

SharkFest '16

The Ancient History of Computers and Network Sniffers*

**Or: Failure is always an option*

Len Shustek

Chairman, Computer History Museum



June 14, 2016

Why am I here?



Token Ring Sniffer[®]
first shipped September 1986

“sissy computers”



network them!

WHY
BE CONTROLLED BY A TIMESHARING SYSTEM
WHEN YOU CAN CONTROL A
CLUSTER/ONE?



Clustering is . . . several individual computers sharing a large program library, while preserving the individuality of each machine.

The CLUSTER/ONE™ Concept offers each BASIC user his own computer rather than a small share of one central processor.

Nestar Systems' CLUSTER/ONE creates a new dimension in low-cost computing,

combining the power and economy of individual micro-computers with the ability to store and share a million byte source program library on two full-size flexible diskettes.

To find out more about CLUSTER/ONE, call us at 415/327-0125. Or write to Nestar Systems, Inc., 430 Sherman Avenue, Palo Alto, California 94306.



1.2
megabytes!

PET, APPLE, TRS-80をワークステーションにTSS!

CLUSTER/ONE

パーソナルコンピュータ・ネットワーク・システム

- PET, APPLE, TRS-80などのパーソナルコンピュータをワークステーションに使用するためのローコストなシステム構築が可能。
- パーソナルコンピュータのBASICも利用したローカル処理、ネットワークシステムを利用したアータエントリ、リモートプロセッサシステム、ファイル転送、ハード制御機能などのネットワークシステム構築が容易。
- 専任担当が常駐して、ワークステーションによる会話型オペレーションで正確・迅速なデータ処理が確立できます。
- 個々のワークステーションでソフトウェアの開発・管理が行え、オンラインネットワーク制御機能によって統制のとれたシステムの実現・運用が可能。
- 最大1.2Mバイトの記憶容量を持つ高密度デュアルフロッピーディスクを登録、ワークステーションの台数により、目的・規模に応じたシステムが容易に実現。
- さらにウィンドウスターの18Mバイトのハードディスクを接続することにより大容量データベースシステムに容易に対応。



株式会社アスキー・マイクロソフト
〒100 東京都千代田区 6-4-11 1-1502
TEL (03)435-7351

Cluster/One: Timesharing has come to the microcomputer world

By Paul Voakes
Times Staff Writer

PALO ALTO — If things work out, Harry Saal could become a kind of social chairman for the personal computer industry.

Saal's new company, Nestar Systems Inc., has developed a system that can bring those microcomputers together to do things they could never do alone. Nestar makes a little white box that brings the concept of timesharing to the microcomputer world.

For Saal, the possibilities are endless. Bank customers could stop by for financial consultations with the computers; storefront computer centers could provide entertainment or computation services to the public; and each member of a school class could learn the same lesson on his or her personal computer at the same time.

Saal, 34, is a former university computer science instructor and software designer for IBM. The other three principals in the firm, Leonard Shustek, Nicholas Fortis and James Hinds, also are former employees of firms that manufacture large computers. They've decided to think small, Saal said, because of the growth they see in the microcomputer's future.

Market researchers estimate that the market, now about \$500 million strong, should grow to at least \$2.4 billion by 1982. Nestar expects to piggyback on, and accelerate, that growth with its new product, Cluster/One.

The hobbyists and whiz kids comprising the hard core of the microcomputer market have developed thousands of programs, for nearly every imaginable game and practical function, Saal explained.

Peninsula BUSINESS

PALO ALTO TIMES,
Thursday, Jan. 25, 1979—37

But the programs are kept on cassettes. When they're made available they cost between \$10 and \$50 each and it takes several minutes to load each from one computer to another. That tends to limit each microcomputer's "library" of information.

The Cluster/One, the little white box, contains two diskettes that hold about 630,000 bytes of data, which translates into about 200 different programs. Each of as many as 30 microcomputers in a room or building is connected, by hardwiring, to the Cluster/One. Each small computer user has only to call up a particular program from among the 200, and his or her own computer is loaded and ready to go in a couple of seconds.

Saal said the Cluster/One goes one step better than timesharing because each station, the microcomputer, is a self-contained computer that merely draws on the memory of the central unit. In large-system timesharing, if several stations want to use the central computer at the same time, the demands on the computer create long delays.

Each station can use a different program from the Cluster/One at the same time as well. For example, if 30 students at the 30 computers are learning at 30 different levels,

the system provides those 30 different programs at one time.

The Cluster/One also can mix apples and oranges, or, in the case of small computers, Apples and Pets and TRS-80s and any other microcomputer brand on the market.

Nestar's first market target is the school system, and Saal is undaunted by the post-Proposition 13 tightening of district budgets throughout the state. The Cluster/One system with four microcomputers sells for about \$10,000, "and that's \$90,000 cheaper than \$100,000," which is what Saal said a similar computer system would cost a school a few years ago. Once schools realize the computer's value as a teaching aid, Saal said, every school in the country, on elementary, secondary and college levels, will be using them.

"I believe the computer will insinuate itself into education in a way that is irreversible," he said. Several Peninsula schools already have a collection of microcomputers for student use, and Nestar has been busy showing those schools how the Cluster/One ties the computer together and increases their capacities.

Saal also said the microcomputer is being used in college chemistry classes, to simulate experiments that are either too dangerous or costly for each student to perform in the lab.

One problem with marketing to public school districts, he conceded, is the time between the staffs request and school board's approval to buy a system.

But the firm is exploring other avenues. It is negotiating to take part in a franchise network of



Times staff photo by Gene Tupper

Harry Saal checks one of the diskettes in Nestar's Cluster/One, while the microcomputers elsewhere in the corporate headquarters (Saal's garage) flash some of the Cluster's programs.

stores to help students prepare for standardized examinations like the Scholastic Aptitude Test or law school admissions tests. Each student would work on practice exams on the microcomputer, and the Cluster/One would contain dozens of training programs for the different exams.

"There are 1.5 million students each year who take the college

boards alone," said Saal. "And many of them get coaching. We'll be able to update the programs from year to year as the tests change their emphases, and each program will work on the weaknesses of the student."

Nestar is a start-up business in its "garage" stage, in the Hewlett-Packard tradition. The Nestar employees congregate in Saal's home,

and the Cluster/One and a gaggle of microcomputers are on line in the converted garage. Next month the firm plans to move into an office suite on Sherman Avenue, however.

So far, the company has been financed by the four principals, but Saal said they'll be looking for venture capital later this year as production demands increase.

Computers/Peripherals

Cluster/One Connects 30 Apples, PETs Or TRS-80s

PALO ALTO, CA — A new system, Cluster/One, from Nestar Systems (a new company here) allows the interconnection of up to 30 Apple II, Commodore PET or Radio Shack TRS-80 personal computers. It also brings large-capacity disc storage and high-quality printing to personal-computer networks.

Nestar's concept allows the sharing of expensive resources, but does not reduce the advantages of powerful, low-cost personal computer stations. Since all processing is at the users' terminals, the system is degraded very little as the number of users increases, whereas standard time-sharing systems can be greatly degraded as more users are added.

Cluster/One overcomes most of the disadvantages of personal computers as it provides a large, central program library, large mass storage usable by each station, a high-quality printer usable by each station and the flexibility afforded by such peripheral capabilities.

The Cluster/One system includes hardware (central unit, console and bus) and software. The central unit has a self-contained storage facility—two eight-inch Shugart flexible-disc drives that are soft sectored with 256 bytes per sector. Each disc side holds about 100 average-sized BASIC programs.

Housed with the drives are power supplies, expanded RAM for the console computer, a floppy-disc controller, a bus controller (ClusterBus) for transmitting and receiving information from the personal computer stations (drones), associated electronics and cooling.

Each personal computer requires special hardware and software—provided in the form of plug-in boards in the Apple and PET, and a small mini-box in the TRS-80—to communi-

cate with the console computer, the Queen. No modifications are made to the drones. Installation is by plugging in boards and/or connecting cables.

In the current Nestar system the Queen is a Commodore PET, which starts the system and monitors its operation. It also runs various utility programs, such as initializing new diskettes and making back-up copies.

The Queen is connected to the drones by a 26-wire flat ribbon cable that begins at the central unit, runs to the first station, from there to the second, and on to a maximum of fifteen units. From a second ClusterBus channel, a second string of 15 stations can be connected to the same Queen. The maximum cable length from the Queen to the farthest station is 250 feet.

Data move over the ClusterBus at 80,000 bits per second. Error-checking facilities are in the Queen and drone software which, in most cases, detects errors automatically and then retransmits the damaged portions of data.

One-Language Limitation

The system is now limited to the support of only one language—Microsoft BASIC (also known as Commodore BASIC, Applesoft and Radio Shack Level II BASIC). There are no plans, according to Dr. Harry J. Saal, Nestar Systems president, to support other languages. However, he says the firm is considering support of new microcomputers as they become available. But there are no plans for a general S-100 ClusterBus interface and accompanying software support. Apple, Commodore and Radio Shack also have decided not to provide S-100 bus compatibility.

In Nestar's present release, cross loading of programs from one



Cluster/One can interconnect up to 30 personal computers for such applications as program development and laboratory automation. The principal application so far has been computerized instruction.

machine type to another is not supported; however, Saal promises this restriction will be removed in a new release planned for the third quarter of this year. He cautions, however, that the user must make any changes required because of differences in the exact form of BASIC provided on the various computer types. "Programs using only standard BASIC features," Saal says, "will be transportable without modification."

Nestar also intends to provide printer spooling this June. Such printers as the AXIOM 820 electrosensitive type or the Lear Siegler Model 300 (a 180-character/second, bidirectional, dot-matrix unit) will be supported. Planned additions include an eight-inch Winchester drive next year, bus scheme using coaxial cables to extend communications over thousands of feet at present speeds and a new central unit that will include the Queen.

In laboratory use, local instruments can be interfaced to user stations for data collection or monitoring.

Users interested in developing pro-

grams for microcomputers can connect several stations to the Cluster/One to modify or test a common library of programs.

The price of the basic Cluster/One is \$4500. Optional features, at added cost, are dual double-sided diskette drives, additional memory and ClusterBus extender. These items are now available.

For further information contact Nestar Systems, Inc., 430 Sherman Ave., Palo Alto, CA 94306, (415) 327-0125.

—Stan Baker

Circle 205 on Reader Service Card



The New Nestar Cluster/One "Model A"

Computer System Breakthrough



This white "black box" makes 2 to 65 low-cost Apple computers into a high-speed computer network with an unlimited number of multi-user applications.

A is for Apple... a first-rate personal computer. "Model A" is for the Nestar network that uses as few as two or as many as 65 standard Apple computers; one becomes a central processor; the others, interacting stations up to 1,000 feet away... Each station connects to a central storage system capable of storing up to 33 million bytes on a single hard disk... At an unbelievably low cost.

Other user-written applications may include: classic central data-base systems • inventory control • accounting procedures • legal brief storage and references • mailing list management • medical patient-information records • word processing with complete editing capability • electronic mail systems • inter-office memo systems • multi-user interactive simulations • financial planning systems • data acquisition • educational applications.

Applications limited only by the user's requirements and imagination.



This ordinary Apple computer has now become...without any modifications...the central controller in the Nestar network.

Shared or Private Data

All information can be shared among users or—using the system's protection mechanism—can be password-protected so that only one designated individual or group has access to specific data.

(As an example, a number of people may have permission to read specific data but may not have the ability to modify those data.)

In the Nestar "Model A" network, a standard 48K Apple can function as the dedicated central controller/mass storage

manager, with connections to the Nestar storage subsystems and to other Apples that serve as user stations. Each station is connected to the ClusterBus which can be up to 1,000 feet of 25-wire ribbon cable or standard DB-25 round cable.

The White "Black Box"

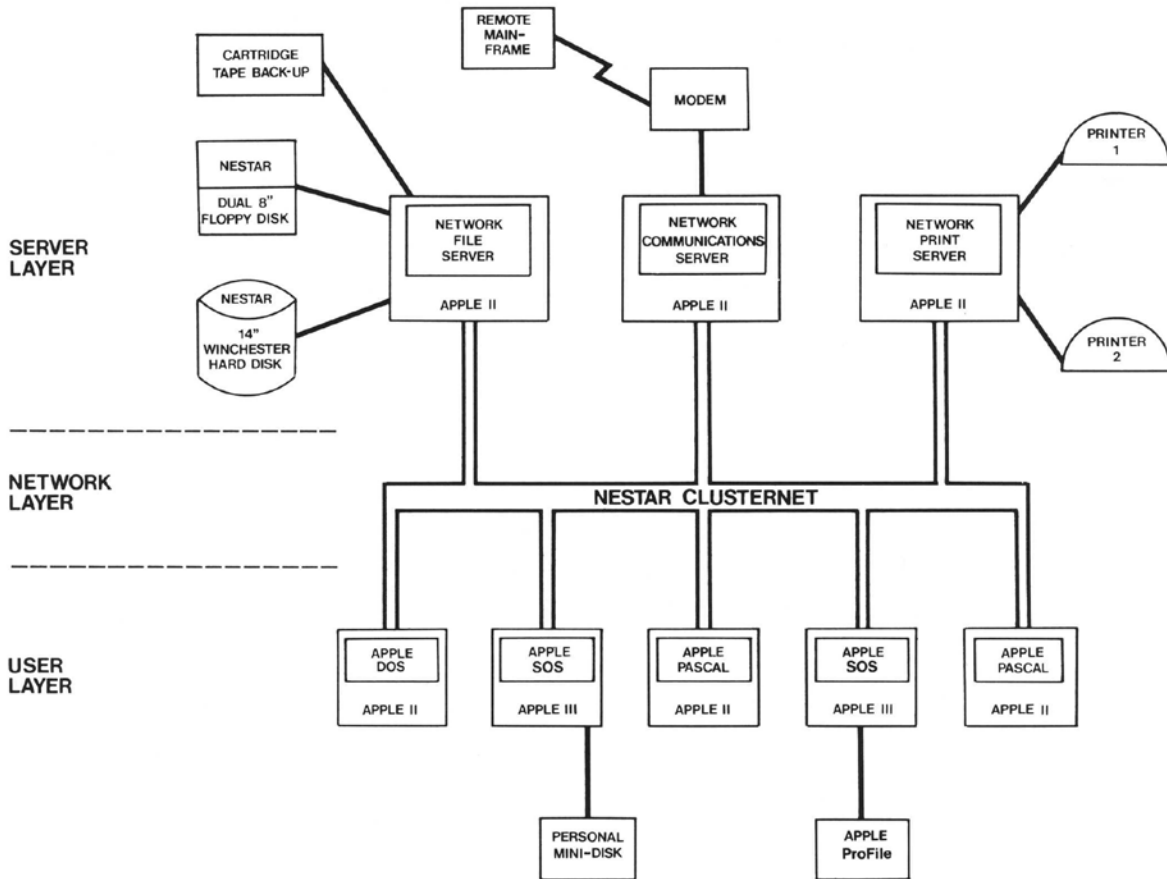
The "Model A" consists of a compact metal box with two double-sided 8-inch floppy disks with formatted available storage of 1,260,000 bytes; the necessary electronics which plug into the central controller Apple; the ClusterBus communication card; the communication cards required for each Apple station, and all necessary software. Also available as an option is the Nestar hard disk drive with either 16.5 or 33 million bytes of formatted available storage in a single unit.

