Dataquest

a company of
The Dun & Bradstreet Corporation

1290 Ridder Park Drive, San Jose, CA 95131-2398
(408) 437-8000 Telex 171973 Fax (408) 437-0292

October 11, 1993

Dear Conference Attendee:

Welcome to our 1993 Worldwide Semiconductor Industry Conference!

Please find attached a special "Look at 1993" version of DQ Monday and a description of the Dataquest 100 High-Technology Stock Index. As a Dataquest Semiconductor service subscriber, you receive a single-user on-line copy of the regular weekly issues. Please contact your account representative for information on redistribution rights of these documents within your organization.

We hope you enjoy yourself during the conference, and please call us with any questions or comments.

Best Regards,

Gene Norrett

Gene Norrett
Vice President and Group Director
Semiconductor Group

What is DQ Monday?

DQ Monday is a weekly market intelligence report which provides its readers with a summary of the important product, market and company news of the prior week. Dataquest's worldwide semiconductor clients access the service electronically via Compuserve. Below is a brief description of the following modules of information a typical DQ Monday report includes:

Economic Weather Report: This section is used to report news on leading economic indicators such as reports from the American Electronics Association, consumer confidence levels, employment outlooks, semiconductor book-to-bill ratio, and other information on the economy which impacts our readers.

DQ Take: The DQ Take includes the top stories of the week with our analysis or "take" on what it means to the company and industry as a whole. The analysis is short and concise, usually only a couple of paragraphs long. If the reader is interested he or she can call the analyst for additional information.

In the News: This section includes information which is not headline material but is worth mentioning. Company alliances, new product introductions, advancements in technology, and other newsworthy items are included here. Inquiries are often prompted by information appearing in this section.

Events: This is a list of conferences, exhibitions and seminars for the high-tech industry which will be taking place in the coming months.

Financial Results / Notes: Revenue and income comparisons are reported from company quarterly financials. This section also includes company outlooks and forecasts as well as information reported to stockholders.

Analyst's Notes: This section appears periodically and includes information obtained at briefings and conferences which is not under NDA and can be shared with our client base. This section provides our readers with a unique source of primary information. This is done in a bulletized fashion with less analysis.

DQ Perspective: The DQ Perspective provides an avenue for the analysts in the semiconductor group to write a more in-depth analysis on a hot topic of the week or a particular subject of interest.

People in the Industry: This section contains quick bullets on executive assignments in the industry.

Monthly Pricing Survey: Once a month pricing snapshots by region of the world are provided on 25 key semiconductor products along with a concise analysis of the current market conditions in each region.

The DQ 100: A weekly stock index tracking the top 100 companies in Silicon Valley. DQ is currently putting an index together which represents companies east of the valley as well.

DQ MONDAY

Industry Events and Analyst Insights

Special Conference Sample Edition

A look at 1993

(The following items represent industry events which have occurred during 1993 and have appeared throughout the year in weekly issues of DQ Monday. This special issue will acquaint the reader with the type of coverage provided in Dataquest's premier on-line market intelligence report. The ** mark indicates more information appeared in the issue dated next to the headline but was left out to lessen the bulk of this document. The analysis provided is generated by Dataquest's worldwide staff of industry analysts.)

BOOK TO BILL SLIPS TO 1.07

In August U.S. market bookings were down 2.3% to $2236.7 million from July's $2289.0 million. August billings are up 37.0% compared to August 1992's $11632.3 million. Compared to the last mid-quarter month, May 1993, August orders are up 0.7%.

Billings in August increased 10.6% to $2051.6 million from July's $1854.4 million. August billings are up 37.6% compared to August 1992's $1490.9 million, Compared to May 1992 billings, August billings are up 8.0%.

U.S. BOOK-TO-BILL RATIO: JAN '89 TO PRESENT
(Three-month Average Orders Booked Divided By Three-Month Average Sales Billed.)

Month	1993	1992	1991	1990	1989
JAN	1.20	1.09	1.03	1.06	1.02
FEB	1.19	1.11	1.14	1.08	1.08
MAR	1.17	1.07	1.10	1.15	1.07
APR	1.16	1.12	1.14	1.15	1.06
MAY	1.13	1.11	1.06	1.15	1.00
JUN	1.11	1.14	1.01	1.06	0.98
JUL	1.12	1.08	0.97	1.02	0.92
AUG	1.07p	1.09	0.97	1.00	0.90
SEP		1.07	0.94	0.96	0.88
OCT		1.11	0.95	0.96	0.92
NOV		1.13	1.01	0.93	0.95
DEC		1.11	1.07	1.00	1.01

(The Book-to-Bill Ratio is provided by the World Semiconductor Trade Statistics through the Semiconductor Industry Association)

1290 Ridder Park Drive, San Jose, CA 95131-2398 / (408) 437-8000 / Telex 127193 / Fax (408) 437-0292

DQ TAKE

SUMITOMO CHEMICAL UPDATE 7/19/93

As of July 13, 1993, Sumitomo Chemical representatives from headquarters in Japan, had reported that due to the continued investigation of the damaged facility, they were unable to provide a full report on the extent of the damage to their ECN resin facility/supply. The following information on the supply of ECN from Japan is as follows:

Manufacturer	Production Capacity	Actual Production Level
Sumitomo Chemical	11,000 MT/year	7,500 MT/year
Nippon Kayaku	6,000 MT/year	5,000 MT/year
Toto Kasei	2,000 MT/year	2,000 MT/year
DaiNippon Ink	1,500 MT/year	1,500 MT/year
Yuka Shell	500 MT/year	300 MT/year
Total	21,000 MT/year	16,300 MT/year

Sumitomo Chemical has estimated that they have a two months supply of epoxy resin and molding compounds.

Companies that use/procure Sumitomo ECN resin for their epoxy resin and molding compound development are as follows:

Manufacturer	Market Share
Nitto Denko	47 %
Sumitomo Bakelite	29 %
Hitachi Kasei	12 %
Toshiba Chemical	5 %
Shinetsu Chemical	5 %
Others	2 %

DQ Take: After further research with other industry sources in Japan, Europe, and the United States, Dataquest has heard that the government of Japan, through MITI, has stepped into the Sumitomo Chemical fray to monitor the utilization of the ECN resin. Industry sources believe that distribution of available supply will be by priority: Japan users first, followed by U.S. and then Korean. Industry sources have reported that Sumitomo Chemical has other warehouses for storage of the ECN resin in different areas from the fire damaged facility, but confirmation from Sumitomo on this have not been made available to the industry.

North American sources have approximately 8 to 10 weeks supply of ECN resin, and currently do not perceive a shortage for at least 3 months. Given the excess capacity available from suppliers in Japan, Europe and North America, we believe that the industry demand will not be affected for another 4 to 6 months or late 1993, early 1994. Customers of Sumitomo Chemical's ECN resin reported a 10 percent increase in the price of this raw material during the first quarter of 1993. Any price increases that develop from this would begin to appear during the third quarter of 1993.

Dataquest's memory group has already heard that some SRAM suppliers are increasing prices. Major DRAM suppliers have expressed concern about available supplies of

1290 Ridder Park Drive, San Jose, CA 95131-2398 / (408) 437-8000 / Telex 127193 / Fax (408) 437-0292

molding compounds for DRAM encapsulation. According to Korean semiconductor suppliers, there is currently a 3 months supply of the compound. They have reported a supplier in Taiwan, as well as in Korea.

Dataquest is currently contacting other previous sources of ECN resins for potential interest as future sources of supply. In a recent Dataquest Alert, Dexter/Hysol and Plaskon were referred as sources of epoxy resin. Both companies procure ECN resin for production of formulated epoxy products and other molding compounds. As such, they are available sources of supply for formulated epoxy products and molding compounds for North America. Dexter/Hysol and Plaskon do not procure the ECN resins and resell under their own "private-label". For certain IC packages, Dexter/Hysol supplies liquid encapsulants or other molding compounds to minimize use of ECN based molding compounds. Non ECN based encapsulants are also used for discretes and diodes. Other companies that have participated in the ECN market are Dow, and Ciba-Geigy. Dow was a supplier of high purity ECN resin to the semiconductor market approximately two years ago. Lack of support in the domestic market resulted in Dow's decision to use the ECN resin producing plant for an alternative product.

Mary A. Olsson

TOSHIBA VIEWS FLASH MEMORY AS ANOTHER TECHNOLOGY DRIVER 1/25/93

Toshiba Corp. will focus on DRAM and flash memory as technology drivers in its semiconductor business. By 1995-96 the company's ULSI Research Laboratory plans to finish developing a 128Mbit flash memory chip. Toshiba plans to commercialize 32Mbit chips within the year and release 64Mbit products in 1994.

DQ Take: The requirements for a process driver are, in short (1) the product can sell in high volumes onto a ready market, so that production can be ramped without having to delay for the design-to-volume production cycle, and a cash flow can be created to defray manufacturing costs, (2) require fineline lithography--push the state of the art, (3) high manufacturing cost content as a fraction of selling price,(4) significant fraction of process that is developed is usable and transferable to other products.

Although DRAMs have been viewed as the "Process Driver" for most companies, both Hitachi and Toshiba used SRAMs to drive their processes in the early 1980s, and today, Intel uses their broad MPU line. After many U.S. makers were driven from the DRAM market in the mid-1980s, Texas Instruments considered EPROMs for their process driver.

At the recent IEDM meeting, and in several other recent forums, there has been much discussion of ASICs or logic as the Process Drivers of the future, as DRAM technology was viewed as diverging too far from the mainstream processes that could be used across the entire product line.

Lane Mason

EC AND KOREAN MANUFACTURERS REACH MONITORING AGREEMENT IN DRAM 2/8/93

It was reported that the European Community and South Korean DRAM producers have reached a preliminary settlement in the EC's product dumping complaint by agreeing to set up a "fast track" cost/price monitoring system that deals separately with Korea's DRAM threesome, Goldstar, Hyundai and Samsung. Under the agreement, confirmed last week by a Samsung, the Korean suppliers are promising not to dump DRAMs in Europe and have agreed to supply the

1290 Ridder Park Drive, San Jose, CA 95131-2398 / (408) 437-8000 / Telex 127193 / Fax (408) 437-0292

EC with cost and pricing data for the confidential monitoring system. If Korean DRAM dumping is suspected, the EC has immediate access to the data to make an evaluation. If dumping is determined, the penalty would be a 24.7% duty, compared with the 10.1% provisional anti-dumping tariff effective since September. As yet still oozing through the system the EC negotiators believe the agreement could be approved by the Commission sometime before Spring.

DQ Take: The proposed settlement to the EC-Korean DRAM dumping complaint is the most pragmatic and fair government response seen to date coming from the EC that will: 1. Allow for quick resolution of future (if any) dumping allegations, and 2. Not disrupt the currently uncertain DRAM market. Apparently patterned after the U.S. DOC's super 301 anti-dumping law, the EC proposal, if approved, should prove as effective in implementation and in effect. The decision makers of the upcoming final determination of the U.S.-Korean DRAM dumping case due next month would be wise to look at the fine print of this proposal and coordinate their legislation where possible. If coordinated well, unfair price competition would be dealt with quickly in most regions of the world and no region would be stigmatized as the "high cost island" in the world DRAM market. While the indigenous DRAM industry of each region was the instigator of each of these complaints, the outcome affects a much larger electronics (PC in particular) industry. The current EC proposal addresses the dumping issue head on, yet realizes the necessity to keep the overall electronics industry of the region competitive. DOC take note!

Mark Giudici

MICRON LICENSES DIE-LEVEL BURN-IN TECHNOLOGY TO CHIP SUPPLY 3/22/93

Micron Semiconductor announced that it has finalized an agreement to license its "Softool KGD Plus" technology to Chip Supply, of Orlando Florida. The technology will allow both companies to produce fully-tested, burned-in, military-grade semiconductor dice with component yields comparable to yields of packaged devices.

DQ TAKE Here is an example of one of those relations that just makes good sense. Chip Supply has made a name for itself in the semiconductor market by providing a unique service. The company purchases unpackaged devices from a number of vendors, and sorts them according to the needs of hybrid and multichip module (MCM) manufacturers. This is a small business (North America's 1993 usage was $143 million according to Dataquest's Multichip Module Packaging Report) fundamentally custom in nature, so it requires a high level of vendor/purchaser interaction. Micron Technology, on the other hand, prides itself in its volume production prowess, and is currently evaluating ways of off-loading its military business, which provided a good base for the company to grow from in the eighties, but lately is anything but their most important market.

Both Micron and Chip Supply realized that the Micron die-level burn-in capability was a good technology back in 1991, when it was first announced by Micron. This cutting-edge technology was previously not commercially available. There is a growing interest in MCMs, but costs tend to be high because of the level of rework necessitated by the use of untested devices. The die-level burn-in technology which will be alternate-sourced through this agreement will certainly provide a timely solution to one of the industry's knottier problems.

