the HP 4972A present protocol header information (contained in each frame) in an easily understood manner. In addition, the protocol interpreters expedite frame-by-frame troubleshooting by:

- highlighting incorrect and invalid header field values
- presenting information in common and easily recognized formats
- substituting logical names for numeric values of addresses and services.

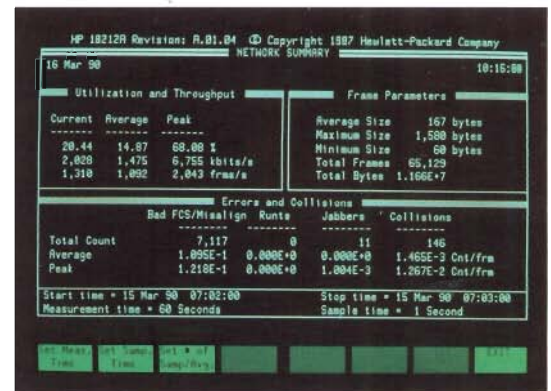


System incompatibilities are quickly spotted in frames decoded by the HP 4972A's protocol interpreters.

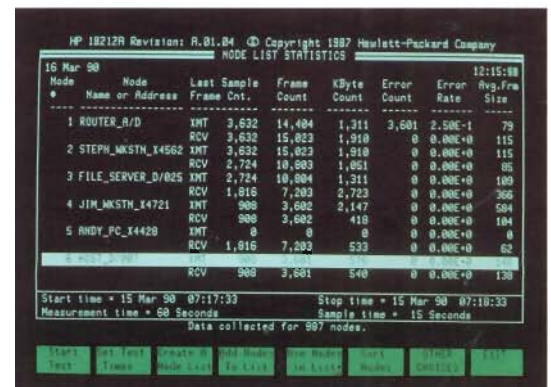
Network connectivity problems, that are often intermittent, are spotted instantly and effortlessly when autosequence tests are run on the HP 4972A. Alarms, set off when preset thresholds on utilization or errors are exceeded, may be used to trigger other statistical measurements to isolate the source of the problem.



This particular measurement sequence locates sources of unusually high error rates and identifies systems involved in broadcast storms.



The first measurement in the sequence, network summary, provides an overview of current network activity.



When an alarm is triggered, the node list statistics measurement records data that implicates the offending station.

Addressing problems are easily uprooted with the help of the name lists built into the HP 4972A and its applications. When logical names are assigned to numeric address values and then substituted into decoded frames, these problems surface quickly.



Comparing current network conditions to archived results helps spot problems and inefficiencies.

Node #	Node Name	Node Address	Bus Position	Response
1	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
2	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
3	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
4	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
5	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
6	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
7	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
8	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
9	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
10	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
11	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
12	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
13	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
14	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED
15	HOSTEN MVD	00-00-00-00-00-00-00-00	127	UNTESTED

```

#64 Jan 23 @ 0:06:20.90066 127 .x.....xxx No error
Ether: JOHN_VECTRA GOLIATH
IP : GOLIATH JOHN_14976 DDD_IP
TCP : S227 ACK PSN
Server ----- Client ( 73 bytes )
FTP : ISB Opening data connection for /bin/lx -l (15.6.72.55,1600) (0 bytes)

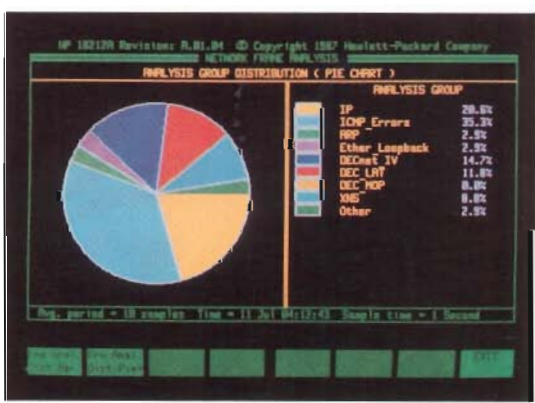
#65 Jan 23 @ 0:06:20.90222 60 .x.....xxx No error
Ether: JOHN_VECTRA GOLIATH
IP : GOLIATH JOHN_14976 DDD_IP
TCP : 1600 STN
Server ----- Client ( 0 bytes )

#66 Jan 23 @ 0:06:21.00280 60 .x.....xxx No error
Ether: GOLIATH JOHN_VECTRA
IP : JOHN_14976 GOLIATH DDD_IP
TCP : 1600 FTP_DATA
Client ----- Server ( 0 bytes )
  
```

Physical and network layer address lists provide a means for replacement of numeric values with logical names.