The user station communication cards contain 2KB of ROM, 1KB of RAM and all necessary bus electronics. They are compatible with standard Apple interface cards including those for mini-disks, serial and parallel printers, modems, sound, and graphics tablets. The ClusterBus communication card plugs into any of the peripheral connectors inside the Apple and is perceived by the Apple to be an Apple mini-disk controller card and thus will be automatically initialized when the Apple is turned on.

Why the Apple?

Programs written in language supported currently by Apple—Applesoft BASIC, Integer BASIC, machine language, Pascal—will function without change in the "Model A." Any hardware in the Apple universe obeying Apple standard conventions can be used. Most applications in automation, accounting, legal, or small business use can be immediately put to work without any reprogramming.

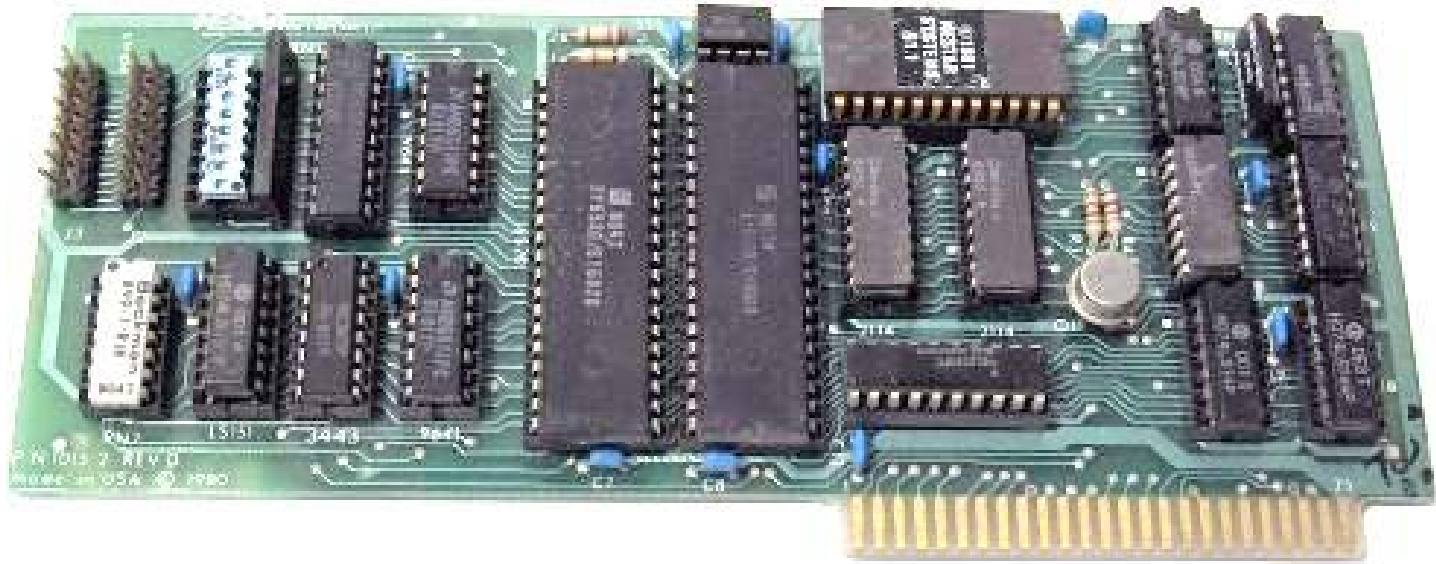
THE CLUSTER/ONE™ IS MORE THAN A NETWORK.....



CHM has 100,000 things

- 38,467 physical objects
- 6,629 photographs
- 3,002 videos
- 817 oral histories
- 42,297 documents
- 8912 software objects

preserving hardware



102681418

preserving source code

```
650 905A A010          LDY #VDTYP
670 909C B14F          LDA (PDBLK),Y  TYPE OF 1ST ENTRY
680 909E C910          CMP #FVDESC
690 90A0 F003          EEQ *+5
700 90A2 4CDD94        JMP DIRER3  NO LABEL
710 90A5 A920          SRCHSK LDA #DELFN  START WITH 2ND ENTRY
720 90A7 D025          BNE SRCE3 (UNC) RETURN IT TO CALLER
730 90A9                ;
740 90A9                ;
750 90A9                ;
760 90A9 20E390        SRCE1 JSR SRCHRD  READ THEM
770 90AC A902          SRCH2 LDA #0  OFFSET IN DIR. BLK
780 90AE 8553          SRCH3 STA DIROFF
790 90B0 18            CLC
800 90B1 6910          ADC #DETYP
810 90B3 A8            TAY
820 90B4 B14F          LDA (PDBLK),Y  GET TYPE FIELD
830 90B6 C900          CMP #FLAST
840 90B8 60            RTS  RETURN WITH CC SET
850 90B9                ;
860 90B9 4A553         DSRCHN LDA DIROFF
870 90BB C9E0          CMP #DELEN*DENUM-DELEN
880 90BD F025          BEQ SRCH4  LAST ENTRY
890 90BF 18            CLC  GO TO NEXT ENTRY
900 90C0 6920          ADC #DELEN
910 90C2 D0EA          PNE SRCH3 (ALWAYS BRANCHES)
920 90C4 1654          SRCH4 INC DIRBLK  NEXT DIR BLK
930 90C6 D002          BNE SRCE5
940 90C8 1655          INC DIRBLK+1
950 90CA CE3CAF        SRCH5 DFC SRCPCE  COUNT ELKS
960 90CD D023          BNE SRCH6
970 90CF 4C3F95        JMP ERR4  DIRECTORY FULL
980 90D2 1650          SRCH6 INC PDBLK+1 POINT TO NEXT BLOCK IN CORE
990 90D4 A903          LDA #3  EVERY FOUR TIMES
1000 90D6 2454         BIT DIRBLK  REREAD FROM DISK
1010 90D8 D0D2          BNE SRCH2  NO, IN CORE
1020 90DA A550          LDA PDBLK+1  RESET TO BEGINNING
1030 90DC 18            CLC
1040 90DD 69FC          ADC #256-4
1050 90DF 8550          STA PDBLK+1
1060 90E1 D0C6          BNE SRCE1  READ AGAIN
1070 90E3                ;
1080 90E3                ;
1090 90E3                ;
1100 90E3 203090        SRCHRD JSR WMOVE  READ 4 DIR. BLKS
1110 90E6 54            .BYT DIRBLK,DBLK
1110 90E7 42            .BYT PDBLK,DADR
1120 90E8 4F            .BYT K400,DSIZ,0
1120 90E9 46
1130 90EA 59
1130 90EB 44
1130 90EC 00
1140 90ED 203390        JSR DREAD
1150 90F0 F023          BEQ SRCH2
1160 90F2 4C4495        JMP ERR1  DISK ERROR
1170 90F5 60            SRCHZ RTS
1180 90F6                ;
1190 90F6                ;
1200 90F6                ;
1210 90F6                ;
```

Enjoy Local

Don't merely imagine what a local computer network could do for your business. Experience it! The Nestar Cluster/One™, Model A (for Apple®) is available **now**. Best of all, you can get started with Cluster/One for substantially less than a mini-based or large system would cost you.

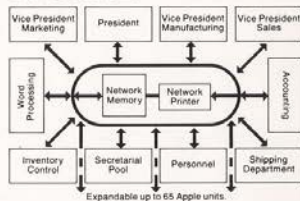
This Network Does It All!

When you invest money, time and energy in a network, you deserve full networking capabilities, not a shared disc system imitating a network. Nestar enables **every** station (computer or peripheral) to talk to every other station. That's flexibility for distributed computing. That's growth potential you can turn into productivity for a whole business—or a whole industry!

The Economics of Nestar

With a Nestar Cluster/One, Model A, you can network up to 65 Apple computers. You enjoy increasing economies of scale as the system grows, because everybody in the network can share expensive peripherals. High quality printers. Low cost-per-byte mass storage systems. High speed modems.

The Cluster/One



Networking—Now!

Distributed Computer Performance

While you save dollars, you also get performance benefits that mini-based systems can't duplicate. For example: Since each station is a computer in itself, users get fast response time no matter what the load on the total system. For example: If one terminal breaks down, you don't lose the whole system.

A Field-Proven System

We don't simply promise you great capabilities. We can demonstrate them. Our networks are working right now. In banks. In travel agencies. In schools and colleges. Even in an amusement park's coin-operated computer arcade. In sum: Cluster/One, Model A is a mature product.

Software, Software, Software

If you're still skeptical about microcomputers, we strongly suggest that you take another look at the Apple's capabilities. And while you're at it, check out the software that's available for the Apple—literally thousands of programs. And Nestar is developing specific software for Cluster/One. THE MESSENGER™, Nestar's proprietary electronic mail system, is available already!

Ready When You Are

We're ready to deliver right now. We offer special discounts to commercial OEMs and software integrators, as well as systems houses. Call or write for free literature, including a detailed discussion of networks vs. other solutions.

NESTAR

NESTAR Systems Incorporated
430 Sherman Avenue, Palo Alto,
CA 94306, (415) 327-0125

*Apple is a registered trademark of Apple Computer, Inc.



PC week 1/22/85

Where Giants Fear To Tread

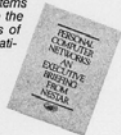


For five years NESTAR has ventured where giants have feared to tread—local area networking. In fact, NESTAR has installed more large local area networks in large institutions than any other manufacturer.

Soon the giants will be involved in networking and that will ensure broad industry support. NESTAR's products will be totally compatible and complementary to the systems sold by the giants. That way you receive the advanced technology and responsiveness of NESTAR today with the comfort that compatibility with giants brings.

Call or write for your copy of:

"Executive Briefing"
2585 East Bayshore Road,
Palo Alto, CA 94303 • (415) 493-2223



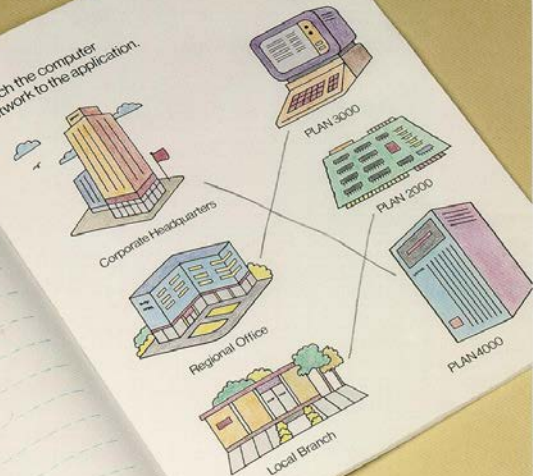
Local Area Networks For Large Organizations

NESTAR



Most Local Area Networks Can't Pass This Simple Test...

Match the computer network to the application.



But Nestar's PLAN Series™ of networking products for microcomputers will work for your headquarters in Manhattan, New York, and your local branch in Manhattan, Kansas—as well as your regional office in Chicago. Here are some technical details:

Our PLAN 2000™ links IBM PCs. Use our PLAN 2000 to link as many as 255 IBM PCs or XT's in a token passing network that can cover several miles. Any one station can access up to three printers and eight hard disks at a time.

Our PLAN 3000™ is a bargain for IBM PCs and Apples. You can get a file server, a print server, 3270, 3770 and 3780 emulation, electronic mail, Apple and IBM PC support, 6 operating systems, multi-level file structures, multi-level password protection, disk capacity as small as 10 Mbytes, high-speed digital tape back-up, and more! Best of all, a 10 Mbyte file server costs less than \$10,000.

Our PLAN 4000™ grows from 30 to 548 Mbytes. It offers all the features of the PLAN 3000, and has enough capacity to handle very large organizations.

Don't buy more or less networking than you need. Contact Nestar Systems, 2585 East Bayshore Road, Palo Alto, CA 94303, (415) 493-2223, Telex: 171420-NESTAR PLA. In Europe contact Nestar Systems Limited, 122/3 High Street, Uxbridge, Middlesex UB8 1JT, United Kingdom, Tel: Uxbridge (0895) 59831, Telex: 896607.

PLAN Series model	PLAN 2000	PLAN 3000	PLAN 4000
Typical number of users	2-4	3-12	10-100
Maximum number of users	255	255	255
Speed	2.5 Mbits/s	2.5 Mbits/s	2.5 Mbits/s
Maximum distance	22,000 ft.	22,000 ft.	22,000 ft.
Minimum file server cost	\$500	\$9,995	\$15,995

NESTAR

PLAN 3000™ FILE SERVER



STAR

PLAN 4000™ FILE SERVER



STAR

NESTAR PLAN SERIES

PLAN 5000 MULTI-FUNCTION FILE SERVER

Nestar's PLAN 5000 is a high capacity, floor-standing, multi-function server typically supporting 30 to 60 users per file server. Designed to provide the larger capacity needed to support heavy storage

requirements with multiple additional server functions, the PLAN 5000 is a key component of Nestar's total systems approach to resource and information sharing. The PLAN 5000 combines sophisticated networking technologies with field-proven server firmware to provide a distinctive, highly useful information systems networking product for use by large organizations.

The PLAN 5000 is a multi-function server, managing access to multiple printers and shared disk storage for networked user workstations (PCs). Its features include:

- **Password protection;**
- **Efficient storage, with back-up capability;**
- **Error checking and recovery;**
- **Reliable, integrated tape back-up;**
- **Fault-tolerant ("Shadow") mode;**
- **Controlled access to files;**
- **System manager function;**
- **Print server supports two parallel plus one serial printer;**
- **Simultaneous de-spooling on all three printers; and**
- **User-specified printer forms, set up, number of copies, and priority.**

Additional functions are available through co-processor expansion cards. One print server co-processor card is standard.