Jim Handy and Mary A. Olson

1290 Ridder Park Drive, San Jose, CA 95131-2398 / (408) 437-8000 / Telex 127193 / Fax (408) 437-0292

ADI INTRODUCES ASYNCHRONOUS DIGITAL AUDIO PROCESSORS 8/16/93
Analog Devices Inc. has introduced the first ICs that are dedicated digital sample rate converters. They are designed to work with arbitrarily clocked sample data rates or dynamically changing sample rates on digital data such as that caused by clock jitter. The ICs, given the trademarked name of Sampleport ICs, convert data from a wide range of input sample rates to the user-set output rate. No user programming is required. The AD1890 and AD1891 are 20 bit and 16 bit devices respectively and are priced at $34 and $21 in 1,000 piece quantities. Performance specs include a 106-dB minimum THD+N and 120-dB minimum dynamic range

DQ Take: Despite the ideal of DSP, signal processing necessarily operates in real-time and is subject to real-world (i.e. analog) variations. Digital coding involves a clock source at the time of the A/D conversion, a clock source that is usually embedded in the data stream, to minimize synchronization problems at the reproduction end. Clock jitter and clock drift can create distortion in audio reproduction, especially in delta-sigma converters, just as drift in linear components did in analog systems. Even when an embedded clock signal is available, it must be recovered accurately, not always an easy task when distorted by the transmission link.

In addition to the sampling rate stability problem is the dilemma resulting from myriad sampling rate standards. Digital consumer audio, telephone and multimedia standards all use different sets of sampling rates. Multimedia audio alone uses rates of 44.1, 37.8, 22.05, 18.9 and 10.025 khz sampling rates. CD, DAT, DCC and MiniDisc add another set of different sampling rates. General purpose multimedia audio systems will require a wide range of sample rate interoperability to accommodate all of these standards, especially as computer, communications and consumer products converge.

The AD1890 and AD1891 ICs are intended to solve these sample rate and clocking problems known to few outside of professional audio circles. Past fixes have required complex and expensive DSP systems. The growth of digital audio, in it's many formats, into the consumer and computer markets will depend on simpler and more cost-effective solutions, especially for the interoperability problem. Today, the market for these ICs is relatively small. However, just as DSP has led to a rapid increase in audio system complexity and features in just a few years time (16 bit audio has become the standard in multimedia PCs, FM synthesis giving way to wave table lookup, etc.), we expect that sample rate conversion will become a requirement in high end multimedia and audio systems.

Gary Granbois

MOTOROLA EXPANDS MICROCONTROLLER AND DSP CAPACITY IN SCOTLAND 8/23/93
Motorola announced that it will invest $73 million to expand its East Kilbride facility. The East Kilbride plant, produces a wide range of both standard and custom microprocessor and memory for markets in the UK and mainland Europe. Motorola also has two other facilities in Scotland, located in Easter Inch and Livingston.

DQ Take: Motorola's lead times have been extending dramatically for certain part types in its microcontroller families. This expansion is due to the high demand for Motorola's 68HC05 and to a lesser extent its 68HC11 family of microcontrollers. This high demand is fueled by consumer, automotive, and communications applications. The Scotland facility is already experienced in manufacturing these product types and should experience no major difficulties in qualifying these products for production once the facility is ready.

Jerry Banks

1290 Ridder Park Drive, San Jose, CA 95131-2398 / (408) 437-8000 / Telex 127193 / Fax (408) 437-0292

MICROMODULE SYSTEMS ANNOUNCES CACHE RAMs 8/30/93
MicroModule Systems announced a family of high performance cache RAMs in 32Kx72 configuration with speeds of 9, 10, or 12ns. All modules are available using synchronous, burst mode and asynchronous technologies. Samples will be available Q4 starting at $400. Volume is expected Q1 next year. Products are in EIAJ-standard 28x28 mm plastic (PQFP) packages.

DQ Take: Not long ago, this analyst was highly skeptical of the prospects of the Multichip Module (MCM). It looked like an expensive way to provide an infinitesimally small speed advantage to the high-speed interface between caches and CPUs. One visit to MicroModule Systems reversed this perception. The company has found ways to conquer all of the cost issues related to the manufacture of MCMs, right down to the point that they even manufacture modules for the cutthroat consumer PC market, and these modules are cost-effective replacements for simple CPU/cache upgrade circuit cards.

This new product addresses some of the most vexing aspects of Pentium cache design. Typical 486 caches use interleaved banks of SRAMs to burst data back into the CPU at full speed. This means that a cache for this 32-bit processor would require eight byte-wide SRAMs to be tied to the CPU's address bus. Since the Pentium has a 64-bit data bus, sixteen byte-wide SRAMs would be required to support full-speed bursting. The capacitive loading of all of these SRAMs and the required PC board signal traces (around 200-300pF per pin) would cause 40MHz operation to be difficult, 50MHz to be mind-numbing, and the Pentium's 66MHz speed to be virtually unattainable. Through the use of bursting SRAMs, the same devices which are contained within the MicroModule cache, the loading can be halved, but this still doesn't solve the problem. MicroModule's approach has removed nearly all of the package-related and trace-related capacitance from the cache design by squeezing eight unpackaged bursting SRAMs into a single tiny flat pack with very short, low-capacitance traces. As a result, the capacitance drops to about 15pF/pin. That's impressive!

This part does an awful lot to solve the headaches of Pentium cache design, and it's very reasonably priced, so we think its prospects are excellent. MicroModule Systems will be a company to watch.

Jim Handy

IBM ANNOUNCES BLUE LIGHTNING FAMILY OF 486 SUBSYSTEMS 8/2/93
IBM (today) announced its Blue Lightning family of 486 compatible subsystems (a microprocessor configured on a populated PC motherboard or processor daughtercard). Included are 33/100 MHz, 25/75 MHz, 33/66 MHz and 25/50 MHz products. Pricing ranges from $400 to $700 in lots of 1000 per month. Most will be available in quantity in the Fall. Samples are ready now.

DQ Take: With the announcement of Blue Lightning, IBM has proven that it can make a high performance cost effective piece of silicon. Now it must overcome the other barriers to entry into the 486 market which Intel is rapidly striving to build. To start with, Blue Lightning is 486SX instruction set compatible. In simple terms, this means that it has no floating point unit. Intel is striving to make the 486DX2 the processor of choice for desktop applications. This clock doubled 486 includes an on-board floating point unit, and it is Intel's hope that an FPU will become one of those "check off" items consumers are looking for when they make their buy decision. IBM must put together a marketing campaign which supports their contention that for most desktop business applications, a floating point unit is superfluous, and in fact adds unnecessary cost.

Additionally, Intel is working on multiple derivatives of its 486 family in the hopes that its competitors (IBM, AMD, Cyrix/TI) will constantly be playing catch up. In order to avoid playing the catch up game IBM will have continue to develop differentiated products and offer system designers a clear alternative for next generation x86 based designs.

IBM has demonstrated leading edge process technology, it apparently has a strong processor development team. The company must now overcome the huge amount of marketing momentum which Intel has developed. This appears to be the company's biggest challenge, and it is too soon to tell how successful they will be in meeting this challenge.

Jerry Banks

LAM PLAYING LIKE A FOX 9/13/93

Lam Research got a couple of wins last week which will add to an already heated battle between itself and Applied Materials, the leading supplier of etchers. First it received R&D Magazine's top product innovation award, the R&D 100, for its Transformer Coupled Plasma (TCP) technology, which was introduced last year and is used to manufacture 16-Mb and up(64, 256...etc.) devices.. Lam offers to TCP products, the TCP 9400 polysilicon etch system and the TCP 9600 metal etch system. Lam also became the first recipient of IBM Microelectronics Customer Satisfaction Award. IBM reports that this annual award distinguishes equipment suppliers that exhibit exemplary commitment to customer satisfaction in all areas of interaction with IBM.

DQ Take: These two items reflect positively the major realignment of the company a couple of years ago, which placed emphasis along product and application markets. This increased focus has improved both the product technology and quality. As a result Lam Research may surpass the sales of Applied Materials this year in dry etch equipment, becoming the largest supplier of etchers in the world.

Clark Fuhs

FCC LAYS GAUNTLET FOR NEW PCN SERVICES 9/27/93

The FCC has issued the rules for auctioning the part of the spectrum pertaining to wireless Personal Communication Networks (PCNs). PCN services would functionally compete with voice and data cellular services, paging services, and even the home and office phone. The precedent setting auction would allocate 160 MHz of spectrum in the 1.8 to 2.2 GHz band. The auction is slated to occur sometime after March 1994 and will entail issuing licenses for 51 metropolitan trading areas and 492 basic trading areas. The door is open for cellular telephone companies to bid within certain restrictions. The auction could raise $8-10 billion for the federal treasury.

DQ Take: From the perspective of a semiconductor supplier this announcement provides a more secure time table for the development of a new equipment market. PCN services will require handset and base station technology not very dissimilar to that of digital cellular now being tested around the US. The key question at this point is the value proposition this microcell technology presents versus existing solutions like cellular phones, pagers, and cordless phones. Advocates say the higher frequencies and smaller cell size translates into smaller handsets with better noise qualities. Its our opinion that CDMA-based spread spectrum technology is the favored implementation candidate for

1290 Ridder Park Drive, San Jose, CA 95131-2398 / (408) 437-8000 / Telex 127193 / Fax (408) 437-0292

these new handsets. Although it will most likely be two more years until substantial services sprout, technology partnering with handset makers is happening now.

Gregory Sheppard

Additional DQ Monday "take" examples include:

INTEL SELECTS NEW MEXICO AS SITE OF NEW $1 BILLION FAB EXPANSION 4/5/93**

NEC TO ASSEMBLE 4MB DRAMs IN CHINA 6/7/93**

SUMITOMO UPDATE: Is Dow in or out? 8/16/93**

SUMITOMO PRESS RELEASE ON LAST MONTHS EXPLOSION 8/2/93**

Special Report: Ramifications of the Sumitomo Chemical Factory Explosion 7/11/93**

XILINX/ALTERA TRADE LAWSUITS 6/14/93**

HITACHI'S CUT IN STEPPER ACTIVITIES IS LATEST MOVE IN CONSOLIDATION 6/21/93**

MEDIA VISION INTRODUCES NEW SOUND CARD WITH WAVETABLE FROM KORG 8/9/93**

IN THE NEWS . . .

Product

PIONEER DEVELOPS MULTI-STANDARD COMPRESSION CHIP SETS 6/7/93
Pioneer Electronic Corp. announced it has developed the "CD 1100" series of compressed image decoder chip sets that comply with the MPEG1, JPEG and H.261 international standards and are capable of 25 Mbps decoding. "CD 1101" is a spatial decoder, "CD 1102" is a temporal decoder, and "CD 1103" is a video formatter. CD 1103 is still under development. The new chip sets will be used in such applications as CATV, packaged media (CD-ROM, etc.), video cameras, video conferencing and video phones. Pioneer is also developing a version that will comply with the forthcoming MPEG2 standard. The chip sets were developed at the Pioneer Digital Design Center Ltd. in the UK and will be manufactured in Japan.

ALR SHIPPING PENTIUM BASED PC SYSTEMS 7/11/93
Advanced Logic Research is shipping the Evolution V which offers 64-bit design and 8 MB of memory on the motherboard expandable to 128 MB. The $2,495 price does not include a hard disc drive or monitor For another grand a full system with a 170 MB hard disk drive, DOS, Windows, a mouse, VESA local bus and 1024 by 768 resolution screen are thrown in. ALR says it can deliver PCs with the Pentium in two to three weeks but warns of allocation issues with Intel.

GEC PLESSEY ANNOUNCES CREDIT CARD SIZED TRANSCEIVER 8/16/93
GEC announced its DE6003 Cordless Data Transceiver which will allow users to exchange broadband data on wireless LANs or to "connect" multiple PDAs or point of sale terminals. The

plug in module handles all the radio aspects and designers provide the protocol interface for a particular application. Price is $250 in lots of 10,000.

VLSI ANNOUNCES QUAD T1/E1 LINE INTERFACE UNIT 9/6/93
VLSI Technology announced a four-channel Line Interface unit for application such as central office equipment (where local phone service switches are located). This includes: channel banks, multiplexers and repeaters. The IC, the VP14Q574, supports both ANSI and CCITT formats. Packaged in 128-pin PQFP, samples will be ready in October. By the end of the year, price will be $42 in lots of 10,000.