Poor response times and communication failures resulting from the improper configuration of networked systems are resolved faster with the HP 4972A and its applications.

Network performance degradations are made visible with the HP 4972A's analysis software, when network characteristics are profiled and then periodically monitored.



A large number of routing or error messages can be a warning sign for imminent problems.

```

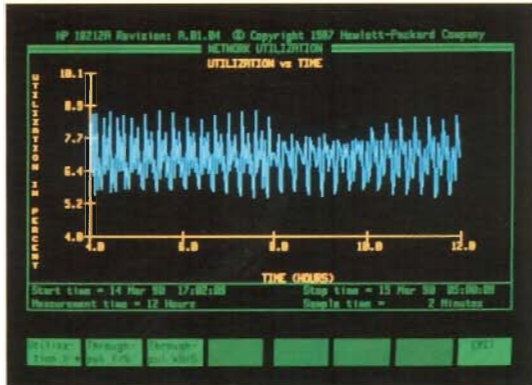
#7 May 2 @ 0:21:59.40219 138 .x.....xxx No error
Ether: CTD_GATEWAY_01 JEFF_14799_VECTRA
IP : 4 124 38761 May Frag Routine
TCP : 0 355 Last Frag
UDP : Good 75-2B JEFF_14799 UDP
RPC : SUN_NFS SUN_PC_NFS 104 60-90
: 131 REPLY ACCEPTED
: Authentication Verifier...
: SUCCESS 0
NFS : Attributes (Attr)...
: MFDIR 00000040755 21
: 185 20 2048
: 8190 113270
: 917504 34670
  
```

File attributes transferred by Sun Microsystems's NFS protocol may indicate a mismatch in the amount of data transferred and the block size of the stored file.



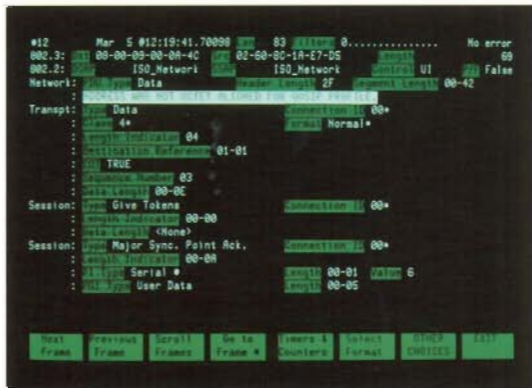
## Network planning and installation

Trend analysis for a variety of network parameters is easily accomplished with the HP 4972A. Its fully configurable statistical measurements enable observation of network behavior over long periods of time—emulating a virtually unlimited capture buffer.



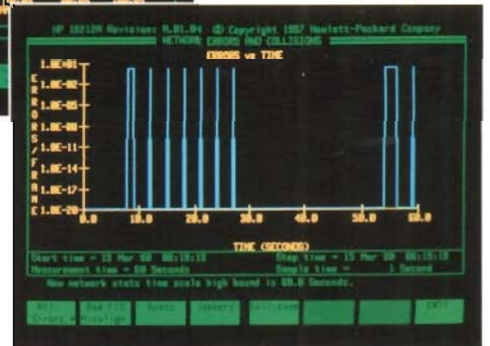
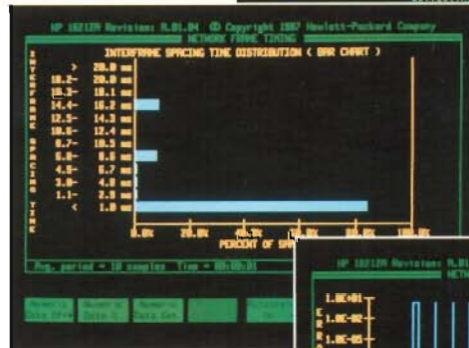
A twelve hour measurement of network bandwidth utilization suggests optimum times for system backups.