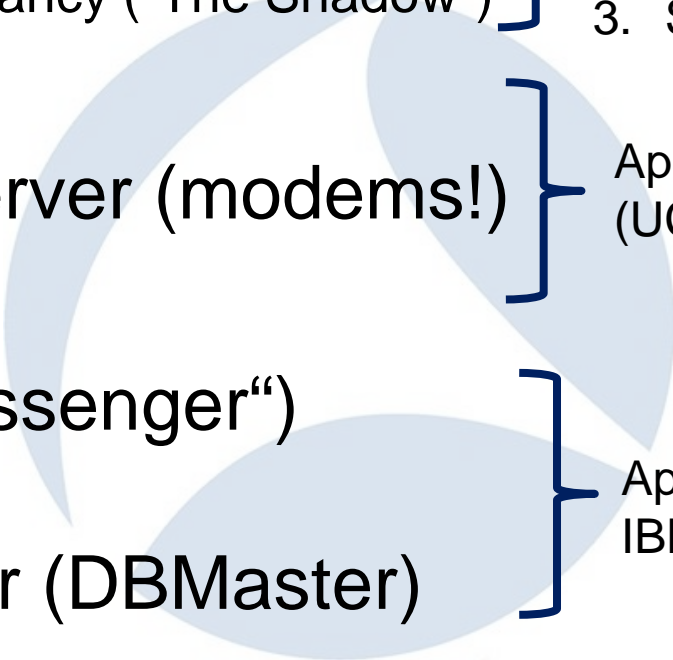
The PLAN 5000 can support up to 255 workstations, servers, and server co-processors on a single network, including any combination of IBM and IBM-compatible PC workstations. The server is housed in an attractive, movable cabinet that fits conveniently under a desk or table. Disk capacity is modular and easily expanded. The system management console can be located near the server or remotely.

The PLAN 5000 is designed to permit users to share data and programs in a secure, reliable system with complete back-up.



PERSONAL COMPUTER-BASED LOCAL AREA NETWORKS

Nestar Systems, Inc.

- File server
 - Transparent redundancy (“The Shadow”)
 - Print server
 - File Transfer Server (modems!)
 - Telex server
 - Email (“The Messenger”)
 - Chat (“Talk”)
 - Database server (DBMaster)
- 
1. Commodore PET
2. Apple II
3. SUN-like 68000 CPU board
- Apple II
(UCSD P-System PASCAL)
- Apple II
IBM PC and clones

It didn't last

NESTAR

1978 – 1986

R.I.P.

Why did Nestar fail?

- Too early
- Bad LAN bets
 - first proprietary flat cable
 - then Datapoint ARCNET
 - then IBM Token Ring
 - Xerox XNS network protocols (not TCP/IP)
- Corvus and Novell ate our lunch

failure is an honorable tradition



Who invented the computer?



SharkFest '16 • Computer History Museum • June 13-16, 2016



Charles Babbage

1791-1871

Babbage's lifelong quest

On finding errors in a newly computed set of tables, Babbage exclaimed:

“I wish to God these calculations had been executed by steam”

Log. 342. N. 220.

0°	6°	Num.	0	1	2	3	4
36'	6'						
40°	40	2200	3424227	4424	4622	4819	5016
	50	1	6200	6398	6595	6792	6990
	7'	2	8173	8370	8568	8765	8962
	10	3	3430145	0342	0539	0736	0933
	20	4	2116	2313	2510	2707	2904
45°	30	5	4086	4283	4480	4677	4874
	40	6	6055	6252	6449	6646	6842
	50	7	8023	8220	8417	8614	8810
	8'	8	9991	0187	0384	0581	0777
	10	9	3441957	2154	2350	2547	2743
50°	20	2210	3923	4119	4316	4512	4709
	30	1	5887	6084	6280	6477	6673
	40	2	7851	8048	8244	8440	8636
	50	3	9814	0010	0207	0403	0599
	9'	4	3451776	1972	2168	2365	2561
55°	10	5	3737	3933	4129	4325	4522
	20	6	5698	5894	6090	6285	6481
	30	7	7657	7853	8049	8245	8440
	40	8	9615	9811	0007	0203	0399
	50	9	3461573	1769	1964	2160	2356
37'	10'	2220	3530	3725	3921	4117	4312
	10	1	5486	5681	5877	6072	6268
	20	2	7441	7636	7831	8027	8222
	30	3	9395	9590	9785	9981	0176
	40	4	3471348	1543	1738	1934	2129
5°	50	5	3300	3495	3691	3886	4081

$$\ln(x+1) = x - \frac{1}{2} x^2 + \frac{1}{3} x^3 - \frac{1}{4} x^4 + \dots$$

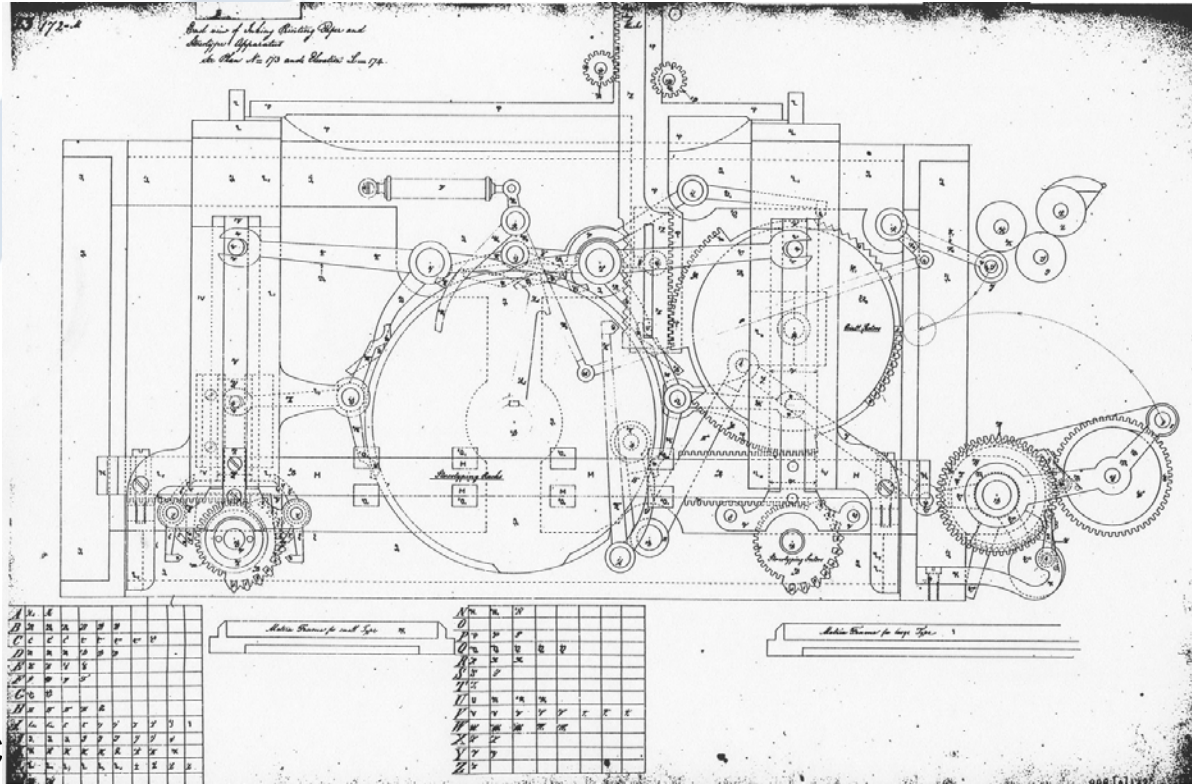
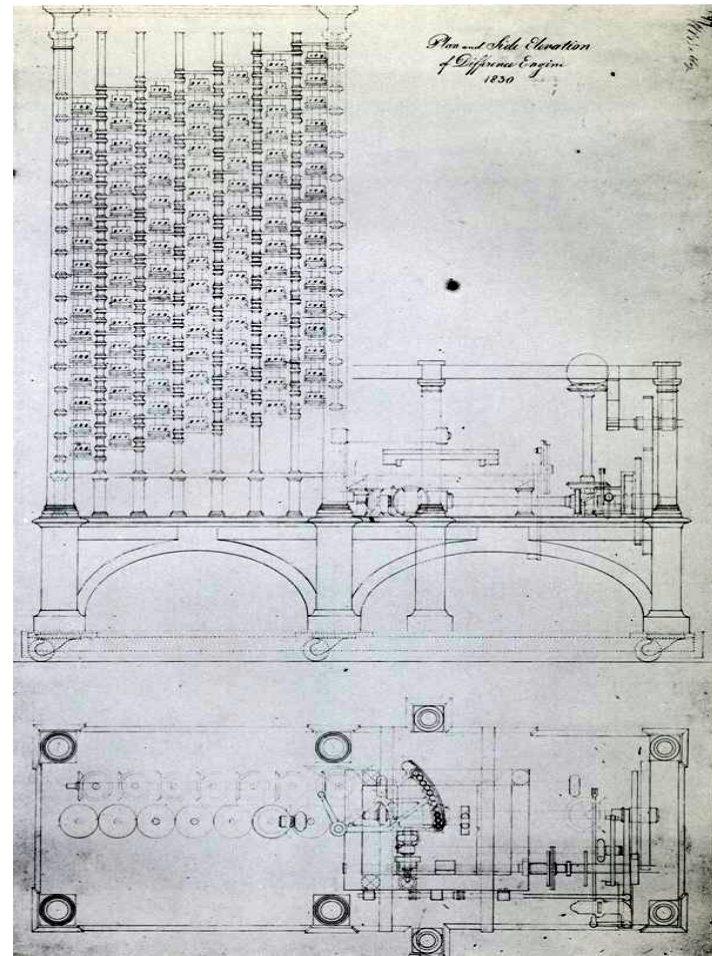
The “Method of Differences”

X	F(X)	1 st difference	2 nd difference
1	5	3	2
2	8	5	2
3	13	7	2
4	20	9	2
5	29	11	2
6	40		

$$F(x) = x^2 + 4$$

Babbage's Difference Engine

- began in 1823
- 16 digit numbers
- 6 differences
- complex printer



Babbage's Scorecard

£17,000 (\$2M) + 19 years
= 12,000 of 25,000 parts made

The project collapses.

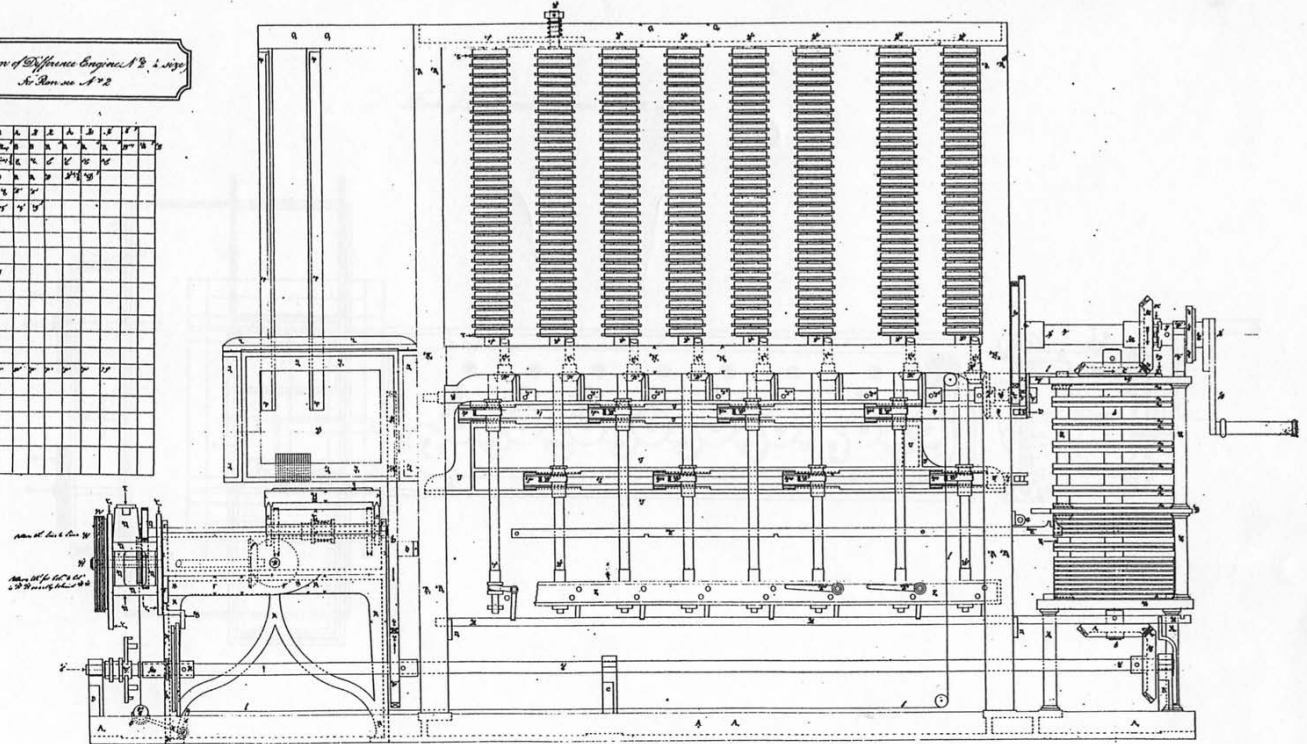


Difference Engine #2

W. S. B. 1847

Description of Difference Engine No. 2, as far as it is now known.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z		
D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z			
E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z				
F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z					
G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z						
H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z							
I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z								
J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z									
K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z										
L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z											
M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z												
N	O	P	Q	R	S	T	U	V	W	X	Y	Z													
O	P	Q	R	S	T	U	V	W	X	Y	Z														
P	Q	R	S	T	U	V	W	X	Y	Z															
Q	R	S	T	U	V	W	X	Y	Z																
R	S	T	U	V	W	X	Y	Z																	
S	T	U	V	W	X	Y	Z																		
T	U	V	W	X	Y	Z																			
U	V	W	X	Y	Z																				
V	W	X	Y	Z																					
W	X	Y	Z																						
X	Y	Z																							
Y	Z																								
Z																									



Bas [?]