Additional DQ Monday product news examples include:

3DO UNVEILS NEW TECHNOLOGY PROPOSED AS CONSUMER STANDARD 1/11/93**

FUJITSU TO INCREASE 16MEG DRAM PRODUCTION 4/8/93**

XEROX INTRODUCES THE LIVEBOARD 5/24/93**

IBM INTRODUCES MULTIMEDIA VALUEPOINT SERIES OF PCs 5/31/93**

YAMAHA DEVELOPS CD RECORDER 6/11/93

MATSUSHITA DEVELOPS NOTEBOOK WITH CD-ROM 9/13/93**

Company

DIGITAL SATELLITE BROADCASTING DECODER PLANT IN CHINA. 1/11/93
Toshiba Corp., Mitsui & Co., Ltd., General Instruments, and Star TV of Hong Kong will construct a digital satellite broadcasting (DSB) decoder plant in China. Estimated investment is about $100 million. Construction is expected to start in 1994. The decoder will probably use the GI system and initially produce about 100,000 units per month.

MITSUBISHI TO GO IT ALONE 1/18/93
Mitsubishi Electric Corp. has decided to develop a 256- Mbit DRAM business alone. The company intends to invest $400 million in facilities for 64-Mbit DRAM mass production and 256-Mbit DRAM development at its Kita Itami plant's ULSI Development Building. The company also plans to start 64Mbit DRAM production by the end of 1994 at the Kita Itami plant.

MATSUSHITA & SONY TO AGREE ON DIGITAL VCR STANDARD 2/22/93
Matsushita Electric and Sony have reached an agreement to set up a digital VCR standard. Both firms have documented the signal processing and approached other vendors. Reports in Japan say Hitachi, JVC, Philips and Thomson may join the alliance. Matsushita and Sony are currently discussing the details of the device's future standard such as the recording method and the tape's width(smaller than current VHS) , which will include camcorder applications and the ability to transmit data via telephone lines. It is claimed that it would be compatible with a variety of HDTV standards; Japanese, American or European. A second generation protection code will be incorporated to prohibit multiple digital copies. Expected product release is early 1994.

HITACHI TO SUPPLY DRAM TECHNOLOGY TO NIPPON STEEL 3/8/93
Hitachi, Ltd. announced it has agreed to supply Nippon Steel Corp. with 4-Mb DRAM production technology. Nippon Steel is expected to acquire NMB Semiconductor Co., Ltd. (NMBS) from

1290 Ridder Park Drive, San Jose, CA 95131-2398 / (408) 437-8000 / Telex 127193 / Fax (408) 437-0292

Minebea Co., Ltd. later this month, and Hitachi plans to commission 4-Mbit DRAM production to NMBS, in a bid to meet growing demand.

MTC JOINT VENTURE IN PEOPLE'S REPUBLIC OF CHINA 4/5/93
MTC Electronics Technologies Co. Ltd. announced signing a joint venture agreement with China Satellite Launching, Tracking, and Control Central (CSLTCC) and a Hong Kong-based investment company to form a joint venture company that will engage in telecommunications services and manufacturing throughout the People's Republic of China.

Additional DQ Monday company news examples include:

SILICON GRAPHICS TO SET UP SUBSIDIARY IN INDIA 3/22/93**

FUJITSU TO INCREASE 16MEG DRAM PRODUCTION 4/5/93**

ROHM TEAMS UP WITH RAMTRON IN FRAM BUSINESS 5/3/93**

NATIONAL SELLS BANGKOK BUT KEEPS PENANG 6/7/93**

COMPAQ IN JOINT VENTURE WITH BEIJING STONE TO BUILD PCs IN CHINA 7/19/93**

Technology

MICROMIRROR MICROMIRROR ON THE WALL 2/8/93
Who has the most impressive spatial light modulator of them all? A new component promising to have high quality applications in display and imaging products is the DMD or digital micromirror device. The DMD is formed monolithically on a silicon substrate using a standard 5V 0.8-micron CMOS process. Texas Instruments recently unveiled its prototype DMD, a micromechanical chip which measures less than 5/8 of an inch on each side yet packs over 300,000 tiny, movable aluminum mirrors as well as logic, memory and control circuitry. The mirrors can be controlled with electronic precision to reflect light and are said to provide a brighter more lifelike display with less noise than the current CRT systems in use. Applications include: fax, copiers, X-ray, computer displays, and HDTV.

TRUEVISION'S DVR TECHNOLOGY 8/9/93
Truevision announced its new DVR video technology. The architecture is comprised of a set of logical components which encode, decode, process and store digital video. The central principle of the architecture is that all digital video data and processing is organized around a large central memory, shared by all parts of the architecture. In DVR, all forms of digital video are stored and manipulated in a single memory space. DVR does not involve any processing or mixing of analog video streams. Rather, all analog video data is digitized into central memory. All subsequent processing is carried out in digital forms on single video frames until the data is converted back into an analog signal or display. A minimum DVR system will have 4 MB of DRAM and initial implementations will support up to 64 MB of DRAM. The first implementations of DVR products will support a variety of video standards at both PAL and NTSC resolutions via a set of optional decoder/encoder modules. The company has not disclosed specifications for the first series of Truevision products that will feature DVR technology but hinted at a Q4 introduction.

MPEG-2 TO GET THE VOTE 8/23/93

1290 Ridder Park Drive, San Jose, CA 95131-2398 / (408) 437-8000 / Telex 127193 / Fax (408) 437-0292

Members of the Motion Pictures Expert Group (MPEG) are expected to vote on the MPEG-2 standard this November. Semiconductor suppliers should be shipping by next summer. MPEG-2 is downward compatible with MPEG-1.

Additional DQ Monday technology news examples include:

STANFORD OFFERS PATENT PORTFOLIO 2/22/93**

EC HDTV, WILL IT BE ANALOG OR DIGITAL? 3/22/93**

ATR ESTABLISHES VOICE TRANSLATION LAB 4/12/93**

INTEL AND PAC BELL WORKING ON DESKTOP CONFERENCING 8/30/93**

JAPAN GOING MOBILE one car/mobile phone for every 70 citizens. 9/13/93**

Events**

FINANCIAL RESULTS**

The following financial results from selected semiconductor and equipment companies show revenue and net income in millions of dollars for the fiscal quarter specified. The percentage change is a comparison to the financial results of the same quarter of the previous year. Parenthesis indicate negative growth. (All numbers are rounded to the nearest tenth.)

COMPANY	QTR	LATEST QTR REVENUE	% CHANGE	LATEST QTR INCOME	% CHANGE
Altera	2	33.1	44.0	4.6	53.0
Anthem Electronics	2	160.9	32.0	6.3	(11.6)
Apple	3	1,862	7.0	(188.3)	(243.0)
Atmel	2	50.6	53.0	6.3	111.0
Brooktree	3	29.8	23.0	18.4	540.0
Dallas Semi	2	38.3	28.0	6.1	32.0
IDT	1	72.8	35.4	4.6	874.0
Intel	2	2,130	61.0	568.5	166.0
Media Vision	2	45.1	250.0	3.4	409.0
Motorola	2	3,936	25.0	224	56.6
Novellus	2	25.3	74.0	3.6	3011.0
PictureTel	2	2,105	13.0	112	55.5
Seeq	3	8.8	16.0	0.3	(1.0)
Synoptics	2	180.1	120.0	24.5	248.0
Xilinx	1	54.4	39.0	8.9	49.0
Xircom	3	21.6	49.0	2.6	59.0

1290 Ridder Park Drive, San Jose, CA 95131-2398 / (408) 437-8000 / Telex 127193 / Fax (408) 437-0292

Financial Notes**. . .

Hitachi, Toshiba, and Fujitsu . released their earnings forecast Thursday for the current business year ending March 1994:

Hitachi expects a 2% increase in current profit to 80 billion yen,

Toshiba expects earnings to remain flat at 55 billion yen,

Fujitsu expects to make 30 billion yen, but sources in Japan say 10 billion yen is a more realistic figure.

Analyst's Notes**. . .

3.3 VOLT VS. 5.0 VOLT SEMICONDUCTOR PRICE PREMIUMS 3/8/93
Below is the current and estimated trend of low voltage(3.3V) semiconductor pricing versus 5.0V product based on recent Dataquest research.

3.3Volt Price Premiums over 5Volt Devices

	1992	1993	1994	1995
SRAM	10%	5%	0%	0%
DRAM	20%	15%	10%	5%
MPU	63%	55%	25%	5%
ASIC	10%	5%	0%	0%
FLASH	20%	15%	12%	10%

Mark Giudici

SHINKO ELECTRIC MMS ALLIANCE HIGHLIGHTS 3/22/93
DQ Monday received the following highlights from our Tokyo office on the Shinko/MMS joint development alliance:

- Shinko design center to be opened at MMS facility by the end of this month
- Shinko synergizes their ceramic substrate technology with MMS's thin film high density circuit technology
- Joint objective is to develop lower cost high performance circuit. MMS and Shinko uses complementary expertise, the design capability of MMS and the packaging ability of Shinko

1290 Ridder Park Drive, San Jose, CA 95131-2398 / (408) 437-8000 / Telex 127193 / Fax (408) 437-0292

- Design center to be started with 5 or so engineers and 1-2 engineers to be dispatched from Shinko
- Mr. Uchida, managing director of Shinko, commented, "In 1995 when the joint developed products will be delivered, the worldwide MCM market size will reach to quarter or so billion dollars. MCM is the key technology needed for PC and WS of next generation."
- MMS separated from DEC in June 1992 by acquired MCM factory from DEC. MMS specializes in design and manufacturer of MCM substrates. Current production capacity is about 600,000 units.
- According to Dataquest's MCM study total system and semiconductor revenue for MCMs is expected to be approximately $3.5 billion and $1.8 billion respectively by 1995.

(Max Nanseki-DQ Japan)

UPDATE ON TELECOM: ATM in the WAN and the LAN 9/27/93
Several months ago, the general belief in the Telecommunications industry was that users would first install ATM (Asynchronous Transfer Mode) products in the LAN (Local Area Network), with installation in the WAN (Wide Area Network) coming at later dates. Since that time we have started to see the opposite scenario develop. ATM is taking shape in the WAN in two major areas.

First, telecommunications carriers are now actively deploying ATM based switches at the basis for end users ATM services. The most significant installations thus far have been at Sprint, Pacific Bell and Metropolitan Fiber Systems. Sprint has deployed TRW ATM switches as the basis for their recently announced ATM service. Pacific Bell and Metropolitan Fiber Systems have both selected the Newbridge Network 32150 ATM platform in order to deploy their public ATM services. Sprint's and Metropolitan Fiber System's services will serve the entire Continental United States, while Pacific Bell's service will serve the State of California only. This far, these services are priced very high and are practical only for the largest of corporate users. Dataquest expects it will take five to ten years for high speed ATM services (45MBPS+) to come down in prices sufficiently enough to be economical for use by non-Fortune 500 type organizations. ATM on the WAN will be a rich man/women's game for many years to come.

The second way ATM services are beginning to be deployed in the WAN are as high speed backbones for large corporate data users. ATM technology will help these corporations to make the most of the capacity of T-3 (45 MBPS) dedicated leased lines by allowing for additional multiplexing over what is available via less advanced data communications protocols. The vast majority of these installs will be used for data communications (mainly LAN traffic) with the integration of voice services coming over the next few years.

ATM is just now becoming a real technology which can be integrated effectively into products and thus far the number of installations is small. On the wide area networking front, Newbridge Networks leads the market share race with a total of 150 ATM WAN switches installed or on firm order. Other vendors who will have to be considered serious players in this coming market are AT&T, Fujitsu, NEC, StrataCom and Telematics.

In the LAN area, most of the movement in the ATM area thus far has been in the interconnection of collapsed backbone LAN segments. In this configuration, ATM switches are used as an alternative to FDDI in order to connect routers which are usually located within the same building or within a campus environment. The vision of ATM to the desk top is not quickly being realized and it is Dataquest's belief that such configurations are still two to three years off for the majority of user sites.

The advent of ATM technology comes at an exciting time in the information processing industry. Data transfer rates in telecommunications networks have clearly not kept pace with the speed increases in computer power and the telecommunications network (both the LAN and especially the WAN), remain bottle necks in the processing and delivery of useful information. ATM technology does not eliminate this bottle neck, but does give some measure of relief to this long standing "Bottle Neck" issue.