Interoperability problems are easily tackled with the protocol interpreters on the HP 4972A. Errors are highlighted, length fields from all layers are correlated and validated, commands are matched with responses, and data flow directions are indicated.



The ISO protocol interpreter also reassembles and resequences frames, and may be used to verify compliance with GOSIP or TOP profiles.

Rigorous testing of bridges and routers prior to installation can reduce network downtime and user frustration. Performance measurements on the HP 4972A allow you to monitor the performance of a device under simulated network conditions, quantifying its capabilities and limitations.



The background traffic generator may be used to stress test network devices while monitoring their performance.

Results you can count on distinguish productivity-enhancing tools from all others. From the HP 4972A's custom-designed data acquisition hardware, to the extensive quality assurance testing applied to all Hewlett-Packard test equipment, the HP 4972A is a LAN protocol analyzer like no other.



High-resolution display, full-sized keyboard and softkey-driven user interface make the HP 4972A very easy to use.

## Specifications

### HP 4972A LAN protocol analyzer

#### Operating characteristics

##### physical interfaces

- Ethernet/IEEE 802.3, 10 Mbps
- StarLAN (optional), 1 Mbps

##### capture buffer

- 1 Mbyte memory can store over 2000 frames

##### receiver performance

- data captured at more than 14,000 frames/second with full filtering capability
- 32 microsecond timestamp resolution

##### transmitter capabilities

- up to 16 user-definable messages
- variable preamble lengths and frame check sequences
- data received simultaneously

##### information storage

- pre- or post-filtered capture buffer contents, performance analysis (statistical) measurements, and test setups may be stored in electronic or hard copy form
- frame data may be logged directly to disk at 400 kbps, nominally

##### post processing

- stored frame data may be further tested and analyzed

##### filters and triggers

- capture conversations and/or protocol types
- up to 16 user-definable filters or triggers
- address, protocol field, data pattern, and error matching

##### timers and counters

- program controlled
- 16 event or loop counters
- 16 transaction or expiration timers

##### password restricted access

- independent passwords for viewing and transmitting data

##### automatic testing

- executes programs or measurements on power-up

##### LAN test library

- programs for active station testing
- filters for capturing specific message types
- various filters, programs and messages

##### coaxial cable test

- open or short conditions reported

##### tutorial

- self-paced training on analyzer capabilities

##### remote operation

- optional RS-232/V.24 interface
- HP 4972A or personal computer as the master unit

##### mass storage

- 20 Mbyte internal Winchester disk
- 600 Kbyte 3.5 in. floppy drive
- two additional drives supported via HP-IB

##### external displays

- high-resolution composite video output for

monochrome monitor

- optional high-resolution RGB video output for color monitor

##### compatible printers

- HP PaintJet, HP ThinkJet
- high-speed HP RuggedWriter, HP 293X series
- most ASCII printers

#### Physical specifications

##### weight (including cables)

- net 20.86 kg (46 lb)
- shipping 27.22 kg (60 lb)

##### dimensions (height x width x depth)

- 19.58\* x 42.55 x 56.52 cm
- (7.71\* x 16.75 x 22.25 in)

\* add 7.62 cm (3 in) to height for pouch

##### operating temperature

- 10 to 45 degrees C (50 to 113 degrees F)

##### storage temperature (without floppy disk)

- 20 to 60 degrees C (-4 to 140 degrees F)

##### power requirements

- 90 to 132 VAC, 180 to 264 VAC
- 47 to 63 Hz single phase

##### power consumption

- 200 watts typical

##### electromagnetic compatibility

- complies with VDE 0871/6.78 limit B
- licensed per FTZ 1046/84

#### Software applications

##### Network performance analysis applications

present condensed (statistical) information in both graphical and tabular formats. Measurement times are variable from 60 seconds to 999 days. Results may be saved electronically or in hard-copy form. The basic measurements available on these analysis packages follow.