7th-order differences, 31 digit numbers

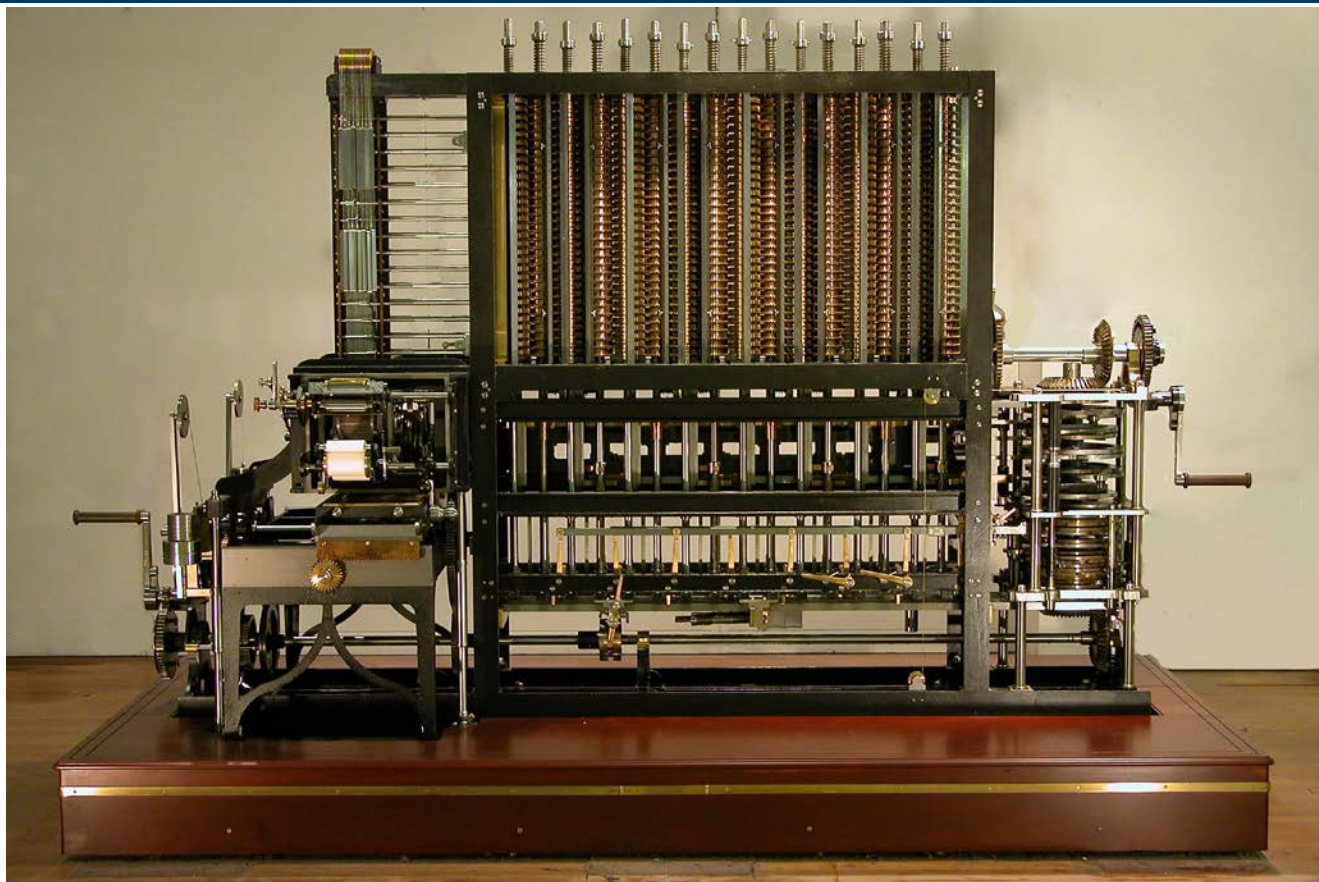
The modern scorecard

\$2M + 17 years
= 8000 parts made

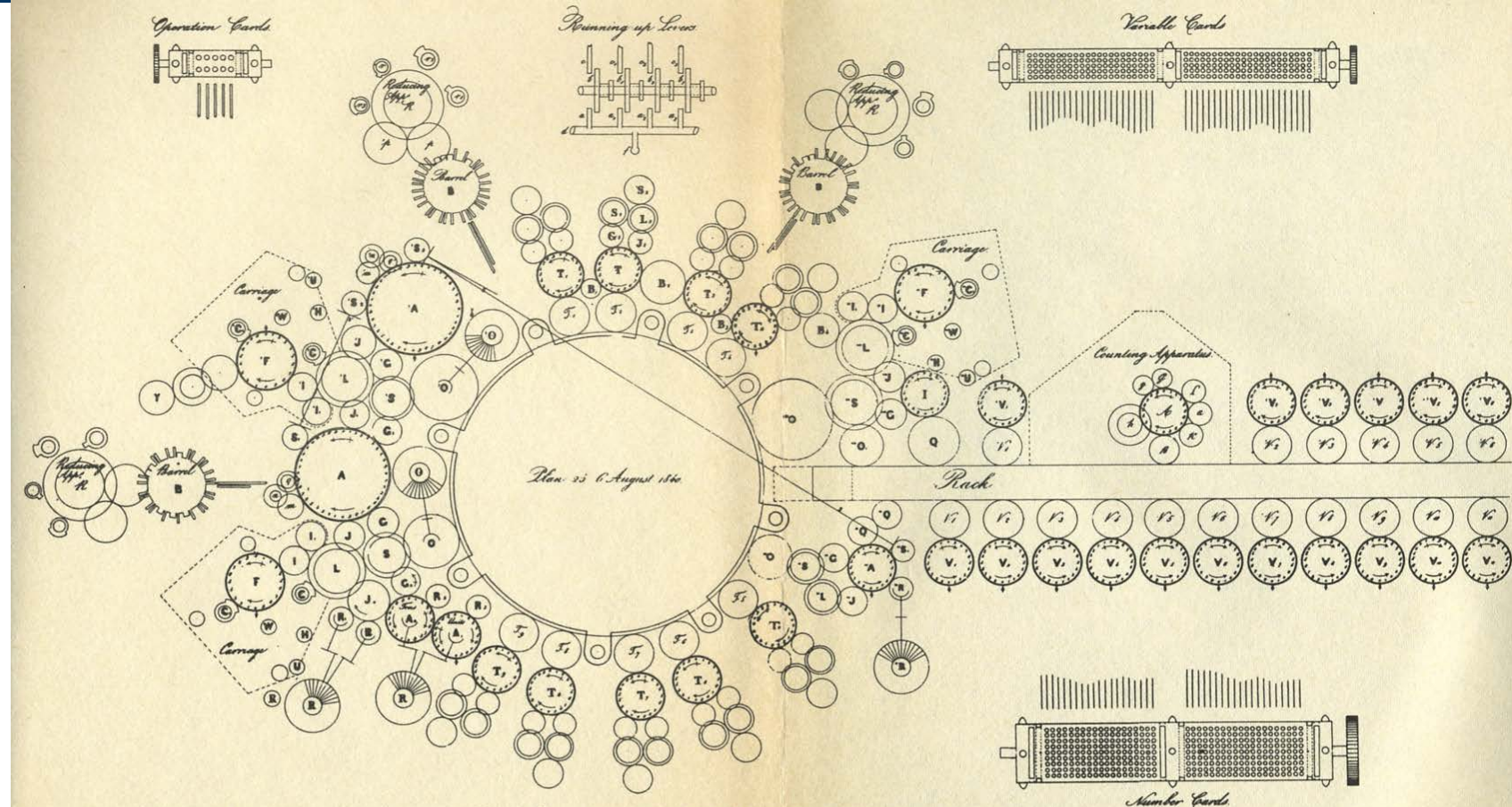
Success!



Doron Swade
London Science Museum



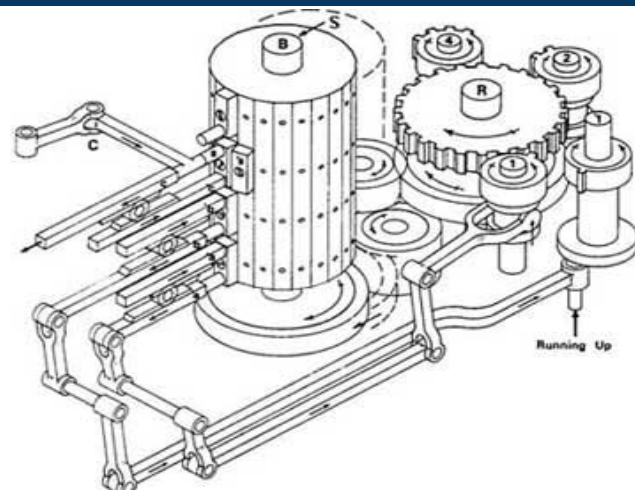
The Analytical Engine



General plan of Mr Babbage's great calculating engine, 1840.

A real computer

- separate CPU (“mill”) and memory (“store”)
- pipelining and parallel processing
- conditional branches and loops
- microcoded carry lookahead



and software!

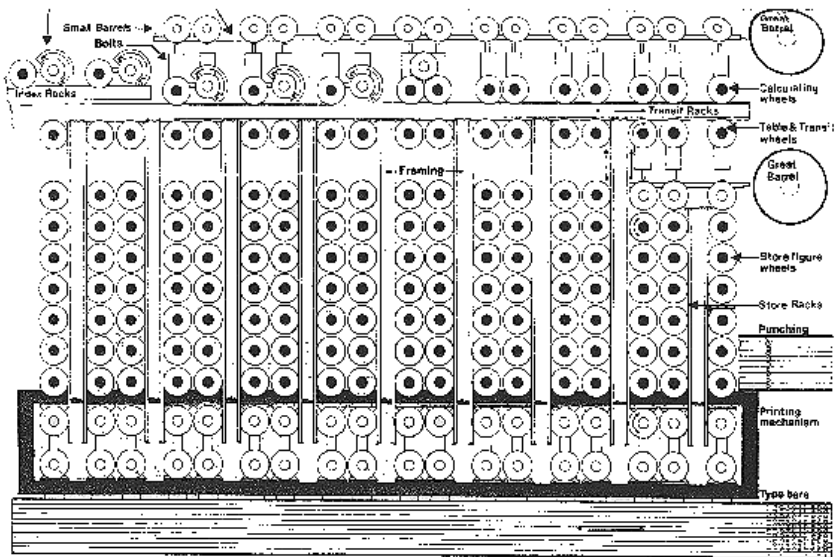


Fig. 2. Plan of Analytical Engine with grid layout, 1858 Rodzina.



lessons we learned

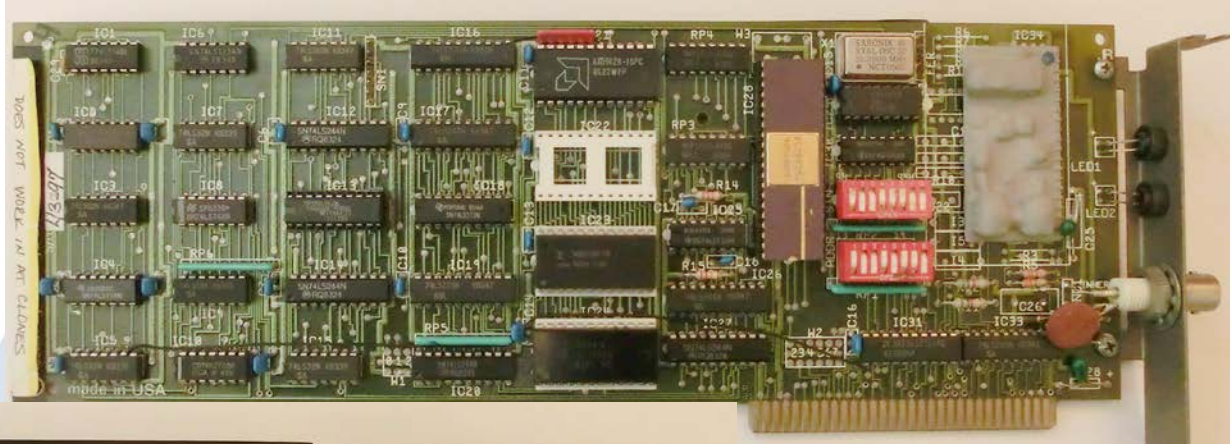


engineering department tool

TART

Transmit and Receive Totaliser

(designed by Nestar UK)



potted,
not patented!

TART source code

```
rem      Create the source and destination filters.  Packets will be accepted
rem      if (SRC(source) AND DST(destination)) is non-zero.
rem      This clever idea is due to John Murphy at Datapoint, and can be used
rem      in many more ways than the code here allows.

      IF (STN1$+STN2$)<>"XXXX" THEN 3600
      FOR I=0 TO 255: SRC%(I)=1: DST%(I)=1: NEXT I:  rem complete wildcard
      GOTO 3899

3600    IF STN1$<>"XX" THEN 3700
      FOR I=0 TO 255: SRC%(I)=2: DST%(I)=1: NEXT I:  rem one station wild
      IF BROADCAST% THEN DST%(0)=3
      SRC%(STN2%)=3: DST%(STN2%)=3:
      GOTO 3899

3700    IF STN2$<>"XX" THEN 3800
      FOR I=0 TO 255: SRC%(I)=2: DST%(I)=1: NEXT I:  rem other station wild
      IF BROADCAST% THEN DST%(0)=3
      SRC%(STN1%)=3: DST%(STN1%)=3
      GOTO 3899

3800    rem neither station wild
      FOR I=0 TO 255: SRC%(I)=0: DST%(I)=0: NEXT I
```

The end of Nestar

Nestar Systems assets



100
employees

“TART” technology
to Harry and Len

DSC: Digital Switch Corporation

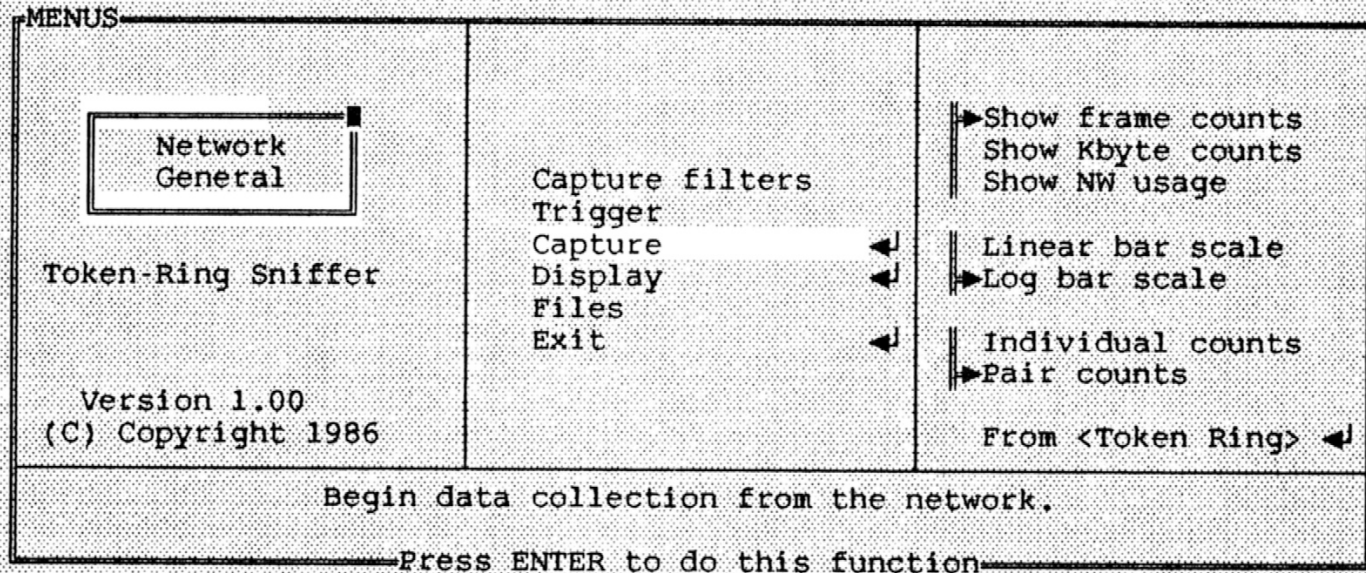
Restart: “Network General”

- **Goals**

- Make TART into a product: “Sniffer”
- Sell 100 of them
- Figure out something else to do

building a PC product in 1986





1 Help

10 New capture

Figure 3-2: The first panel of the Sniffer's Main Menu.