By Joe Noel-courtesy of Dataquest's Telecom-networking service-

INTERNATIONAL FUNKAUSSTELLUNG BERLIN 1993 9/13/93**
The International Funkausstellung Berlin 1993 (IFA'93), the worlds largest consumer electronics show, closed on September 5 after a record event with over 740 exhibitors from 33 countries worldwide. The show which is held every other year attracts all the major consumer companies worldwide, below is some highlights of the show. **

Andrew Norwood Dataquest UK

Additional analysts notes appeared on the following topics:

MICROSOFT WINDOWS HARDWARE ENGINEERING CONFERENCE 3/8/93 **

DR. GORDON MOORE: "THE OUTLOOK FOR VLSI: WILL THE BALLOON BURST? 4/29/93**

UNDERSUPPLY OF DRAMs TAKES IT TOLL 6/7/93**

TODD RUNDGREN DEMO'S INTERACTIVE AUDIO TITLE ON PHILIPS CD-I PLAYER 7/26/93**

SEMICON/West 1993 8/2/93**

DQ PERSPECTIVE

Here We Go Again--A New Trial in Intel Corporation versus Advanced Micro Devices Inc. Special Report. . .4/26/93

In a legal shot heard 'round the world, U.S. District Court Judge William A. Ingram granted Advanced Micro Devices (AMD) a new trial on the issue of whether a 1976 agreement with Intel granted AMD a license to use Intel's 80287 microcode in AMD's products. The rationale for the decision is that Intel withheld four documents that could have influenced the jury's findings. According to the judge's opinion, regardless of whether the original decision was "correct," the non production of the documents legally prevented AMD from fairly presenting its defense. Judge Ingram cited precedent-setting cases stating that "This standard does not require that the withheld evidence be of such nature as to alter the result in the case." In other words, the verdict may still have been made in Intel's favor, but AMD should have had access to the documents in question and the opportunity to present them as evidence in the jury trial.

According to Judge Ingram's order, the documents were as follows:

- An August 10, 1990 *Litigation Reporter*
- An undated Math CoProcessors Competitive Summary
- A September 1990 Math CoProcessors Competitive Summary
- An Intel news release discussing the Intel/AMD litigation

Dataquest Perspective

Dataquest's perspective will not deal with any opinions of legality. We will deal strictly with the impact this decision may have on the market. Readers of this report who need a legal opinion should consult with an attorney.

Since the announcement granting the new trial, AMD has publicly stated that it will begin shipments of 486 product immediately. This 486 device uses the Intel-developed microcode. AMD has been using this product to qualify the process and manufacturing flow. We believe that, as a result of this preliminary work, AMD is fully capable of beginning immediate, albeit small, volume shipments of production-worthy 486 product. We also believe that it is desperately looking for ways to expand its limited capacity.

AMD's 486 device is manufactured in its submicron design facility. The process is unique to the 486 and as a consequence AMD cannot "rob" wafer starts from other logic or microprocessor products to increase its 486 capacity. At this point it appears that any increase in 486 capacity will have to come from expanding or improving efficiencies in existing fabs, reworking older fab lines, or building new facilities.

The existing Am386 product is manufactured using both 1.0- and 0.8-micron CMOS. As neither of these processes can be used for the 486, we can expect AMD to continue its attempt to extend the life of the 386 family. If it is successful in this effort, AMD should also be able to extend the 486 life cycle. By contrast, for strategic purposes Intel might prefer a shorter life cycle for the 486 product.

AMD will continue efforts on its cleanroom version of the 486. AMD stated that it planned introduction of a 486 device with "clean microcode" on July 6, 1993. This strategy is prudent. Why? Because AMD faces potential legal exposure regarding shipments of 486 devices that use the Intel microcode *if* Intel ultimately prevails. Also, this should help AMD become technologically independent from Intel.

For AMD, the 1993 window of opportunity now works this way. AMD can immediately enter the 486 market *now* with devices based on Intel's microcode. Its capacity constraint could limit the near term market impact, but the company is accelerating its marketing, design-in, and manufacturing efforts. AMD should be able to increase 486 capacity during the second half of this year and perhaps make the transition to devices based on its own microcode. We estimate that AMD will be able to ship up to 500,000 486 equivalents out of their Sub-micron Development Center (SDC). This could generate revenues in the $100M to $150M range. AMD hopes to be able to ramp the SDC facility to 1 million units per quarter by the second quarter of 1994.

AMD is currently looking for foundry support for the AMD microcoded version. AMD does not believe that their agreement with Intel allows them to use outside foundry to manufacture the Intel microcoded product.

The Products

AMD has announced the first members of its 486 product family based upon Intel microcode. They are as follows:

486DX-40	CPGA	$306	5	Now
486DX-33	CPGA	$306	5	Now
486DXLV-33	QFP	$306	3.3	July
486DX2-50	CPGA	$417	5	June

1290 Ridder Park Drive, San Jose, CA 95131-2398 / (408) 437-8000 / Telex 127193 / Fax (408) 437-0292

and not formally announced but receiving mention:

486DX2-66	CPGA	N/A	5	By year end

AMD claims that six vendors will be supporting their 486 with pc logic chip sets. Among those mentioned were Opti, Chips & Technology, Micro Power, Symphony, and Eteq. Phoenix Technology has also announced BIOS support for the family.

Jerry J. Banks and Ronald Bohn

More. . .

AMD also held several teleconferences. The first was by Jerry W.J. Sanders III, AMD's chairman and CEO.

The second was by the following members of AMD's PCD marketing team: Bob McConnell, Vice President of PCD; Subodh Toprani, Director of Marketing for PCD; Bruce Smith, Strategic Marketing Manager for PCD; and David Frink, External Affairs Manager.

Some key points from the teleconference by PCD Marketing follow.

Question: Why ship Intel-coded devices now with AMD-coded devices available by July 1993?
Answer: Time-to-market drives AMD enter the market now, however, AMD's "clean microcode" work will continue toward the July 4 introduction date. For customer's, AMD-coded parts should be "transparent" with Intel-code parts. AMD intends--as possible--to phase out Intel-coded devices at an "early date" but in line with customer consent.

Question: What is the die size and transistor count of the Am486? Answer: Die size--137,000 square mils. Transistors--930,000 active transistors.

Question: What is AMD's 486 capacity/unit shipment outlook for 1993?
Answer: AMD aims for 5 percent market share by year end 1993. AMD estimate 1993 shipment of less than 500,000 units, i.e., "300,000 to 500,000" units. AMD's so-called "stockpile" of 486s has been overstated and in fact totals about 100,000 units or less.
AMD's SDC facility in Sunnyvale should be quite busy this year. In addition to 486 devices, SDC will be used for flash memory, other advanced processors, logic as well as R&D efforts.

Question: Is AMD seeking any foundry arrangements re the 486 devices?
Answer: Yes, that effort is underway although the time frame remains uncertain. Foundry would be limited to AMD-coded parts. The 1993 shipment estimated noted above assumes no foundry agreement for this year.

Question: What will be the 486 pricing strategy?
Answer: In view of the 1993 capacity outlook, AMD does not plan to use pricing as an offensive weapon for this year. For 1994, however, more traditional supply-demand-learning curve factors should drive the pricing equation.
(Note: From Dataquest's perspective, this pricing strategy could shift over the second half of 1993 if but only if AMD soon strikes a foundry deal.)

Question: What is AMD's 486 capacity/unit shipment outlook for 1994?
Answer: AMD aims for 20 percent market share by year end 1994 which AMD bases on an estimated 1994 annual run rate of 35 million units. This estimate assumes that a foundry arrangement(s) will be in place.

Question: What's AMD's long-term outlook for 486 capacity independent of foundry arrangements?

Answer: For 1995, AMD's Fab 25 in Austin should be able to produce 5,000 8-inch wafers per week. The process should migrate from 0.5-microns down during 1995 to 0.25-microns over time.

(Ronald Bohn)

Additional DQ Monday perspectives written this year include:

THE FINAL DUMPING PENALTIES ARE RELEASED: MUCH ADO ABOUT NOTHING 3/22/93**

THE DRAM PRICE OUTLOOK ON THE EVE OF THE MICRON CASE DECISION 3/8/93**

INTERMEDIA '93--IS THE FUTURE NOW? 4/18/93**

IBM ENTERS MERCHANT ASIC MARKET AT CICC 5/10/93**

HOW DIGITAL TECHNOLOGY IS CHANGING THE WAY MOVIES LIKE JURASSIC PARK ARE BEING MADE 6/21/93

CONSUMER AUDIO: DCC vs MD 9/6/93**

People in the Industry**

(The Dataquest analysts who participate in DQ MONDAY throughout the year include Jerry Banks, Ron Bohn, Mark Giudici, Gary Grandbois, Joe Grenier, Jim Handy, Duane Kuroda, Bryan Lewis, Ken Lowe, Lane Mason, Junko Matsubara, Mary Olsson, Nick Samaras, and Greg Sheppard) The DQ 100 is provided by Ade Olorunsola, Terry Birkholz, and Jing Huang of Research Operations. Analysts from other Dataquest services including computer systems, telecom, and software make periodic contributions as well.

Rick Spence [illegible]

DQ Monday welcomes your comments and suggestions.

Write to us at.. DQ Monday/Dataquest
1290 Ridder Park
San Jose, CA 95131

or FAX us at.... 408/437-0292

1290 Ridder Park Drive, San Jose, CA 95131-2398 / (408) 437-8000 / Telex 127193 / Fax (408) 437-0292

DATAQUEST 100 HIGH-TECHNOLOGY STOCK INDEX

The *Dataquest 100 High-Technology Stock Index* is designed to reflect trends and fluctuations in the aggregate market value of the Silicon Valley's 100 leading high technology companies. The *Dataquest 100* includes companies in the high-technology information businesses covered by Dataquest.

Companies included in the *Dataquest 100* satisfy the following criteria:

- Corporate headquarters in the greater Silicon Valley area
- Publicly traded common stock
- Stock traded on national exchanges (i.e., NYSE, ASE, or NASDAQ)

The *Dataquest 100* is reported as a composite index. The composite index is also disaggregated into the following five subindexes:

Computers and peripherals	27 companies
Communications	19
Software	16
Semiconductor device manufacturers	24
Semiconductor equipment manufacturers	8
Total	94 companies

The composite index includes six additional companies engaged in a broad range of high technology activities and products and/or high technology businesses not elsewhere classified.

Dataquest believes that each of the subindexes accounts for more than 95 percent of the revenue-generating capability and nearly 100 percent of the net market value of the population of companies operating in that technology category that satisfy the necessary criteria.

The *Dataquest 100* belongs to the class of business indicators known as market capitalization indexes. A company's market capitalization is defined as the product of the current stock price times the number of outstanding shares. Because common stock is the residual claim on assets, the market capitalization is stock investors' collective wisdom of the current *net* value of a company. Further, stock prices are "forward looking" because they reflect the investment community's expectation of future net operating income. Therefore, current stock prices -- and hence, the *Dataquest 100* -- can be a useful leading indicator of future business conditions.

The *Dataquest 100* is relatively easy to understand. At December 31, 1992, the index value was set equal to 1,000. If yesterday's index was 1,100 and today's is 1,110, then the change in today's index is 10 points. This means that the market is up 0.9 percent since yesterday, and 11.0 percent since the end of 1992.

At the end of each trading day, a new index value is calculated by taking the summation of each company's closing stock price multiplied by the number of outstanding shares, and dividing by the same summation calculated at the end of 1992. The result is then multiplied by 1,000.

THE DATAQUEST 100 HIGH-TECHNOLOGY STOCK INDEX – COMPANY COMPOSITION

Semiconductor Devices	
Advanced Micro Devices	AMD
Altera	ALTR
Atmel	ATML
California Micro Devices	CAMD
Chips & Technologies	CHPS
Cirrus Logic	CRUS
Cypress Semiconductor	CY
Exar	EXAR
Integrated Device Technology	IDTI
Intel	INTC
International Microelectronics	IMPX
Linear Technology	LLTC
Logic Devices	LOGC
LSI Logic	LSI
Maxim Integrated	MXIM
National Semiconductor	NSM
Seeq Technology	SEEQ
Sierra Semiconductor	SERA
Siliconix	SILI
Supertex	SUPX
VLSI Technology	VLSI
Xicor	XICO
Xilinx	XLNX
Zilog	ZLOG
Total Number of Companies:	24

Semiconductor Manufacturing Equipment	
Applied Materials	AMAT
Genus	GGNS
IKOS Systems	IKOS
KLA Instruments	KLAC
Lam Research	LCRX
Novellus	NVLS
Silicon Valley Group	SVGI
Zycad	ZCAD
Total Number of Companies:	8

Communications	
3COM	COMS
Aspect	ASPT
California Microwave	CMIC
Centigram	CGRM
Cisco Systems	CSCO
Compression Labs	CLIX
CXR Corp.	CXR
Digital Microwave	DMIC
ICOT Corp.	ICOT
Network Equipment	NWK
Octel	OCTL
Silicon General	SILN
Stanford Telecomm	STII
Stratacom	STRM
Synoptics	SNPX
TCI International	TCII
Telebit	TBIT
VMX	WMXI
Watkins-Johnson	WJ
Total Number of Companies:	19

Software	
Adobe	ADBE
Ask	ASKI
Borland	BORL
Cadence Design	CDN
Caere	CAER
Frame Technology	FRAM
Informix	IFMX
Integrated Systems	INTS
Intellicorp	INAI
Learning Co.	LRNG
McAfee Associates	MCAF
Oracle	ORCL
Ross Systems	ROSS
Software Publishing Corp.	SPCO
Symantec	SYMC
Synopsys	SNPS
Total Number of Companies:	16