##### Ethernet network performance analysis (included with HP 4972A)

###### network analysis

- utilization percentage, frames/second, or Kbytes/second
- errors and collisions
- interframe timing and frame length
- frame analysis by filters matched

###### node analysis

- transmit and receive stats for active stations
- transmit and receive stats for logical connections
- matrix of activity between stations

###### transmit statistics

- background traffic generator will transmit random or user-defined frames at specified utilization rate
- channel acquisition time
- station response time

###### automatic sequence

- programs statistical measurements
- trigger on thresholds exceeded (alarms)
- data logging to paper or disk

**TCP/IP network performance analysis (HP 18222A)**

- connection analysis
  - throughput rate and retransmissions
  - response time
  - packet and send window size
- system activity
  - frames and bytes to/from IP addresses
- network usage
  - IP frames and Kbytes
  - TCP port distribution

**DECnet network performance analysis (HP 18225A)**

- connection analysis
  - throughput rate and retransmissions
  - response time
  - frame size
- system activity
  - frames and bytes to/from DECnet addresses
- network usage
  - DECnet frames and Kbytes
  - distribution of message types

**Protocol interpreters** decode header information for the protocols listed. Name lists provide substitution of logical names in the display of decoded frames. Many interpreters may reside in system memory, allowing frames from multiple protocol suites to be examined simultaneously.

**TCP/IP protocol interpreter (HP 18221A)**

- protocol headers decoded
  - IP, ICMP, ARP, RARP
  - TCP, UDP
  - FTP, TELNET, SMTP
- errors highlighted
  - header checksums and invalid lengths
- logical name lists
  - IP addresses
  - TCP ports
- direction of data flow indicated
- commands matched with responses
- detailed, summary or hexadecimal displays
- test library
  - ARP stimulus/response test
  - ICMP Echo stimulus/response test
  - various filters, programs and messages

**DECnet protocol interpreter (HP 18224A)**

- protocol headers decoded
  - DRP, NSP, MOP
  - SCP, FOUND
  - DAP, CTERM, LAT
- errors highlighted
  - header checksums and invalid lengths
  - protocol violations
- logical name lists
  - DECnet addresses
- detailed, summary or hexadecimal displays
- test library

- DECnet System ID stimulus/response test
- various filters, programs and messages

**Sun-NFS protocol interpreter (HP 18228A)**

- protocol headers decoded
  - RPC, PMAP
  - YP, NFS
- errors highlighted
  - header checksums and invalid lengths
  - rejected frames
- procedure calls matched with replies
- detailed, summary or hexadecimal displays

**XNS protocol interpreter (HP 18223A)**

- protocol headers decoded
  - IDP, RIP, ERR, ECHO
  - SPP, PEP
- errors highlighted
  - header checksums and invalid lengths
- logical name lists
  - network, host and sockets
- detailed, summary or hexadecimal displays

**ISO protocol interpreter (HP 18226A)**

- protocol headers decoded
  - ES-IS, CLNP
  - TP0, TP1, TP2, TP3, TP4
  - Session
- errors highlighted
  - header checksums and invalid lengths
  - negotiated option violations
  - profile compliance (GOSIP, TOP)
- frames reassembled and resequenced
- detailed, summary or hexadecimal displays

**Ordering information**

HP 4972A LAN protocol analyzer  
includes Ethernet performance analysis and LAN test library

- Option 001—high resolution RGB color video outputs for 25 kHz external color monitor
- Option 002—remote RS-232 interface
- Option 003—Katakana (JIS-8, EBCDIK)
- Option 005—StarLAN (1 Mbps) network interface
- Option 908—rack mount

- HP 18221A TCP/IP protocol interpreter
- HP 18222A TCP/IP network performance analysis
- HP 18223A XNS protocol interpreter
- HP 18224A DECnet protocol interpreter
- HP 18225A DECnet network performance analysis
- HP 18226A ISO protocol interpreter
- HP 18228A NFS protocol interpreter

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