Sniffer V1.0 source code

```
if (menu_key == -K_RIGHT) {                                /* scroll version */
    tr_makefile (&wwdx, &level [center_level+1], center_level+1); /* make new right memory file */
    mv_cs (W_CENT_ROW, 3, &wwtc);                          /* center window: */
    v_natt (LREVERSE, ENDROW, &wwtc);                      /* reverse bar */
    pl_wn (W_TOP_ROW, W_LEFT_COL+3*W_WIDTH-3-SS_STEP, &wwts); /* scroll window supplies left edge */
    step = stepsize;                                       /* initial hop size for each movement */
    for (i=0; i < W_WIDTH-1; i += stepsize) {
        hslide (W_TOP_ROW, W_LEFT_COL+1+step, /* upper left cnr of slide rectangle */
                W_HEIGHT, W_WIDTH*3-4-step, /* size of rectangle */
                -step, video_mode); /* slide to the left */
        for (j=0; j < step; ++j) /* add new columns on the right */
            show_col (&wwts, SS_STEP-step+j, &wwdx, i+j);
    }
    dtemp = wwtl.dataf;
    wwtl.dataf = wwtc.dataf; /* shift data file ownership */
    wwtc.dataf = wwtr.dataf;
    wwtr.dataf = wwts.dataf;
    wwts.dataf = dtemp;
    mv_cs (W_CENT_ROW, 3, &wwtc); /* center window: */
    v_natt (LREVBLINK, ENDROW, &wwtc); /* flashing bar */
}
else /* -QK_RIGHT */ { /* non-scroll version */
    tr_makefile (wwtr.dataf, &level [center_level+1], center_level+1); /* show new right ww */
    tr_showfile (&wwtr, LNORMAL, FALSE);
    tr_makefile (wwtl.dataf, centerl, center_level-1); /* show old center in left ww */
    tr_showfile (&wwtl, LNORMAL, FALSE);
    tr_makefile (wwtc.dataf, rightl, center_level); /* show old right in center ww */
    tr_showfile (&wwtc, LREVBLINK, TRUE); /* with blinking bar */
}
show_info (newrightl->node, &wwtb); /* show info for selected center node */
} /* can move right */
```

break;

...with 8086 assembler help

```
;          Do a right slide using backward string moves
;
do_right:      add      si,colq[bp]          ; move si to last word of row
              add      si,colq[bp]
              sub      si,2
              sal      ax,1                ; amount * 2
              mov      di,si
              add      di,ax                ; starting di = si + amount * 2
              mov      bx,v_coq            ; precompute endline adjustment for si/di
              add      bx,colq[bp]        ; bx = 2 * (v_coq + colq)
              sal      bx,1
              std      ;backward string direction
              mov      dl,rowq[bp]        ;dl = number of rows to do
              mov      ax,v_seg            ;setup segment regs
              mov      ds,ax
              mov      es,ax
              call     do_move
              cld      ;leave with direction forward
quit:         or      dh,dh                ;maybe turn video back on
              jz      no_unwait
              call    unwind
no_unwait:    pop     es                    ;restore segment regs
              pop     ds
              pop     bp
              ret      ;return
```

The Sniffer™

PRODUCT FEATURES

- the only portable protocol analyzer for IBM Token-Ring Network communications
- a self contained unit for data collection, recording and analysis
- includes a real-time system performance monitoring package
- functions as a network traffic generator
- collects all or a subset of frames without affecting the network
- accepts frames at full network speed
- handles source routing information in frames
- saves and loads collected frames from diskette for later analysis
- essential for debugging application software problems by observing actual high-level message streams without changing software or hardware in the communicating stations
- complex event sequences can be trapped in logic analyzer fashion, by user programming
- required for analyzing performance of higher level protocols
- provides a formatted display of the following frame types:
 - IEEE 802.5 MAC,
 - IEEE 802.2 Type 1 and Type 2 LLC,
 - NETBIOS
 - SMB (e.g., DOS 3.1 and OpenNet),
 - and
 - LLC 2 (e.g., APPC, SNA).
- includes extendable code for end-user adaption to other protocols

SPECIFICATIONS

Package: Portable instrument, with carrying handle

Weight: Approx. 26 lbs

Voltage: 115 VAC (optional: 230 VAC automatically switched)

Processor: Intel 80286

Memory: 640 KB RAM

Storage: One 360 KB 5 1/4 inch floppy drive, 20 MB internal hard disk

Display: 9" green screen, supports optional external RGBI color display

Network: Standard IBM Token-Ring Network DB-9 connector, with 8' cable for wall plate

Warranty: One year

Software: Written in a combination of microcode, machine language and C. End-user modification possible, to provide for extension to proprietary protocols

ORDERING INFORMATION

Model Number: PA-400 Token-Ring Network Portable Protocol Analyzer

Price (USA): \$19,995.00 per unit. OEM terms available for 25 or more units

Network General Corporation
1296B Lawrence Station Road
Sunnyvale, CA 94089
(408) 734-0464
FAX (408) 734-1828

Specifications are subject to change without notice.
The name IBM Token-Ring Network is a trademark of the IBM Corporation.
Copyright 1986 by Network General Corporation.

Rev 2.310

The Sniffer™

Token-Ring Network
Portable Protocol
Analyzer



PRODUCT SUMMARY

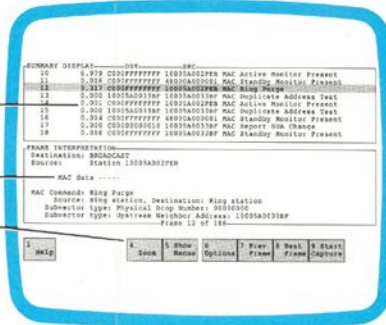
Network General's Token-Ring Network Portable Protocol Analyzer, "The Sniffer," is a combination of hardware and software which serves as a data analyzer for the IBM Token-Ring Network. The Sniffer's unique hardware feature is its ability to capture all frames transmitted on the network. Together with high-level software, the Sniffer monitors network traffic and interprets it in much the same way that a logic analyzer does for digital signals. The Sniffer is built around a high performance (8 MHz) portable personal computer, making it a useful tool both in the field and in the lab.

SAMPLE SCREENS

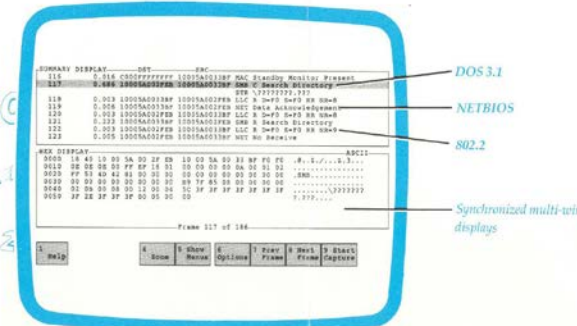
Timestamped frames for performance analysis

Decoded control fields

Easy-to-use menus



NETBIOS 802.2



Synchronized multi-window displays



What to charge



Sniffer cost of goods

computer:	\$1800
network adapter:	\$200
<u>software:</u>	<u>\$10</u>
total:	\$2010

Len: “40% markup: \$2800”

Harry: “\$25,000. It’s worth it.”

“Manufacturing”




SharkFest '16 • Computer History Museum • June 13-16, 2016

Selling the Sniffer

- use Manufacturer's reps
 - thank you, George Comstock
- demo at the customer
 - “look at all those passwords”
 - it sold itself
- more networks, more PIs

Network General Corp. recently unveiled a version of its Sniffer network protocol analyzer that supports Apple Computer, Inc.'s AppleTalk nets. The latest version of the Sniffer will let users evaluate, fine-tune, debug and troubleshoot Ethernet nets that are running the full range of AppleTalk protocols. In addition, the Sniffer is expected to support token-ring nets within the next several months.

Called the PA-1310 Apple Protocol Suite, the software product supports all layers of the AppleTalk protocol model. The Sniffer network protocol analyzers are portable, self-contained units that collect, record and analyze data and monitor real-time network performance.

The PA-1310 Apple Protocol Suite is available now and has a list price of \$995. 

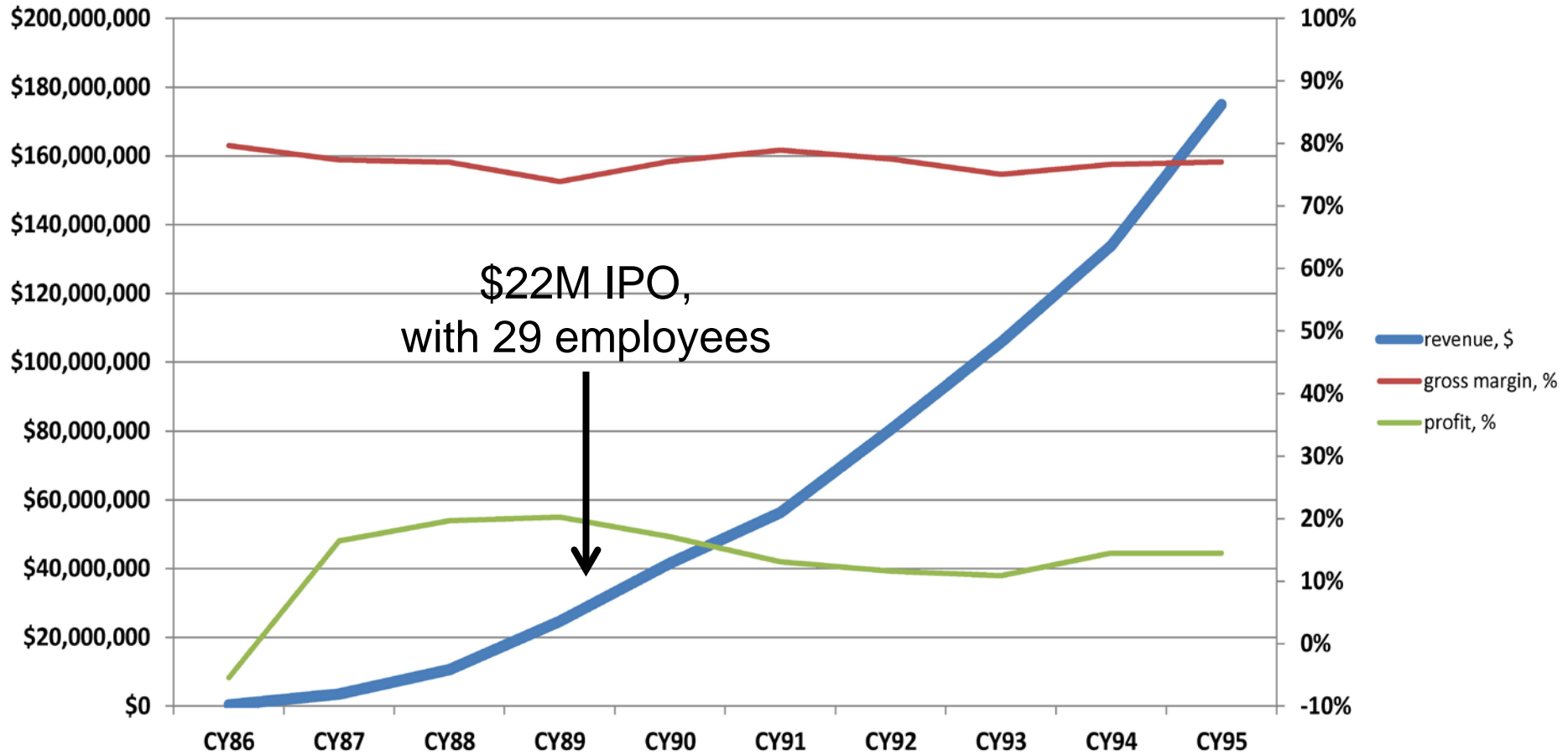
Price by value, not by cost

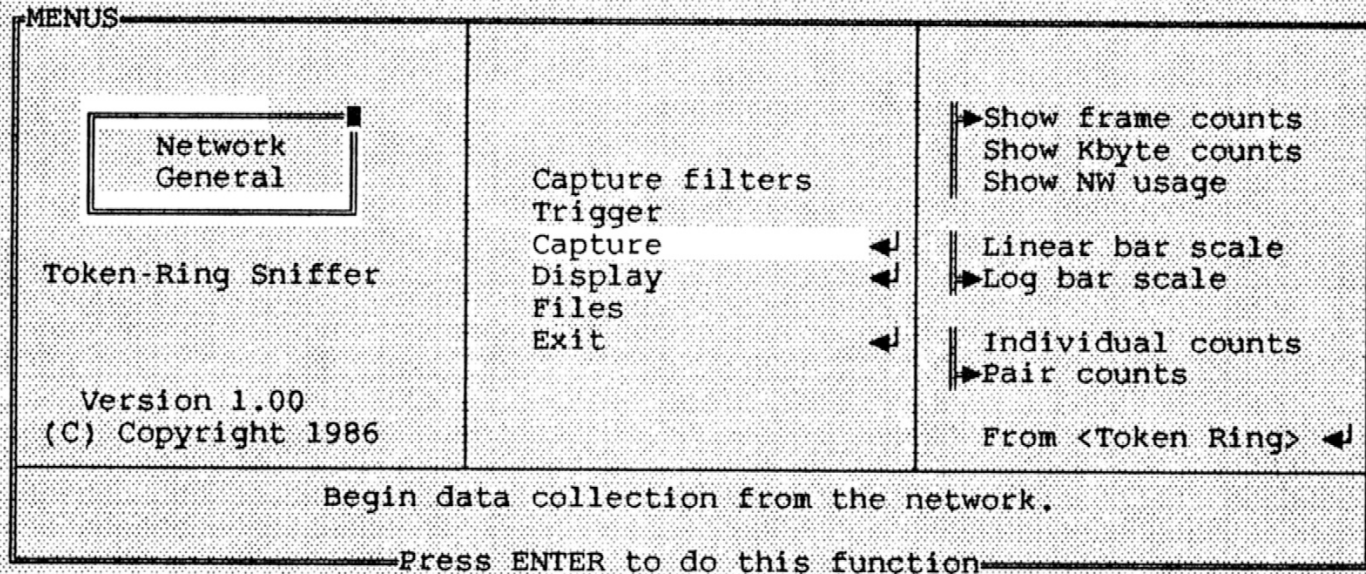
We sold all we could make at \$25,000
and customers were delighted to pay it.