Computers and Peripherals	
Adaptec	ADPT
Amdahl	AMH
Apple	AAPL
Atari	ATC
Conner Peripherals	CNR
Hewlett-Packard	HWP
Komag	KMAG
Massstor Systems	MSCO
Maxtor	MXTR
Memorex	MX
Micronics	MCRN
Mylex	MYLX
Network Computing Devices	NCDI
Pyramid Technology	PYRD
Quantum Corp.	QNTM
Qume	QUME
Rasterops	ROPS
Read Rite	RDRT
Seagate	SGAT
Silicon Graphics	SGI
Sun Microsystems	SUNW
Supermac Technology	SMAC
Syquest	SYQT
System Industries	SYI
Tandem	TDM
Verifone	FFIC
Zitel	ZITL
Total Number of Companies:	27

Others	
Anthem Electronics	ATM
Drexler Technology	DRXR
Interactive Network	INNN
Solectron	SLR
Trimble Navigation	TRMB
Varian Associates	VAR
Total Number of Companies:	6

Dataquest

Conference Shuttle Service

Mon, Oct. 11

Miyako Hotel to Hotel Nikko

6:55 AM & 7:35 AM Pick-up at Post Street

Cathedral Hill Hotel to Hotel Nikko

7:05 AM & 7:45 AM Pick-up at Van Ness Street

6:00 PM Directly to Dataquest Dinner Cruise

Hotel Nikko Pick-up at Mason Street
Miyako Hotel Pick-up at Post Street
Cathedral Hill Hotel Pick-up at Van Ness Street

9:45 PM Return to Miyako Hotel
Cathedral Hill Hotel
Hotel Nikko

Tue, Oct. 12

Miyako Hotel to Hotel Nikko

6:55 AM & 7:35 AM Pick-up at Post Street

Cathedral Hill Hotel to Hotel Nikko

7:05 AM & 7:45 AM Pick-up at Van Ness Street

Attendee Questionnaire

1993 Semiconductor Conference
October 11-12, Notel Nikko, San Francisco

Thank you for attending this year's Semiconductor & Applications Conference. Your thoughts and comments regarding this event are an important part of our process to continually improve the value provided through our conference program. Please help us by taking a few moments to complete this questionnaire.

Which of the following beat describes your company's primary activity?

- ☐ Semiconductor or manufacturer
- ☐ Supplier to the semiconductor industry
- ☐ User of semiconductor products
- ☐ Distributor or Sales Representative
- ☐ Government agency
- ☐ Consultant
- ☐ Investment advisor, venture capitalist, financial analyst
- ☐ Other ______

Which of the following best describes your area of responsibility and title?

Area of Responsibility

- ☐ Strategic Planning / Business Development
- ☐ Product Development / R&D / Engineering
- ☐ Product Management
- ☐ Marketing / Market Research
- ☐ Purchasing / Vendor Selection
- ☐ Sales
- ☐ Operations
- ☐ Other ______

Title

- ☐ CEO, President
- ☐ Vice President
- ☐ Director
- ☐ Manager
- ☐ Analyst
- ☐ Other ______

Please rank the reason(s) you attended this conference in terms of importance.

	MOST				LEAST
To learn more about industry issues	1	2	3	4	5
To examine marketing issues	1	2	3	4	5
To learn about competitive issues	1	2	3	4	5
To hear Dataquest's forecasts	1	2	3	4	5
To hear Dataquest's analysis	1	2	3	4	5
To hear industry leader's viewpoints	1	2	3	4	5
To meet my customers	1	2	3	4	5
To network with peers	1	2	3	4	5
To talk with Dataquest Analysts	1	2	3	4	5
To meet my suppliers	1	2	3	4	5
Other	1	2	3	4	5

Overall, how well did the conference meet these objectives:

HIGHEST				LOWEST
1	2	3	4	5

Would you attend a future Dataquest Conference? ☐ Yes ☐ No

How would you rate the following:

	HIGHEST				LOWEST
Hotel Nikko	1	2	3	4	5
Hotel Room	1	2	3	4	5
Meals	1	2	3	4	5

Would you prefer the conference to have a:

- ☐ Topical issues-oriented breakout sessions like this year
- ☐ Broad industry orientation as in years past

What topics / issues would you like to see addressed next year?

____

____

____

Please Rate the Breakout Session You Attended

	Content HIGH LOW	Delivery HIGH LOW
The Future of Home Multimedia Communications	1 2 3 4 5	1 2 3 4 5
The Future of Flash Memory	1 2 3 4 5	1 2 3 4 5
Procurement Benchmarking	1 2 3 4 5	1 2 3 4 5
Worldwide Capacity Issues	1 2 3 4 5	1 2 3 4 5
Signal Processing Application Trends	1 2 3 4 5	1 2 3 4 5

Additional comments regarding this conference:

____

____

____

What specific topics would you like covered in 1994 Semiconductor Services:

____

____

Are you currently using electronic delivery to your desktop? ☐ Yes ☐ No
If no, are you planning to in 1994? ☐ Yes ☐ No

We are planning to have semiconductor product demonstrations and systems product demonstrations at next year's 20th Annual Semiconductor Conference. Would your company be interested in demonstrating your product capability? ☐ Yes ☐ No

Name:____________________________

Company:____________________________

Phone:______________ FAX:______________

Announcing the

Annual Semiconductor Conference Report, comprised of the

Verbatim Conference Transcript and Executive Summary Report

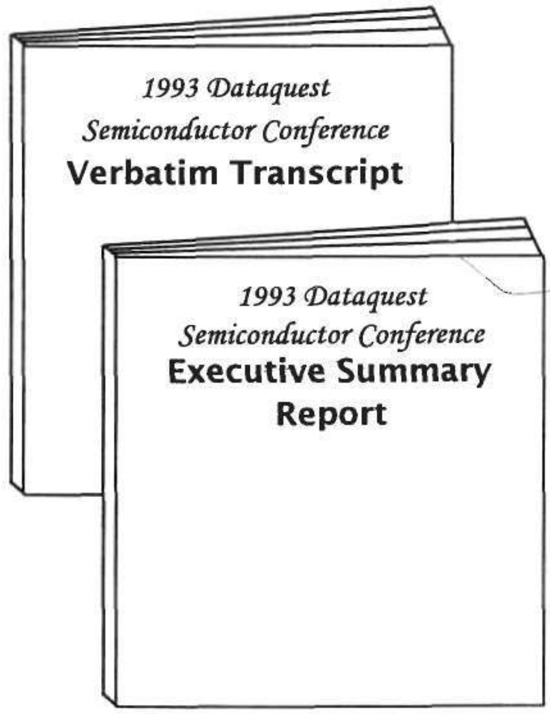
Don't miss your opportunity to capitalize on the vital information presented at the year's most valuable industry forum. ***Order your report today at the Conference Report Desk!***

35% OFF
When you place your order here at the conference!

Get the Conference Transcript

...An invaluable research and training tool, providing a **verbatim transcript of the entire conference** in an easy-to-use, bound document containing:

- All Speeches
- All Panel Discussions
- All Five Breakout Sessions
- All Question & Answer Sessions
- Key Word Index
- Over 400 Graphics and Slides



...and the Executive Summary Report,

which includes *in a separate bound edition:*

- Presentation-quality reports for your management or colleagues
- Timely access to competitive data and key industry issues
- Conference speaker highlights organized by topic

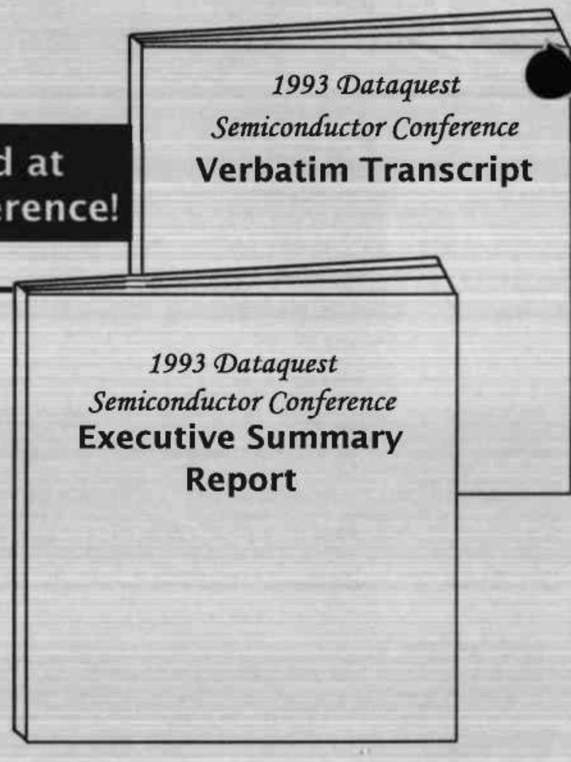
Order Today!

Annual Semiconductor Conference Report

comprised of:

Verbatim Conference Transcript and Executive Summary Report

Don't miss any of the vital information presented at the 19th Annual Dataquest Semiconductor Conference!



Ship To:

Name________________________________

Company________________________________

Address________________________________

City________________ State____ Zip________

Phone________________ Fax________________

Place your order before the end of the conference and get the Annual Semiconductor Conference Report, comprised of the Verbatim Transcript and Executive Summary Report, for the special attendee price of only $285.00 - over 35% off the regular price!

Special Attendee Price!

❑ **285.00** *(Regular Price $440.00)*

Payment Method

❑ Please bill my company. (Use P.O.#________________)
❑ My payment is enclosed.
❑ Please charge my credit card:
❑ American Express ❑ MasterCard ❑ Visa
Card#________________________ Exp________

Signature________________________________

(Order not valid without signature.)

Turn your order in at the Conference Report Desk today!

OR

Fax orders to Market Makers/Dataquest at: **(805)298-4388**
Mail orders with payment to: **Market Makers/Dataquest**
26524 Golden Valley Road, #401
Santa Clarita, CA 91350

SAVE 20%

On any of these vital

1993 Semiconductor Industry Reports

by purchasing them prior to the Conference date of October 11th!

Call your Dataquest representative today

1-800-457-8233

General Reports on the Semiconductor Industry

"Semiconductor Market Trends"

MarketTrends Report, July 1993

This report reviews the total 1992 worldwide semiconductor market and includes individual chapters for the various IC product types with 5-year forecasts given for each product type. *This is a very complete and comprehensive review of the worldwide semiconductor industry and will benefit anyone interested in the semiconductor market and suppliers.*

SEMI-WW-MT 9301 $2495

"Semiconductors Japan"

MarketTrends Report, July 1993

Provides a detailed view of the Japanese semiconductor industry from 1982 - 1997 and includes analysis of market trends and IC product types with 5-year forecasts. *This comprehensive source of information on the Japanese semiconductor market and industry will benefit anyone involved with the Japanese semiconductor industry, especially those engaged in forecasting.*

SEMIJA-MT 9301 $2495

"Semiconductor Asia/Pacific"

MarketTrends Report, August 1993

This report provides a comprehensive analysis of the semiconductor Asia/Pacific market including market trends and forecasts by device type, application and country for the Asia/Pacific region. *This report is a basic necessity for everyone having anything to do with Asia/Pacific semiconductors or electronics. The unprecedented growth of the Asia/Pacific semiconductor market has made it larger than the European semiconductor market and this report will underscore the importance of this market.*

SEMI-AP-MT 9301 $2495

"Japanese Semiconductor Distributors: "The Shosha"

Focus Report, May 1993

Provides a general outline of the Japanese semiconductor distribution system and the role of distributors in Japan. *This report will help you if you want to sell semiconductors in Japan, or if you already sell in Japan but want to improve your distribution efforts and relations with your distributors.*

SEMI-JA-FR 9301 $2995

Reports on Electronic Equipment and Semiconductor Applications

"Worldwide Telephone Handset Production: Cordless and Cellular Opportunities"

Focus Report, July 1993

This report provides an in-depth analysis of telephone handset technology trends and production in Europe, Japan, North America and Asia/Pacific regions and gives an analysis of the semiconductor content and trends for these products. *Semiconductor manufacturers need to know about the semiconductor opportunities in this high growth application market.*

SAMM-EU-FR 9301 $2995

"Small Form Factor Rigid Disk and Solid-State Drives"

Focus Report, May 1993

This report provides an in-depth analysis of disk drive technology trends and production, and gives an analysis of the semiconductor content and semiconductor trends for rigid and solid-state drives. *Semiconductor manufacturers should be aware of the semiconductor opportunities in this important applications market, especially in the emerging solid-state mass storage medium.*

SAMM-WW-FR 9301 $2995

SAVE 20% - Call Your Dataquest Representative Today! 1-800-457-8233

Reports on Electronic Equipment and Semiconductor Applications continued . . .