*1986: 8 Sniffers
4 employees*

*1995: 1000 Sniffers/month
1000 employees*

What a ride!

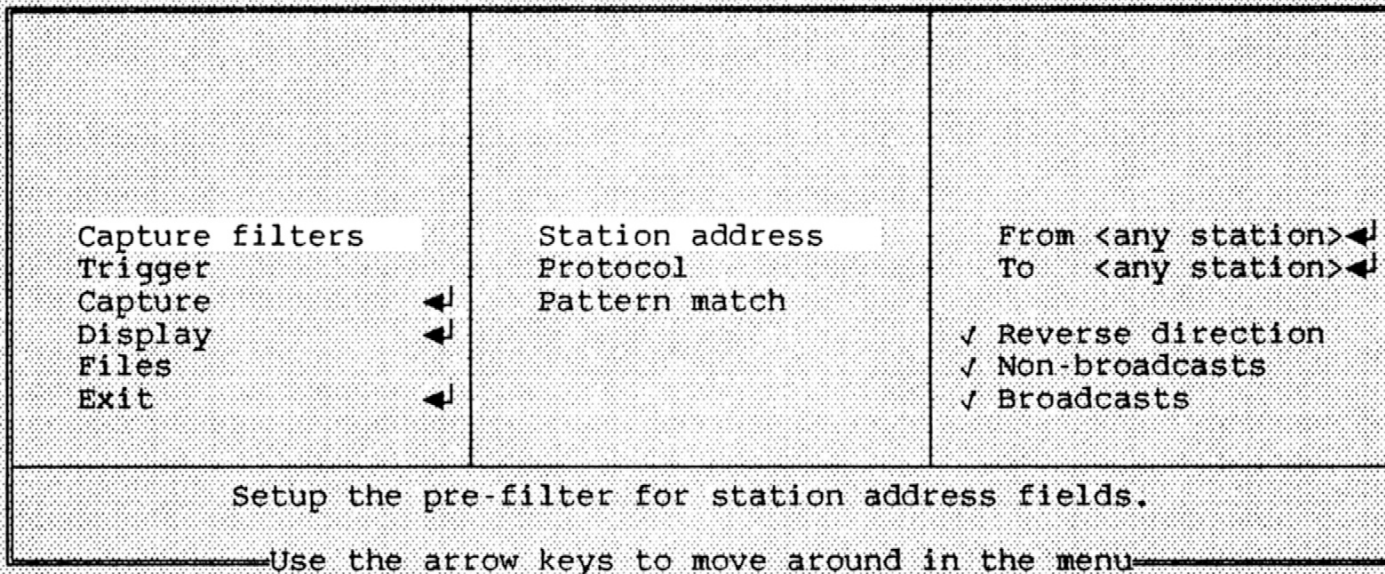




1
Help

10 New
capture

Figure 3-2: The first panel of the Sniffer's Main Menu.



1
Help

10 New
capture

Figure 4-1: Default settings of Capture Filters for station address.

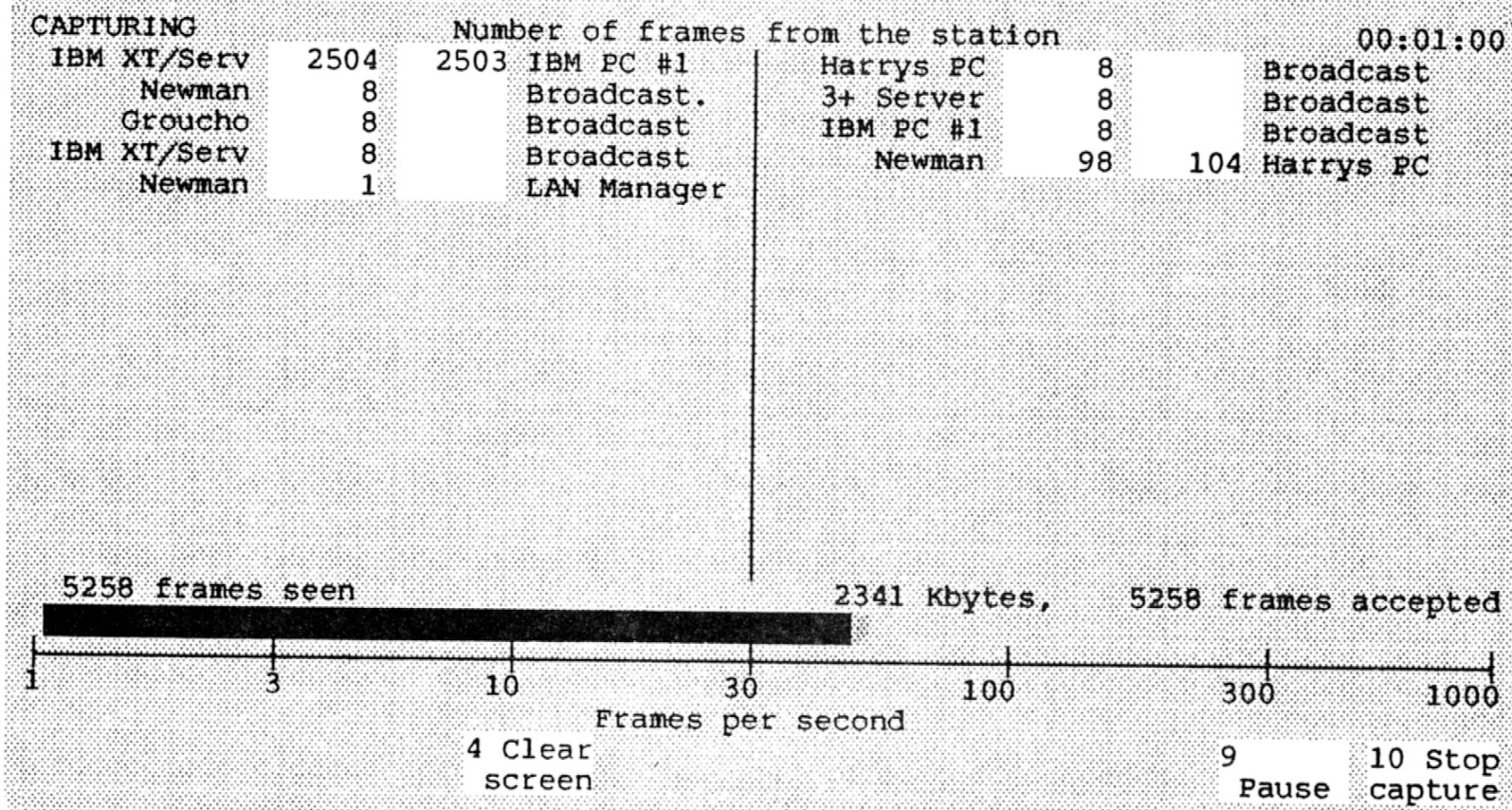


Figure 4-13: Pairwise tabulation during capture, by sending station and addressee.

SUMMARY	Delta t	DST	SRC	
25		Newman	+Harrys PC	SNA XID Fmt 3 T2 NETWORK .RCVP
26	0.010	Harrys PC	+Newman	SNA XID Fmt 3 T2 NETWORK .SEND
27	0.013	Harrys PC	+Newman	SNA XID Fmt 3 T2 NETWORK .SEND
28	0.009	Newman	+Harrys PC	SNA XID Fmt 3 T2 NETWORK .RCVP
29	0.016	Newman	+Harrys PC	SNA XID Fmt 3 T2 NETWORK .RCVP
30	0.008	Harrys PC	+Newman	SNA XID Fmt 3 T2 NETWORK .SEND
35	0.083	Harrys PC	+Newman	SNA REQ: BIND SENDLU
37	0.061	Newman	+Harrys PC	SNA RSP: BIND
39	0.044	Harrys PC	+Newman	SNA REQ: LUSTAT
41	0.028	Newman	+Harrys PC	SNA RSP: FMD
43	0.021	Newman	+Harrys PC	SNA REQ: BIS
45	0.021	Harrys PC	+Newman	SNA RSP: FMD
47	0.020	Harrys PC	+Newman	SNA REQ: BIS
49	0.059	Newman	+Harrys PC	SNA REQ: UNBIND
58	0.123	Newman	+Harrys PC	SNA XID Fmt 3 T2 NETWORK .RCVP
59	0.011	Harrys PC	+Newman	SNA XID Fmt 3 T2 NETWORK .SEND
60	0.013	Harrys PC	+Newman	SNA XID Fmt 3 T2 NETWORK .SEND
61	0.012	Newman	+Harrys PC	SNA XID Fmt 3 T2 NETWORK .RCVP
62	0.014	Newman	+Harrys PC	SNA XID Fmt 3 T2 NETWORK .RCVP
63	0.011	Harrys PC	+Newman	SNA XID Fmt 3 T2 NETWORK .SEND

1 Help 2 Set mark 5 Menus 6 Disply options 7 Prev frame 8 Next frame 10 New capture

Figure 5-11: Summary view, showing frame 35 in the context of neighboring frames.

SUMMARY	Rel time	From Mary	From Tom
59	7.582	NETBIOS +Mary	NET Find name TOMPC<03>
60	7.593		NET Name TOMPC<03> recognized
61	7.603	NET D=02 S=04	Session initialize
63	7.613		NET D=04 S=02 Session confirm
65	7.629	NET D=02 S=04	Data

DETAIL

SMB: Return code = 0,0 (OK)
SMB: Originator = "MARYXTSV"
SMB: Destination = "TOMPC"
SMB: [Message text]
SMB:

Frame 65 of 84

HEX	ASCII
0020 FF 53 4D 42 D0 00 00 00 00 00 00 00 00 00 00	.SMB.....
0030 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0040 00 23 00 04 4D 41 52 59 58 54 53 56 00 04 54 4F	.#..MARYXTSV TO
0050 4D 50 43 00 01 0F 00 48 65 6C 6C 6F 20 74 68 65	MPC....Hello the
0060 72 65 20 54 6F 6D	re Tom

Frame 65 of 84

- Use TAB to select windows
- | | | | | | | | |
|------|-------|--------|-------|-----------|--------|--------|---------|
| 1 | 2 Set | 4 Zoom | 5 | 6 Display | 7 Prev | 8 Next | 10 New |
| Help | mark | in | Menus | options | frame | frame | capture |

Figure 2-9: Transmission of the message.

```
SUMMARY-----Delta t-----From Newman
 35          0.055  SNA REQ: BIND SEN
 36          0.002
 37          0.058
 38          0.002  LLC R D=04 S=04 R
 39          0.041  SNA REQ: LUSTAT
```

```
DETAIL
----- SNA SC-RU (Session Control R

SC code = 31 (BIND: Bind Session)
Format/type flags = 00
FM profile flags = 13
-----Frame 35 of 225-----
```

```
HEX-----EBCDIC
0000 10 40 40 00 00 00 00 02 . . . . .
0008 40 00 00 00 00 01 04 04 . . . . .
0010 00 00 2D 00 01 01 00 0C . . . . .
0018 6B 80 00 31 00 13 07 B0 , . . . . .
0020 B0 D0 B1 02 00 85 85 80 .}...ee.
-----Frame 35 of 225-----
```

```
SUMMARY-----Delta t-----From Newman
 49          0.056
 50          0.002  LLC R D=04 S=04 R
 51          0.037  LLC C D=04 S=04 D
 52          0.000
 53          0.002
```

```
DETAIL
----- SNA SC-RU (Session Control R

SC code = 32 (UNBIND: Unbind Sessi

*** 1 byte(s) of additional data p
-----Frame 49 of 225-----
```

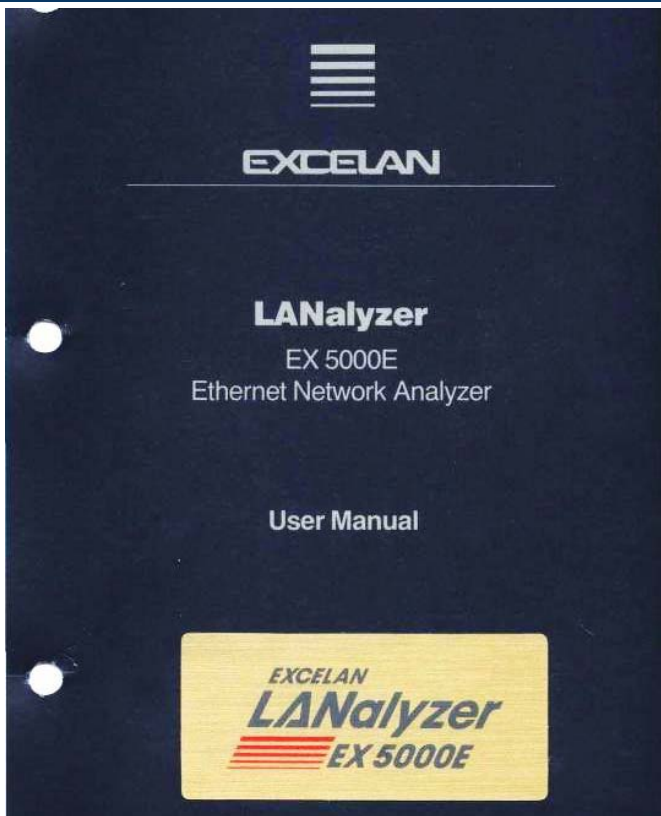
```
HEX-----EBCDIC
0000 10 40 40 00 00 00 00 01 . . . . .
0008 40 00 00 00 00 02 04 04 . . . . .
0010 06 08 2D 00 01 01 00 0E . . . . .
0018 6B 80 00 32 01 . . . . .
-----Frame 49 of 225-----
```

Use TAB to select windows

1	2 Set	4 Zoom	5	6Display	7 Prev	8 Next	10 New
Help	mark	in	Menus	options	frame	frame	capture

Figure 5-16: Two viewports, each with three windows.

Competition



“Nutcracker”

WALL STREET JOURNAL
OCT 4, 1995

The friendly reminder is brought to you by Network General.

Sniffer



“This friendly reminder is brought to you by Network General.”

Sniffer is a registered trademark of Network General Technology Corporation, a wholly owned subsidiary of Network General Corporation. In the five years that Sniffer has been a registered trademark, it has become synonymous with network analysis. But Sniffer is a brand name, not a generic term for a product category. So, please, use it only as an adjective to describe the Network General Sniffer line of network analysis products. Thanks.



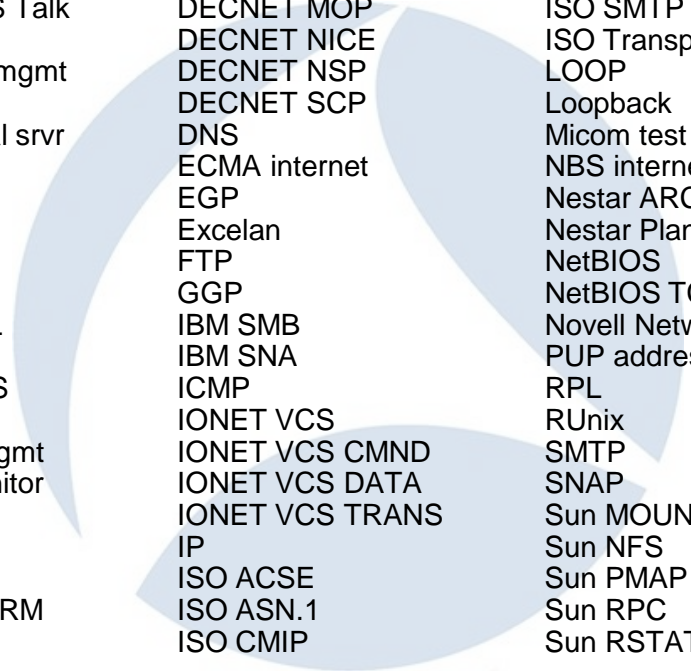
© 1995 Network General Corporation. Makers of the one and only Sniffer® Network Analyzers and Distributed Sniffer Systems®.

Wall Street Journal
Full page ad
October 4, 1995

The big wins

- **Ease of use**
- Many protocol interpreters
 - Obsessive about reverse-engineering proprietary protocols
 - Customer-written PIs
- Many network types

Standard Protocol interpreters



3COM 3+	Banyan VINES Ntwk Mgr	DECNET DRP	ISO Network	Sun YP
AppleTalk ADSP	Banyan VINES SPP	DECNET FOUND	ISO PPP	Symbolics private
AppleTalk AFP	Banyan VINES StreetTalk	DECNET LAT	ISO ROSE	TCP
AppleTalk ARP	Banyan VINES Svr Svc	DECNET LAVC	ISO Session	Telnet
AppleTalk ASP	Banyan VINES Talk	DECNET MOP	ISO SMTP	TFTP
AppleTalk ATP	BOOTP	DECNET NICE	ISO Transport	TRING DLC
AppleTalk DDP	Bridge bridge mgmt	DECNET NSP	LOOP	TRING LLC
AppleTalk ECHO	Bridge CS-1	DECNET SCP	Loopback	TRING MAC
AppleTalk KSP	Bridge terminal svr	DNS	Micom test	TRING RI
AppleTalk LAP	Chaosnet	ECMA internet	NBS internet	U-B
AppleTalk NBP	ComDesign	EGP	Nestar ARCnet	Vitalink bridge mgmt
AppleTalk PAP	Cronus direct	Excelan	Nestar PlanSeries	X.25
AppleTalk RTMP	Cronus VLN	FTP	NetBIOS	X.25 level 3
AppleTalk ZIP	Datapoint DLL	GGP	NetBIOS TCP	X.75 internet
ARP	Datapoint RCL	IBM SMB	Novell Netware	Xerox BOOTP
AT&T	Datapoint RIO	IBM SNA	PUP address translation	Xerox EGP
Banyan VINES AFRP	Datapoint RMS	ICMP	RPL	Xerox GGP
Banyan VINES Echo	DEC 911	IONET VCS	RUnix	Xerox ND
Banyan VINES File Svc	DEC bridge mgmt	IONET VCS CMND	SMTP	Xerox PUP
Banyan VINES FRP	DEC LAN monitor	IONET VCS DATA	SNAP	Xerox PUP ARP
Banyan VINES FTP	DEC LAST	IONET VCS TRANS	Sun MOUNT	Xerox RIP
Banyan VINES IP	DEC LAVC	IP	Sun NFS	Xerox TFTP
Banyan VINES LLC	DEC NetBIOS	ISO ACSE	Sun PMAP	Xerox XNS
Banyan VINES Loopback	DECNET CTERM	ISO ASN.1	Sun RPC	Xyplex
Banyan VINES Matchmaker	DECNET DAP	ISO CMIP	Sun RSTAT	

Network types

- IBM Token-Ring
- Token Bus
- Ethernet (thick, thin, twisted pair)
- Datapoint ARCnet
- Starlan
- AppleTalk
- Corvus Omninet
- FDDI
- ISDN
- Frame Relay
- SDLC
- ATM
- X.25
- Sytek/IBM broadband

a school for LAN managers



Expert Sniffer

TAKE IT FROM THE EXPERTS.

Delta	T	DST	SRC	
1		3Com 19CB63	<SunOpt118997	IPX Uninterpreted packet 1
2	0.0018	SunOpt118997	<3Com 19CB63	IPX Uninterpreted packet 1
3	19.3729	Broadcast	<3Com 19CB63	ARP C PA=[161.69.3.165] PB
4	0.0004	3Com 19CB63	<Compag88DE27	ARP R PA=[161.69.3.165] HW

Family	%Bytes	0	25	50	75	100	% Bandwidth	Frames/sec
AppleTalk	0.00						average 0	11
Banyan	0.00						current 0	35
DECnet	0.00						maximum 4	156
NetBIOS	0.00						bandwidth 18 Mb/s	
NetWare	0.18						duration 57s	
ISO	0.00						start run 07/31 13:39:14	
SNA	0.00						% analyzed 100	
TCP/IP	99.88						--- TCP/IP %Traffic ---	
XNS	0.00						HTTP 98.72	Telnet 0.00
Other/Err	0.00						News 0.00	Mail 0.00
							FTP 0.00	Other 1.03



EXPERT SNIFFER

The Industry's Most Advanced Network Problem Solving Tool.

When it comes to network troubleshooting, there's only one expert. Expert Sniffer®, the network analyzer from Network General.®

Expert Sniffer automatically pinpoints and identifies network problems. Then it goes one step further by suggest-

ing solutions in plain, readable English. Expert Sniffer also detects trouble signs before they become real problems, helping you prevent costly downtime.

Expert Sniffer's comprehensive protocol interpretation and expert analysis prompted

users to rate it #1 among protocol analyzers.* And LAN Times presented Expert Sniffer with both its Reader's Choice and Editor's Choice Awards.

Call for a free demo disk. And see for yourself why the experts agree, Expert Sniffer is a network essential.

1-800-SNIFFER #G2405



Combine your network expertise with Expert Sniffer to keep your network up and running.

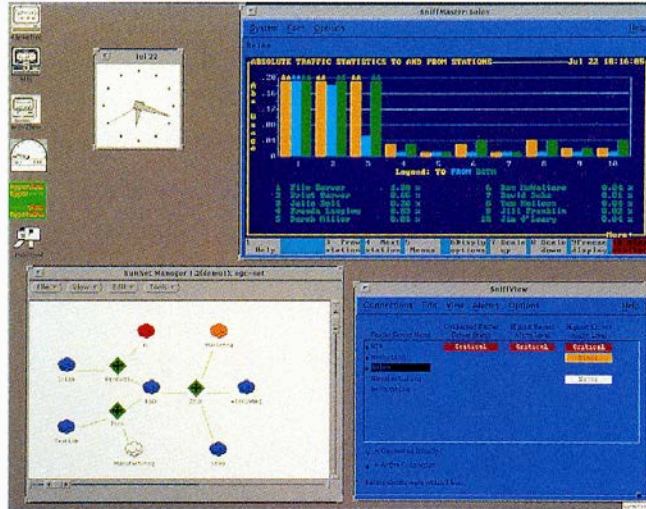
COME VISIT US AT NETWORK + INTEROP '94 AT BOOTH #2442.

© Copyright 1994 Network General Corporation. All rights reserved. Network General and Sniffer are registered trademarks of Network General Corporation. *From a recent ComputerWorld survey.

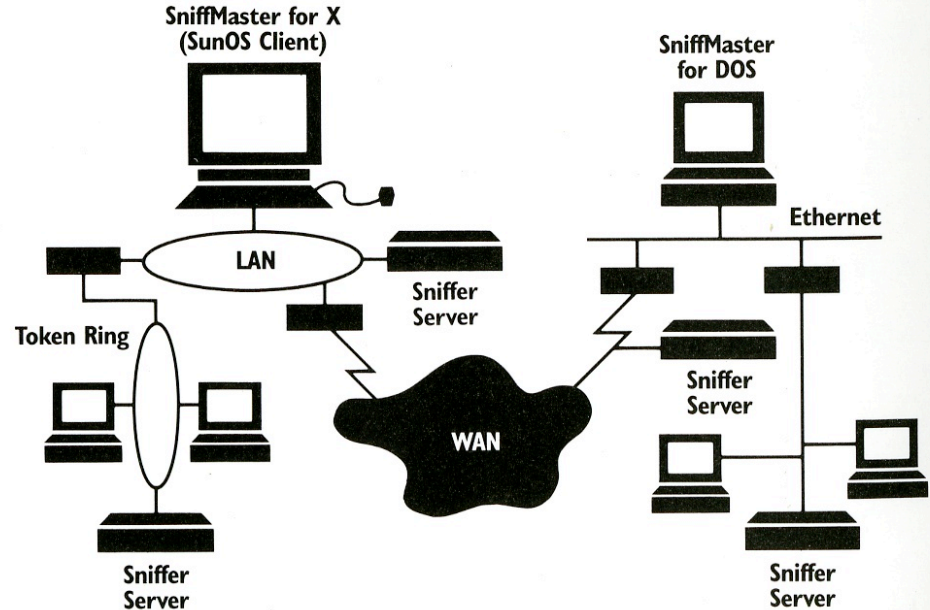
DSS: Distributed Sniffer

Distributed Sniffer Systems for Complex Networks

The Network General Distributed Sniffer System (DSS) provides the practical solution for network managers who need to diagnose the



SniffMaster for X (SunOS Client) runs on a Sun SPARCstation with SunOS 4.1x and X-Windows. Applications running on multiple Sniffer Servers may be displayed simultaneously. Access to SniffMaster for X may be gained by multiple X workstations—or terminals—located throughout the enterprise network.



Distributed Sniffer System on a Network

REVIEW

The Watchdog Sniffs Out LAN Traffic Statistics

Network General's Management Tool Presents a Vast Amount of Data in a Logical Way

BY PETER TAIT REVIEW BOARD

Local area networks have been around for more than a decade, and in that time the typical LAN has undergone incredible changes. It makes sense that the tools available for maintaining LANs should also evolve to keep pace with these changes.

Network General Corp.'s Network Monitor Watchdog 1.0 is an example of the latest kind of tool for LAN maintenance and troubleshooting. As networks grow, the high cost of system down time easily justifies the expense of sophisticated analysis or management tools such as Network General's Sniffer or Hewlett-Packard's Lanprobe.

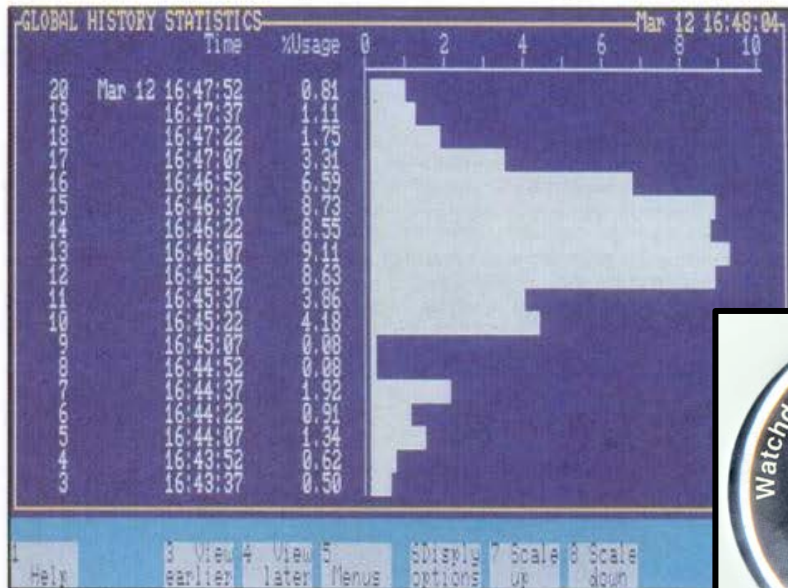
The problem: As PC LANs have proliferated, the average cost of each network node has dropped, making it harder to justify \$20,000 analysis tools for anything but the largest networks.

Watchdog provides some of the functionality of its big brother, the Sniffer, without any of the sophisticated protocol analysis features for about one-

tion of the packets on an Ethernet network are Novell, DEC-Net, XNS, or any of the other protocol types, what the average packet size is, and how many packet errors there are for each node. It cannot, however, disassemble a given packet into the rest of its protocol layers. Because the manager of a large network is more interested in knowing who is generating traffic or errors than what each data packet contains, this is likely to be a worthwhile trade-off for most users.

Watchdog consists of three components — a network adapter card, a TSR program that captures data from the network card, and the application software for displaying the captured information. In order to examine network packets straight off the wire, Watchdog uses its own network interface card, or NIC. (It must be ordered with the appropriate adapter for your network. Although Watchdog currently supports only Ethernet versions, a token ring version will be available by the end of the year.) The version we tested, for Ethernet networks, included a Racal Interlan card.