"Electronic Equipment"

MarketTrends Report, August 1993

Contains a detailed overview of the six major electronic equipment markets (data processing, communications, industrial, military transportation and consumer) with market size, forecasting and other relevant market data included. *Semiconductor manufacturers selling into these markets and anyone else who wants to understand the worldwide electronic equipment trends will find this report invaluable.*

CEDANAMT 9301 $2495

"European Communications Market"

MarketTrends Report, April 1993

Analyzes the European communications market and its importance to the semiconductor industry. Includes data on communication equipment demand and the semiconductor content. *Invaluable report for semiconductor manufacturers who want to penetrate the growing and strategic European communications equipment market.*

SAMM-EU-MT 9301 $2995

Reports on the Semiconductor Wafer Fab Equipment and Materials Industry . .

"Microenvironments"

Focus Report, April 1993

This report discusses controlled microenvironments as an alternative strategy to manufacturing ICs in conventional cleanrooms. Includes brief profiles of vendors supplying microenvironment equipment. *Semiconductor manufacturers, wafer fab equipment suppliers and cleanroom contractors need to understand this alternative strategy as it might substantially affect their own operations and equipment.*

SEMM-WW-FR 9301 $995

"Wafer Fab Equipment 1992 Market in Review"

MarketTrends Report, June 1993

This report provides a comprehensive view of the 1992 worldwide wafer fab equipment market and analyzes the general trends in the market, technology issues and company activities for each major segment of the wafer fab equipment market. Data for 1990-1992 presented. *Wafer fab equipment manufacturers will better understand the market they are competing in, and semiconductor manufacturers will better understand their vendor base.*

SEMM-WW-MT 9302 $3995

"Semiconductor Equipment, Manufacturing and Materials Forecast"

MarketTrends Report, August 1993

This semiannual report gives Dataquest's 5-year forecast (1993-1997) for wafer fab equipment, capital spending, silicon wafers, semiconductor production and consumption along with an analysis of the trends supporting the forecasts. *Wafer fab equipment and material companies will find this report to be necessary input to their own forecasting, strategic planning and business development.*

SEMI-MT 9301 $2495

Reports on Semiconductor Buying and Procurement . . . .

"European Semiconductor Procurement Trends"

Report, July 1993

Provides an analysis of European semiconductor procurement trends in 1992/1993 including a discussion of spending patterns, inventory management, semiconductor buying, and key purchasing criteria for each major electronic equipment applications segment. *This report will help semiconductor vendors better understand their European customers' purchasing behavior and procurement issues.*

SPSG-WW-UW 9301 $2995

"Procurement Benchmarking"

Focus Report , August 1993

Procurement benchmarking is a new strategy being implemented to improve the semiconductor procurement issues. This report discusses this strategy and how it is being used to benchmark the purchasing, supplier evaluation and the procurement forecasting processes. *Will help semiconductor buyers determine if they should benchmark and if so, the steps needed to implement a benchmarking process.*

SPSG-WW-FR 9301 $2995

Reports on Semiconductor Buying and Procurement continued

"Semiconductor Procurement"

User Wants and Needs Report , August 1993

Reports on the key issues facing North American procurement managers and buyers of semiconductors including supplier criteria, information on inventory levels and benchmarking. *To help semiconductor suppliers better understand their customer's purchasing behavior and to provide semiconductor users with information that can improve their purchasing processes.*

SPSG-WW-UW 9301 $2995

Reports on Specific Semiconductor Devices

"Trends in the SRAM Market"

MarketTrends Report, May 1993

Provides a good in-depth understanding of the SRAM market, the vendors involved, the issues which motivate the market, the competitive environment, and SRAM applications. *Whether you are an SRAM manufacturer or SRAM user, you will gain insight into this market including a better understanding of SRAM business cycles.*

MMRY-WW-MT 9301 $2495

"DRAM User Wants and Needs - Alternative DRAM Architectures"

User Wants and Needs Report, August 1993

The DRAM market is entering a period of change as systems require new approaches to move data to and from DRAMs. This report discusses the 5 main contenders for the next DRAM architecture to be used in next-generation systems. *If you are at all involved with DRAMs, either as a DRAM manufacturer or DRAM user, you need to understand the kinds of DRAMs that will be needed for future systems.*

MMRY-WW-WW 9301 $2995

"Embedded Microprocessor Market"

Focus Report, April 1993

This report includes a detailed breakout of the major embedded applications, embedded applications forecasts, microprocessor market share for each embedded application, and Dataquest's view on which microprocessor architectures will be winners. *The growth of the microprocessor market is usually linked to growth in computers, but the embedded (non-computer) microprocessor market is growing as more and more non-computer applications for microprocessors develop.*

MCROWW-FR 9301 $2495

"European MOS Memory Consumption Forecast 1991 - 1997"

MarketTrends Report, June 1993

Provides an analysis and forecast of the European MOS memory market segmented by memory types and includes, for each type, data on revenue, units, total available market, and average selling price. *This report will provide comprehensive information on the high growth European MOS memory market for semiconductor manufacturing, European IC distribution, and European buyers of semiconductors.*

SEMI-EU-MT 9301 $2995

"European ASIC Market Consumption Forecast 1987 - 1997"

MarketTrends Report, July 1993

Provides a detailed analysis of the European ASIC market, including detailed forecasts for the various product types, forecasts for the regions within Europe, and identifies and forecasts the major growth application for ASICs within Europe. *If you sell in Europe or are planning to, then this report will boost your understanding of the ASIC device market and the application opportunities in Europe.*

SEMI-EU-MT 9302 $2995

"European Microcomponent Market Consumption Forecast 1987 - 1997"

MarketTrends Report , October 1993

Provides a detailed analysis of the European microcomponent market, together with forecasts for the microcomponent and microperipheral markets. Included are forecasts for the regions within Europe and identification and forecasts of the major growth application for microcomponents within Europe. *If you sell in Europe or are planning to, then this report will provide valuable insight into the microcomponent market and application opportunities in Europe.* **$2995**

"Integrated Circuit Packaging Trends"

Focus Report, April 1993

This report contains worldwide and regional information on single chip IC packaging trends and forecasts (1992-1997), including package type and pin counts for the various semiconductor devices. *Intended to provide a worldwide review of IC package technology for semiconductor companies, system designers and material companies.* **SEMI-WW-FR 9301 $2495**

Dataquest®

1993

DATAQUEST CONFERENCE

Hotel Nikko
October 11-12
San Francisco, CA

Dataquest Semiconductor Industry Conference

Dataquest®

Published by Dataquest Incorporated

TABLE OF CONTENTS

Program
Complete Agenda

Attendees
Attendee List by Company

Presentations
Slides and Notes

Focused Breakout Sessions
Future Computing

Home Multimedia

Flash Memory

Procurement Benchmarking

Signal Processing

DATAQUEST SEMICONDUCTOR INDUSTRY CONFERENCE

October 11-12
Hotel Nikko
San Francisco, California

Sunday, October 10

6 - 8:00 PM	**Conference Preregistration**	Grand Ballroom Foyer (3rd Floor)

Monday, October 11

7:00 AM	**Conference Registration and Continental Breakfast**	Grand Ballroom Foyer
8:15 AM	**Welcome and Introduction** Judy Hamilton *President* *Dataquest Incorporated*	Grand Ballroom
8:30 AM	**"1994 Forecast—The Silicon Cycle Continues"** Gene Norrett *Corporate Vice President and Director, Semiconductor Group* *Dataquest Incorporated*	Grand Ballroom
9:00 AM	**KEYNOTE SPEAKER** **"Which Semiconductor Industry?"** Gordon E. Moore *Chairman of the Board* *Intel Corporation*	Grand Ballroom
9:45 AM	**"Merchant Market Success Strategies"** Dr. Michael J. Attardo *Senior Vice President; General Manager, Technology Products* *IBM Microelectronics*	Grand Ballroom
10:15 AM	**Coffee Break**	Grand Ballroom Foyer
10:45 AM	**"Multimedia and Microelectronics: Building the 21st Century Partnership"** Robert M. Kavner *AT&T Group Executive, Communications Products Group* *AT&T*	Grand Ballroom
11:15 AM	**"The Organization of the Future"** Dr. Robert Johansen *Senior Research Fellow and Director, New Technologies Program* *Institute for the Future (IFTF)*	Grand Ballroom
11:45 AM	**"Internetworking: Growth, Challenges, and Opportunities"** John Chambers *Senior Vice President* *Cisco Systems, Inc.*	Grand Ballroom

Agenda Continues

Agenda

12:15 noon	**LUNCH**	Grey Pearl/Pink Pearl
1:30 PM	**"The Promise of Pictures...Is Productivity"** Richard M. Beyer *President, Communications and Computing Group* *National Semiconductor*	Grand Ballroom
2:00 PM	**"Enabling Platforms for the Digital Office"** Karen Hargrove *Senior General Manager, Digital Office Systems* *Microsoft Corporation*	Grand Ballroom
2:30 PM	**Topic to Be Determined** Dr. Lani Spund *Chief Technologist, Enterprise Systems Division* *Apple Computer, Inc.*	Grand Ballroom
3:00 PM	**Coffee Break**	Grand Ballroom Foyer
3:30 PM	**PANEL DISCUSSION:** **"The Future of Computing"**	Grand Ballroom

MODERATOR:
Ken Lowe, Principal Analyst, Semiconductor Microcomponents Service
Dataquest Incorporated

PANELISTS:
Thomas A. Beaver, Corporate Vice President and Director, PowerPC Programs
Motorola

Karen Hargrove, Senior General Manager, Digital Office Systems
Microsoft Corporation

J. Gerry Purdy, Vice President and Chief Analyst, Mobile Computing
Dataquest Incorporated

Brad Smith, Vice President, Worldwide Computer Systems and Peripherals Group
Dataquest Incorporated

Dr. Lani Spund, Chief Technologist, Enterprise Systems Division
Apple Computer, Inc.

David L. House, Senior Vice President
Intel Corporation

6:15 PM	**Coach Transportation to San Francisco Bay Cocktail/Dinner Cruise**
10:30 PM	**Return to Hotel Nikko**

Agenda Continues

Tuesday, October 12

7:00 AM	**Continental Breakfast**	Grand Ballroom Foyer
8:15 AM	**Introduction** Joe Grenier *Vice President, Manufacturing and Applications, Semiconductors* *Dataquest Incorporated*	Grand Ballroom
8:30 AM	**"Global Trends Seen From a European Perspective"** Pasquale Pistorio *President and CEO* *SGS-Thomson Microelectronics*	Grand Ballroom
9:00 AM	**"Federal Technology Policy: A New Era"** Lionel "Skip" Johns *Associate Director, Office of Science and Technology Policy,* *Executive Office of the President* *Office of Technology Assessment (OTA)*	Grand Ballroom
9:30 AM	**"China: A Newcomer in Asia"** Dan Heyler *Manager, Semiconductor Research* *Dataquest Asia/Pacific*	Grand Ballroom
10:00 AM	**Coffee Break**	Grand Ballroom Foyer
10:30 AM	**"Computer Market Trends in Japan"** Junichi Saeki *Director, Computer and Peripheral Research* *Dataquest Japan*	Grand Ballroom
11:00 AM	**"Cooperation and Competition in Converging Markets"** William P. Weber *Executive Vice President* *Texas Instruments, Inc.*	Grand Ballroom
11:30 AM	**The Multimedia Decade** Trip Hawkins *President and CEO* *The 3DO Company*	Grand Ballroom
12:00 noon	**LUNCH**	Grey Pearl and Foyer

Agenda Continues

Breakout Sessions

1:30 PM **THE FUTURE OF HOME MULTIMEDIA COMMUNICATIONS** — Grand Ballroom I

MODERATOR:
Greg Sheppard, Director/Principal Analyst
Dataquest Incorporated

PANELISTS:
William G. Luehrs, Vice President and General Manager, Video Systems
Scientific-Atlanta, Inc.

Bruce Ryon, Principal Analyst for Multimedia
Dataquest Incorporated

Ed Thompson, Director, New Business Development, Broadcast Products Group
Compression Labs, Incorporated

Simon Dolan, Director of Marketing, DSP Division
LSI Logic

Kevin Seeman, Director of Broadband Services
Pacific Bell Information Systems

1:30 PM **THE FUTURE OF FLASH MEMORY** — Grand Ballroom II

MODERATOR:
Nicolas Samaras, Director and Principal Analyst
Dataquest Incorported

PANELISTS:
Bruno Beverina, Vice President, Memory Group; General Manager, Flash Division
SGS-Thomson Microelectronics

Walid Maghribi, Vice President, Non-Volatile Memory Division
Advanced Micro Devices, Inc.

Dr. Toshiaki Masuhara, General Manager, Technology Operations, Semiconductor and IC Division
Hitachi Ltd.