Using a separate NIC does offer a

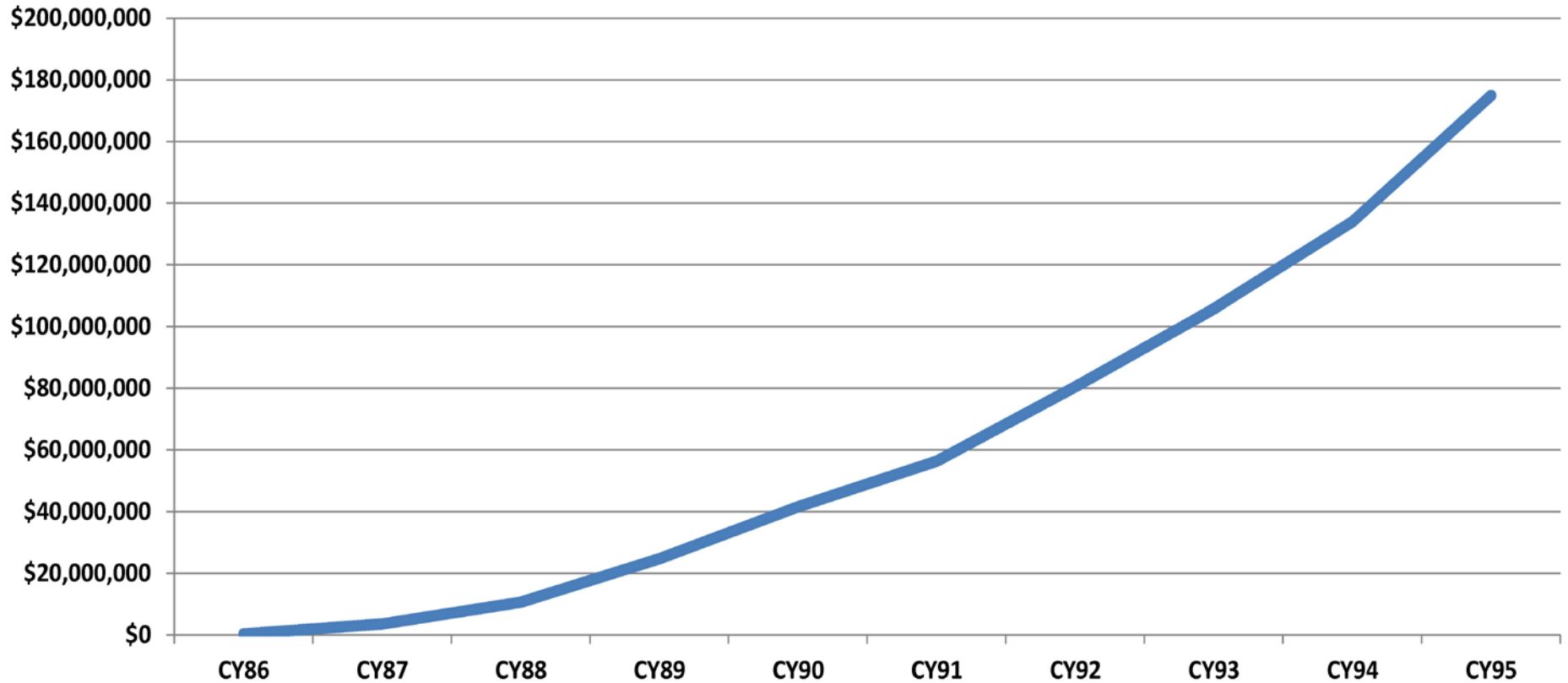


Network General's Watchdog Network Monitor can graphically display utilization of a period of time.

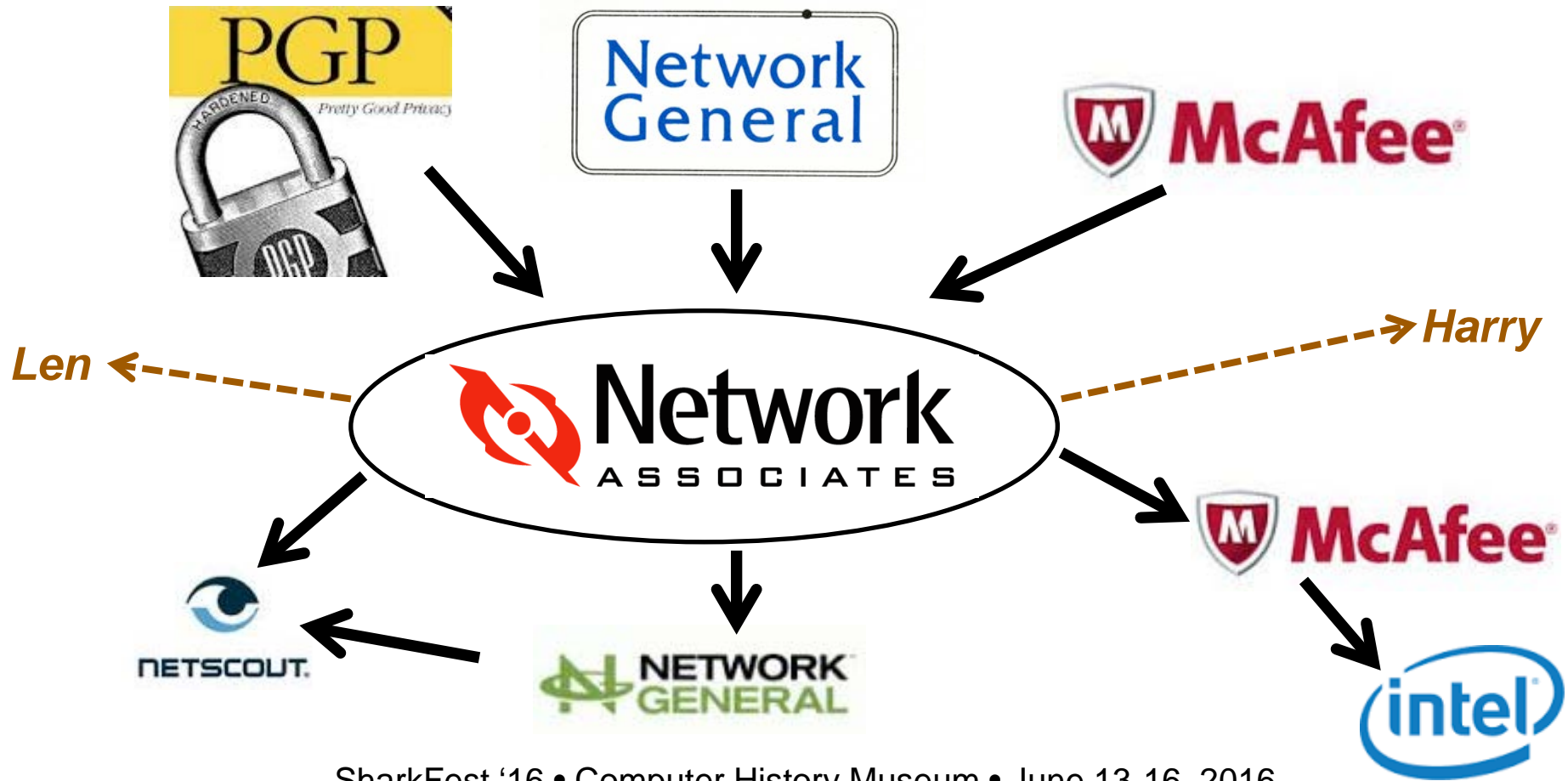


It's hard to keep growing

Network General revenue, \$



It gets complicated



the Sniffer ~~®~~ lives on...



ETHEREAL
PACKET SNIFFER

TCPDUMP & LIBPCAP



PACKET-SNIFFER
.NET





COMMERCIAL

SharkFest '16 • Computer History Museum • June 13-16, 2016



**Computer
History
Museum**

- **Collection**

- hardware, software, images, video, documents, source code, etc.

- **Exhibits (real and on the web)**

- **Public programs**

- **Historical research and journalist outreach**

- **Education**

- **Corporate archiving**

- **new: Software History Center**

- **new: “Exponential” Center on entrepreneurship**

Our warehouse,
20 minutes away



New third building:
Archival and
research center

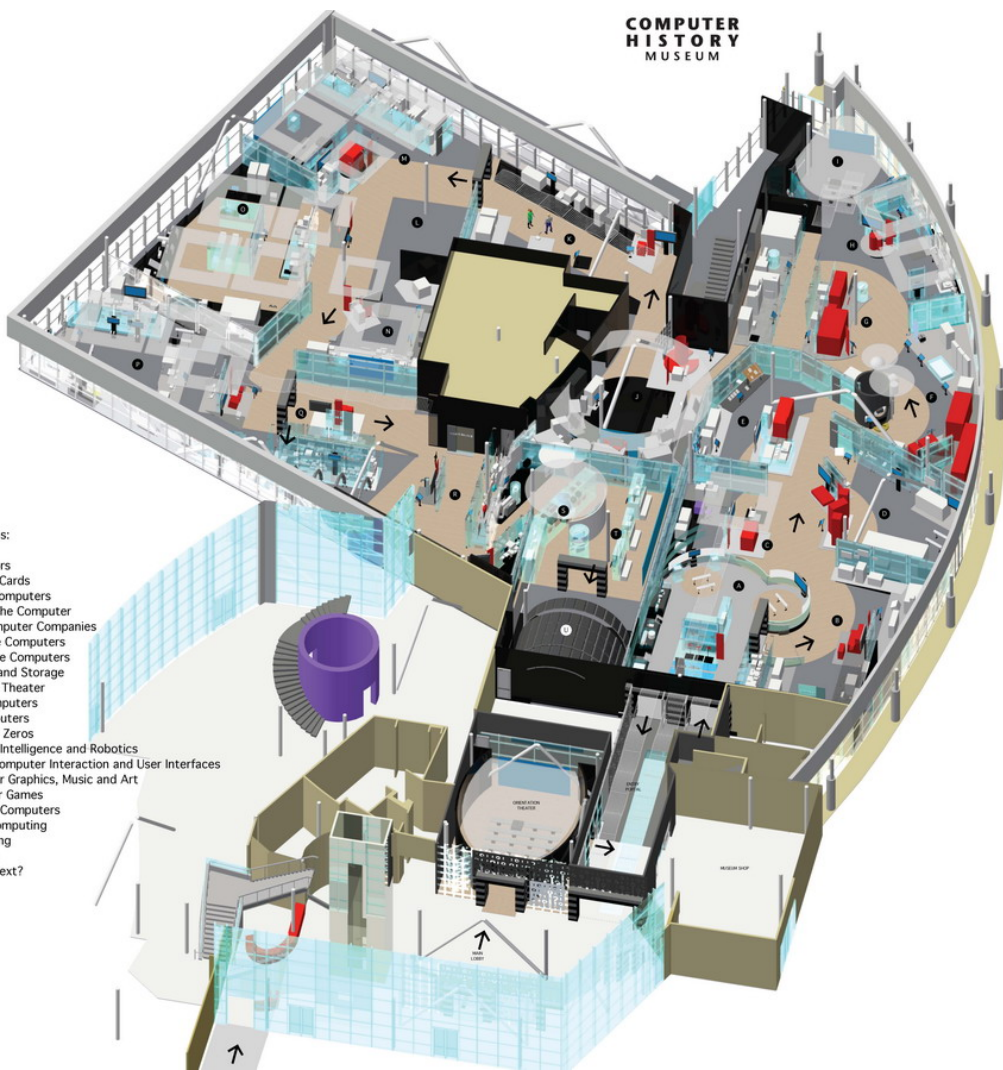
R | EVOLUTION

The First 2,000 Years of Computing

www.computerhistory.org

Exhibit Areas:

- A. Calculators
- B. Punched Cards
- C. Analog Computers
- D. Birth of the Computer
- E. Early Computer Companies
- F. Real Time Computers
- G. Mainframe Computers
- H. Memory and Storage
- I. Software Theater
- J. Supercomputers
- K. Minicomputers
- L. Ones and Zeros
- M. Artificial Intelligence and Robotics
- N. Human Computer Interaction and User Interfaces
- O. Computer Graphics, Music and Art
- P. Computer Games
- Q. Personal Computers
- R. Mobile Computing
- S. Networking
- T. The Web
- U. What's Next?



R|EVOLUTION

The First 2000 Years of Computing



16, 2016

The IBM 360



THE IBM 360 SYSTEM

The IBM 360 system is a family of mainframe computers that was introduced in 1964. It was designed to be a single system architecture, meaning that it could handle a wide range of applications and workloads. The system was composed of several different models, ranging from the small IBM 360/31 to the large IBM 360/91. The 360 system was a major success for IBM, and it helped to establish the company as a leader in the mainframe computer market.

SYSTEMS AND SOFTWARE

The IBM 360 system was designed to be flexible and adaptable. It could be configured in a variety of ways to meet the needs of different organizations. The system was supported by a wide range of software, including operating systems, compilers, and applications. The IBM 360 system was also known for its reliability and performance, and it was used by many of the world's largest corporations.

SYSTEMS AND SOFTWARE

The IBM 360 system was designed to be flexible and adaptable. It could be configured in a variety of ways to meet the needs of different organizations. The system was supported by a wide range of software, including operating systems, compilers, and applications. The IBM 360 system was also known for its reliability and performance, and it was used by many of the world's largest corporations.

SYSTEMS AND SOFTWARE

The IBM 360 system was designed to be flexible and adaptable. It could be configured in a variety of ways to meet the needs of different organizations. The system was supported by a wide range of software, including operating systems, compilers, and applications. The IBM 360 system was also known for its reliability and performance, and it was used by many of the world's largest corporations.

SYSTEMS AND SOFTWARE

The IBM 360 system was designed to be flexible and adaptable. It could be configured in a variety of ways to meet the needs of different organizations. The system was supported by a wide range of software, including operating systems, compilers, and applications. The IBM 360 system was also known for its reliability and performance, and it was used by many of the world's largest corporations.

SYSTEMS AND SOFTWARE

The IBM 360 system was designed to be flexible and adaptable. It could be configured in a variety of ways to meet the needs of different organizations. The system was supported by a wide range of software, including operating systems, compilers, and applications. The IBM 360 system was also known for its reliability and performance, and it was used by many of the world's largest corporations.

NEWSLETTER

Homebrew Computer Club

Robert Peck, Editor - Post Office Box 618, Redwood City, CA 94062 - Tel. 650. 734. 3000



FM TUNER SPECIFICATIONS

r Electronics

VOLUME ELECTRONICS MAGAZINE - JANUARY 1975 / \$2.50

SAVE ENOUGH!

World's First Minicomputer Kit

Rival Commercial Models...

10" SAVE OVER \$1000

DIGITAL COMPUTER



KENBAK-1

FUN Modern

Small schools can't understand it. The only way to assure the reader is appropriate for the first time can learn its three five address

can write program interest. PRICE \$790.00 KENBAK-1 CORP. P.O. Box 1324 Los Angeles, CA 90048

- Scientific Calculator Project
- CCD's-TV Camera Tube Successor?
- Thyristor-Controlled Photoflashers?

random data

SEE YOU AT

SEE YOU AT

onal
ne
goals
started
ermed
es
y minute

1975, LA
1975, 1976
1977, 1978
1979, 1980
1981, 1982
1983, 1984
1985, 1986
1987, 1988
1989, 1990
1991, 1992
1993, 1994
1995, 1996
1997, 1998
1999, 2000
2001, 2002
2003, 2004
2005, 2006
2007, 2008
2009, 2010
2011, 2012
2013, 2014
2015, 2016
2017, 2018
2019, 2020
2021, 2022
2023, 2024
2025, 2026
2027, 2028
2029, 2030
2031, 2032
2033, 2034
2035, 2036
2037, 2038
2039, 2040
2041, 2042
2043, 2044
2045, 2046
2047, 2048
2049, 2050
2051, 2052
2053, 2054
2055, 2056
2057, 2058
2059, 2060
2061, 2062
2063, 2064
2065, 2066
2067, 2068
2069, 2070
2071, 2072
2073, 2074
2075, 2076
2077, 2078
2079, 2080
2081, 2082
2083, 2084
2085, 2086
2087, 2088
2089, 2090
2091, 2092
2093, 2094
2095, 2096
2097, 2098
2099, 2100

The End



SharkFest '16 • Computer History Museum • June 13-16, 2016