Dr. Richard Pashley, Vice President, Memory Components Division
Intel Corporation

Osamu Ozawa Ph.D., Technology Executive
Toshiba Corporation

Agenda Continues

1:30 PM	**PROCUREMENT BENCHMARKING**	Grand Ballroom III

MODERATORS:
Mark Giudici, Director and Principal Analyst, Semiconductor Procurement Service
Dataquest Incorporated

Ronald Bohn, Senior Industry Analyst, Semiconductor Procurement Service
Dataquest Incorporated

PANELISTS:
Larry Durandette, Benchmarking Program Manager
Hewlett-Packard Company

A. Kenneth Pattin, Vice President, Worldwide Supply and Acquisition Management
IBM Personal Computer Company

P. William Quinn, Vice President, Procurement
SCI Systems, Incorporated

Bill J. Russell, Purchasing Manager, Electronics Systems and Advanced Technology Division
Texas Instruments, Inc.

1:30 PM	**WORLDWIDE CAPACITY ISSUES**	Pink Pearl I

MODERATOR:
Joe Grenier, Vice President, Semiconductor Manufacturing and Applications Group
Dataquest Incorporated

PANELISTS:
Eugene W. Bernosky, President, CEO, and Cofounder
Applied Chemical Solutions

Thomas Nelson, Process Manager, Electronics Commercial Development Group
Praxair, Inc.

John Osborne, Vice President
Lam Research Corporation

Jack Saltich, Director, Fab 25 Wafer Facility
Advanced Micro Devices

1:30 PM	**SIGNAL PROCESSING APPLICATION TRENDS**	Pink Pearl II

SESSION LEADERS:
Jerry Banks, Director and Principal Analyst,
Semiconductor Microcomponents Service
Dataquest Incorporated

Gary Grandbois, Senior Industry Analyst, Semiconductor Group
Dataquest Incorporated

3:30 PM **CONFERENCE ADJOURNS**

Agenda Continues

20th Annual

Semiconductor '94

October 6-8, 1994 • Palm Desert, CA
Marriott's Desert Springs Resort & Spa

Celebrate with us as we mark two decades of bringing you insights on the critical issues, analyses, and predictions for the semiconductor industry

---

To register, please complete this form and fax to (805) 298-4388 or mail it to the address below. Your confirmation will be sent to you by mail. (For additional conference registrations, please copy this form.) Please print or type clearly to ensure correct spelling on conference materials.

Last Name: ____________________ First Name: ____________________

Title: ____________________

Company: ____________________

Street: ____________________ Mail Stop: ____________________

City: ____________________ State: __________ Zip: __________

Tel: ____________________ Fax: ____________________

Special Anniversary Registration Fee: $995

This rate applies for registrations received by December 31, 1993. The rate increases to $1,195 after January 1, 1994.

Schedule: Conference: Oct 6-7, 1994 • Golf outing: Oct 8, 1994 (tentatively scheduled)
Details for a spouse program will be available after January 1, 1994.

Form of payment: (Payment or purchase order must be received by December 31, 1993 to obtain this special rate.)

1. Purchase Order# ____________________
2. Credit Card (check one) ☐ MasterCard ☐ American Express ☐ Visa ☐ Diners Club
   Card # ____________________ Expiration Date __________
   Signature ____________________
3. Check by mail ☐

Cancellation Policy: Cancellations received before September 23, 1994 are subject to a $100.00 cancellation fee. Cancellations received after September 23 are subject to payment in full. Substitutions may be made in writing up to one week prior to the conference. Non-attendance is subject to full payment.

Dataquest Conference Registration Desk

Toll Free
(800) 457-8233
U.S. only

Fax
(805) 298-4388

Telephone
(805) 298-3262

Make checks payable to Dataquest and send to:
Dataquest, Inc.
26524 Golden Valley Road, Suite 401
Santa Clarita, CA 91350

Attendees

Dataquest®

Attendees

A.B.N. Amro Bank
Lebbeus Case
Vice President
Robert Hartinger
Vice President

Actel Corporation
Andy Haines
Director of Marketing
Tom Todd
Product Marketing Manager

Advanced Micro Devices
Rathi Almaula
Corporate Marketing Manager
David Bostwick
Director, Corporate Marketing Research
Tony Liu
Module Operation Manager
Walid Maghribi
Vice President, Non-Volatile Memory Division
Scott Owen
Director, Business Development
Bernadette Ryan
Marketing Analyst
Jack Saltich
Director, Fab 25 Water Facility

Advanced Technology Laboratories
Keith Gitchel
Procurement Manager

Advantest America Inc.
Robert Lee
Product Marketing Manager

Air Liquide Electronics
Dennis LeBlond
Vice President and General Manager, Electronics

Air Products and Chemicals, Inc.
Alex Masetti
Commercial Manager, Electronics Division

Alban, Inc.
Willi Bacher
President

AMI
Steve Wadsworth
Central Application Manager

Amkor Electronics
John Boruch
President

Analog Devices, Inc.
Tom Cate
Director, Strategic Programs

Apple Computer, Inc.
Terry Kaspar
Semiconductor Group Manager
Dr. Lani Spund
Chief Technologist, Enterprise Systems Division

Applied Chemical Solutions
Eugene Bernosky
President, CEO, Cofounder

Applied Materials
George Canavan
Global Marketing Manager
Dana Ditmore
President, North American Business Operations
Don Fuller
Marketing Manager, ACET Division
Michael Musson
Director, Investor Relations
Jan Schwartz
Sales Operations Manager

Arrow/Schweber
J. Anthony Winger
Vice President, Marketing

AT&T
David Duncan
Manager, Purchasing ICs
Melville Smart
Intellectual Property Director
Roger Stricker
Intellectual Properties Director

Walter Simmons
P & T Director
C.J. Uhl
Department Head

AT&T Bell Labs
Douglas Haggan
Supervisor, Device Technology

AT&T Capital Corporation
Charles Brown
Senior Vice President
Jeff Del Porto
Andy Kielman

AT&T Microelectronics
Robert Kavner
AT&T Group Executive, Communications Products Group
Glenn Schmeal
Product Management Director, MOS

AT&T/NCR
Jon Dougherty
General Manager

B.P. Chemicals
Cathryne Ryan
Semicarb Production Manager

Bain & Company
Vincent Tobkin
Director

Brooktree Corporation
Naresh Batra
Vice President, ATE Division

Capital Research Corporation
Beck Abbe
Portfolio Manager

Capital Guardian Research
Jay Misra

Chartered Semiconductor
Steve Della Rocchetta
Vice President, Sales and Marketing

Cirrus Logic
George Alexy
Senior Vice President, Corporate Marketing
Bo Ericsson
Director of Marketing
Mike Liccardo
Vice President, Strategic Planning

Cisco Systems, Inc.
John Chambers
Senior Vice President
Robert Vellios
Strategic Procurement Specialist

Citi-Corp.
Mano Appapillai
Vice President/Technology Analyst

Codex Corporation
Renee Dorjahn
Director, Market Research

Comdisco Electronics Group
Steven Grundon
Vice President, Marketing

Comlinear Corporation
Kurt Rentel
Director of R&D

Compression Labs, Inc.
Ed Thompson
Director, New Business Development Broadcast Products Group

Conductus
Linda Capuano
Chief Financial Officer

Conner Peripherals
Dennis Praske
Vice President of Electronics

Consilium

Angus MacDonald
Product Manager

Credence Systems Corporation

Rick Carmichael
Vice President of Marketing

Jim Healy
President

Robert Huston
Vice President, Technology

Greg Illes
Director

Cunningham Communication

Malinda Banash
Client Service Manager

Dataquest Asia/Pacific

Dan Heyler
Industry Analyst

Dataquest Incorporated

Jerry Banks
Director/Principal Analyst

Ronald Bohn
Senior Industry Analyst

Gary Grandbois
Senior Industry Analyst

Joe Grenier
Vice President, Manufacturing and Applications

Mark Guidici
Director/Principal Analyst

Judy Hamilton
President and CEO

Jing Huang
Market Research Analyst

Ken Lowe
Principal Analyst, Semiconductor Microcomponents

Gene Norrett
Vice President and Group Director, Semiconductors

J. Gerry Purdy
Vice President, Mobile Computing

Bruce Ryon
Principal Analyst, Multimedia

Nick Samaras
Director/Principal Analyst

Greg Sheppard
Director/Principal Analyst

Brad Smith
Vice President, Personal Computers

Dataquest Japan

Junichi Saeki
Director

Digital Equipment Corporation

Glenn McLaughlin
SCO Strategic Purchasing Manager

Colleen Smith
SBO Commodity/Supplier Manager

Dun & Bradstreet Information Services

Lee Krueger
Electronics Industry Specialist

Eastman Kodak Company

Peter Bonney

Edward Wynne
Commodity Manager

Eaton Corporation

Ian Morris
Manager, Business Development

Electro-Scientific Industries, Inc.

Russ Schlager
Semiconductor Product Manager

Electronic Times

Rob Causey
Press

David Manners
Press

Electronic Research Service

Kuo John
Planning Engineer

Epson America, Inc.

Kevin Mooney
Product Manager

Attendees

Ernst & Young
Susan James
Partner

ERSO/ITRI
Heuy-Ling Chen

ETEC Systems
Jorge Freyer
Director of Marketing
Jon Poreda
Director of U.S. Sales

Exel Microelectronics
Edwin Chow
Vice President, General Manager

Ford Microelectronics, Inc.
Ralph Schauer
President

Ford Motor Company
Mary Glover
Buyer

Fujitsu Microelectronics
John Herzing
Vice President, Sales
Tom Miller
Vice President of Marketing
Patrick O'Hearn
Director, Strategic Marketing

GEC Plessey Semiconductor
Joseph Hustein
General Council
Phil Pollok
Vice President, Marketing
Haskell Waddle
President and General Manager
Phil Welsh
Marketing Manager, Communications

General Instrument Corporation
Donald Butler
Vice President, Engineering
Steven Maine
Vice President, Business Development

Goldstar Electronic Company, Ltd.
Kwang Sun Baek
Managing Director
Don Chun
Senior Managing Director
Yu Sig Kang
President

Greene, Tweed & Company
Dalia Vernikovsky
Semiconductor Marketing Manager

Hayes MicroComputer
Thomas Campbell
COO

Hewlett-Packard Company
Bob Bowden
Director Semiconductor
Larry Durandette
Benchmarking Program Manager
Jim Lee
Procurement Engineer
Peter McIntyre
Industry Market Manager
Tom Newsom
Marketing Manager

Hill & Knowlton
Bruce LeBoss
Senior Vice President,
Advanced Technology Practice Director

Hitachi America, Ltd.
Burt Barber
Market Research Engineer
Dr. Toshiaki Masuhara
General Manager, Technology Operations
Semiconductor and IC Division
David Raulino
Market Research Engineer
Katsuro Sasaki
Senior Manager

Ron Schwarer
Marketing Planning Manager
Kiyoshi Uragami
Vice President

Hitachi Microsystems, Inc.
Tony Moroyan
Vice President of HMSI

Hoechst Celanese Corporation
Tony Corso
Vice President/General Manager

Hoya Electronics Corporation
Kyung Kim
President and CEO

Hughes Aircraft
Chet Farris
Assistant Division Manager
Patrick Kenaley
Marketing Manager

Hyundai Electronics America
Dennis McKenna
General Manager and Vice President
William Scharrenberg
Diretor of Marketing

IBM Corporation
Dr. Michael Attardo
Senior Vice President
General Manager, Technology
Bill Cochran
Manager
Frank Jalenko
Director, OEM Business Development
Edward Kobeda
Advisory Engineer
Rusty Sargent
Business Analyst
Barry Seidner
Manager, Strategic Marketing
Roy Towlen
Senior Analyst
Cary Ziter
Public Relations

IBM Microelectronics
James Monahan, Jr.
Communications Manager
Irene Sun
Manager OEM

IBM PC Company
A.K. Pattin
Vice President,
Worldwide Supply and Acquisition Manager

IBM Technology Products
Frank Martin
Program Manager

Information Storage Device
David Angel
President

Institute for the Future (IFTF)
Dr. Robert Johansen
Senior Research Fellow and Director, New Technologies Program

Intel
Ralph Gillespie
Director of Materials
Dave House
Senior Vice President
Dave Johnson
High Performance Platforms Manager
Greg Komoto
Strategic Market Analyst
Bruce Kubicka
Manager, North American Market Research
Gordon Moore
Chairman of the Board
H.F. Ng
Product Marketing Engineer
Mark Norwood
Manager, Corporate Research
Dr. Richard Pashley
General Manager, Memory Components Division
Michael Stark
Manufacturing Technology

S.H. Wong
General Manager of Business Unit

Italtel
Gianfranco Bernardi
Purchasing Manager

Italtel Sit
Ferruccio Nebuloni
Buyer

JETRO San Francisco
Kazuo Miyazawa
Director of Technological Affairs

Kobe Steel USA, Inc.
Mike Goto
Director

LAM Research Corporation
Bob Fink
Vice President and COO
John Osborne
Vice President
Bruce Rhine
Vice President, Oxide Division

Lattice Semiconductor Corp.
Steve Skaggs

LSI Logic Corporation
Kevin Bligh
Vice President, Marketing U.S.
Dom Consorte
Director, Marketing
Ken Dalle-Molle
Market Research Analyst
Simon Dolan
Director of Marketing, DSP Division
Bruce Entin
Vice President
Moshe Gavrielov
Vice President, ASIC Development
Brian Hala
Executive Vice President
Karen O'Connell
Director of Marketing

Shubha Tuljapurkar
Vice President and General Manager

Ma Laboratories
Abraham Ma
President

Market Makers, Inc.
Pam Black
John Teuber
President
Allison Young

Marvbeni International Electronics
Kent Hasegawa
Manager, Export/International Marketing

Materials Research Corporation
Giovanni Nocerino
Vice President, Marketing and Sales

Maxtor Corporation
Nick Valenzuela
Strategic Planning Manager

MCA, Inc.
Jean LeMoin
President

Microchip Technology Inc.
Mitch Little
Vice President, Memory Products Division
Steve Sanghi
President and CEO

MicroModule Systems
W. C. Robinette, Jr.
Chairman and CEO

Microsoft Corporation
Karen Hargrove
Senior General Manager, Digital Office Systems

Mitsubishi EDG
Michael Bocian
Vice President, Sales

Mitsubishi Electric Corporation

Koichi Kamahara
Manager, Semiconductor Marketing
Chris Peterson
Manager, Strategic Planning

Montgomery Securities

Tom Thornhill
Vice President

Motorola

Tom Beaver
Corporate Vice President and Director, PowerPC Programs
Arie Brish
Marketing Manager
Richard Brunner
Market Development Manager
David Lloyd
Director of Marketing
Rich Parks
Manager

Motorola Semiconductor

Tim Saccomanno
Business Planning Manager

Motorola, European Semiconductor Group

Alain Thiry
Marketing Director, Europe

National Semiconductor

Richard Beyer
President, Communications and Computing Group
Charles Carinalli
Senior Vice President and Chief Technical Officer
Sanjeer Dua
Marketing Manager, MPD
Anne Gregory
Marketing Manager, MPD
Steve Hamilton
Director, Memory Marketing
Michael Kimball
Marketing Research Manager
Rajeeva Lahri
Director
Paul Lubeck
Marketing Manager, MPD
Joseph Martin
Vice President
Richard Merrill
Manager
Jim Owens
Executive Vice President of Analog Operations
Kirk Pond
President of Standard Products Group
Richard Sanquini
Senior Vice President, Business Development
George Scalise
Bob Strain
Director, Strategic Technology
Anne Wagner
Vice President, International Communications
Mary Wu
Director, China Business Development

NCR Corporation

William Daughton
AVP, Semicustom Products
Steven Easley
Director, Strategic Planning and Marketing
Robin Wagner
Director of Marketing
Bill Wurtz
Semicustom Product Manager

NCR Microelectronics

Robert Harrah
National Sales Director

NCR-CETC

Joe Holt
Director of Operations

NEC Electronics, Inc.

Satoru Sato
Director, Corporate Planning
Crispina Toth
Business Analyst

Bryn Young
Business Analyst

Netherlands Centre/Microelectronics
Harry Bosch
CEO Public Relations

Netherlands Foreign Investment Agency
Rutger Schuitemaker
Director, West Coast Operations

Newbridge Networks
Don Hnatyshin
Director of Corporate Procurement

Nikon Precision
Allan Dickinson
Vice President, Sales and Marketing
Thomas Duft
Technical Marketing Manager

NKT Elektronik
Jorn Kjar Marcussen
Kim Stenberg

Northern Telecom, Ltd.
Wanda Baldwin
Manager of Consultant Relations
Laurence Trunley
Senior Manager External Sourcing

NSC
Holly Rollo
Communications Manager
Sandra Schramm
Communications Manager

Office of Technology Assessment
Lionel"Skip" Johns
Associate Director, Office of Science and Technology Policy, Executive Office of the President

Oki Electric Industry
Cliff Vaughan
Research Marketing Manager

Pacific Bell Information Systems
Kevin Seeman
Director, Broadband Services

Paul Castrucci & Associates
Paul Castrucci
Managing Director

Phillips Semiconductor
Brian Bachman
Vice President, General Manager SBG

Praxair, Inc.
Thomas Nelson
Process Manager, Electronics Commercial Development Group
Don Pierce
Strategic Accounts Manager

Price Waterhouse
Paul Turner
Executive Director, PWTC

Prometrix
Gary Bultman
Vice President, Marketing

Ramtron Corporation
George Stathakis
Chairman and CEO

Raytheon Company
James DiLorenzo
General Manager

Reliance Electric
Dennis Schaefer
Corporate Manager, Electronic Purchases

Ritronics Components, PTE
Moh Wah Heng

Robertson, Stephens & Company
Daniel Klesken
Partner

Rockwell International
Doug Clemons
Market Research Manager

ROLM
Gerhard Apfelauer
Director of Technical Planning
John Rasmus
Director of New Business Development

Ross-Dove Company, Inc.
Lee Cochran
Chief Financial Officer
Bruce Leister
President of DoveTech
Kevin Otus
DoveTech Appraisal Manager

S-MOS Systems, Inc.
Tom Endicott
Vice President of Product Management
Dan Hauer
President and CEO
Robert Wong
Director

Samsung Electronics
Sook Youm Kim
Assistant Manager

Samsung Semiconductor
Mark Ellsberry
Director, Memory Marketing
Irene Harrington
Executive Assistant
J.R. Lee
Planning Manager
Keith McDonald
Vice President, Sales and Marketing
Young-Bae Rha
Senior Vice President, Sales and Marketing
Martin Saso
Director of Sales and Marketing

Sanyo Semiconductor Corporation
Howard Sussman
Senior Manager, MOS Products

SCI Systems, Inc.
P.W. Quinn
Vice President, Procurement

Scientific-Atlanta, Inc.
William Luehrs
Vice President and General Manager, Video Systems

Sematech
Elisa Bass
Research Librarian
Linda Chao
Competitive Analyst
Sam Harrell
Chief Strategy Officer
Karen Kissler
Competitive Analyst
Bill Mitchell
Frank Robertson
Director of Furnace and Implant Operations

Sematech/Intel
Eileen Neacy
Future Factory Analyst

Sematech/Motorola
Steven Brown
Future Factory Analyst

Semiconductor Industry Association
Doug Andrey
Manager of Statistical Programs

Semiconductor Systems, Inc.
Jerry Masterson
Vice President and CFO
Mike Parodi
President

Semitomo Metal, USA.
Hachiro Sumi
Representative Manager

Attendees

Sequent Computer Systems
Sally Malone
Senior Buyer

Sequent Computer
Randy Merrill
Supplier Partnering Manager

SGS-Thomson Microelectronics
Bruno Beverina
Vice President, Memory Group
General Manager, Flash Division
Pasquale Pistorio
President and CEO
Prosper Quashie
Marketing Services Director

Shinko Electric America, Inc.
Will Eckert
Vice President, Sales and Marketing

Shipley Company
John Suydam
Director of Technical Sales

Silicon Valley Group, Inc.
Papken Der Torossian
Chairman and CEO

Silicon Graphics
Lori Hawker
Procurement Manager
Gayle Hayes
Procurement Manager

Singapore Economic Development Board
Hin-Cheong Foong
Voon-Kheong Liow
Hilary Quah

SMI Ceramics America, Inc.
Iwao Fujimaki
President

Solectron
Jeff Bloch
Director of Supply Base Manager
Steve Ng
Vice President, Worldwide Operations

Solid State Technology
Peter Dunn
Senior News Editor

Sony Corporation of America
Jean Pierre Laussade
Vice President, Component Products

Standard Microsystems Corporation
Art Sidorsky
Executive Vice President

Sumitomo Chemical America
Masaaki Hama
Manager and Chief Representative

Sumitomo Sitix Silicon, Inc.
George Rehfeldt
President and CEO

Sumitomo Metal Mining, USA, Inc.
Yoshiyuki Uesaka
Sales Manager

Taiwan Semiconductor Manufacturing
John Chen
Senior Director, Product Services
F.C. Tseng
Vice President of Operations

Tandem Computers
Aurangzeb Khan
Development Engineering Manager
John Norris
Technology Program Manager

Tektronix Components Corp.
Rick Hill
President

Tel America, Inc.
Ken Muroi
Marketing Staff

Teradyne, Inc.
George d'Arbeloff
Vice President
Chip Thayer
Maketing Director
Frederick VanVeen
Vice President

Texas Instruments, Inc.
Kevin McGarity
Senior Vice President
William Russell
Purchasing Manager, Electronics Systems and Advanced Technology Division
William Weber
Executive Vice President and President

The 3DO Company
Trip Hawkins
President and CEO

The Bank of California
Bill Bloore
Assistant Vice President

Toppan Printronics
Jim Lewis
President

Toshiba America
Satchit Dokras
Manager, Strategic Planning

Toshiba Corporation
Dr. Osamu Ozawa
Technology Executve

TSMC, USA
Paul Chien
Senior Director
Gianni Kuo
Marketing Engineer
Pan-Wei Lai
Director of Engineering
Mou-Shiung Lin

U.S. Department of Commerce
Robin Roark
Semiconductor Industry Analyst
Robert Scott
Senior Trade Specialist

Ultratech Stepper
Dan Berry
Senior Vice President
Joe Nava
Vice President/Sales
Arthur Zafiropoulo
President and CEO

Union Bank
Tony Kwee
Vice President, Technology Industries

Unisys Corporation
Richard Joy
Vice President and General Manager
James Vanhollebeke
Manager Supply Base Management

Unit Instruments, Inc.
Don Burkman
Vice President, Sales and Marketing

United Technologies Microelectronic Center
Ron Hehr
New Product Definition Manager

US Leasing Corporation
Colleen Lusian
Manager, Asset Management REG

Varian Associates
William Johnson
Vice President, Sales

Attendees

Varian Ion Implant Systems
Bruce Thayer
Marketing Manager

Vertex Management, Inc.
Bruce Graham
Investment Manager

Vertex Semiconductor
Bob Feretich
Vice President of Engineering

VLSI Technology, Inc.
Som Das
Director, Strategic Programs
Denise Green
Senior Controller/Worldwide Sales and Technology
Leon Humble
Vice President and General Manager
Umesh Padval
Director, Apple Products
Doug Powell
Sales
Ralph Warmach
Director, Strategic Marketing
Ho Yu
Vice President of Technology

Wacker Siltronic Corporation
Jim Aylor
Vice President, Commercial Applications
Dr. Rudolph Staudigl
President

Watkins, Johnson Company
Kurt Lightfoot
Director Marketing

Wyle Laboratories
Charley Clough
Chairman and CEO

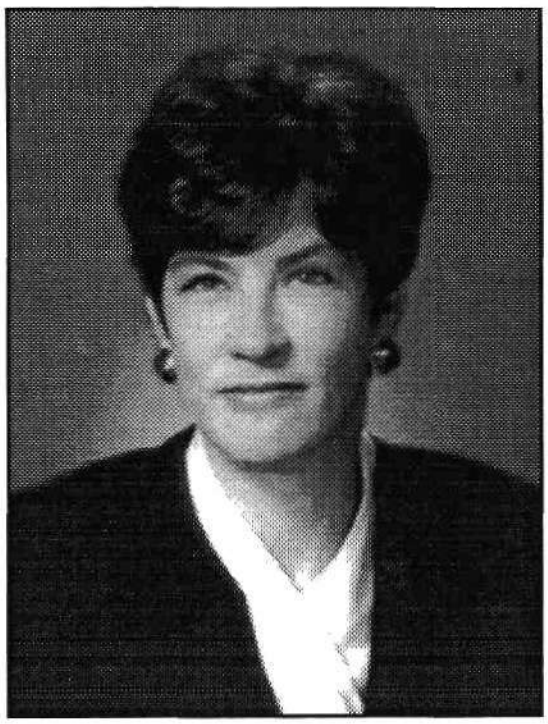
Xilinx, Inc.
Charles Fox
Director, Marketing

Yamaichi Electronics, Inc.
Bob Million
Marketing Manager

Dataquest®

Welcome and Introduction

Judith H. Hamilton
President
Dataquest Incorporated



As President, Ms. Hamilton is responsible for Dataquest's worldwide market research and consulting activities. In this role, she provides overall leadership to Dataquest's 450 professional staff and associates; ensures overall client care for Dataquest's 2,000 industry clients; and contributes direction and vision to the major areas of Dataquest research coverage in Semiconductors, Computer Systems and Peripherals, Communications, Document Management, Software, and Services. In addition, she oversees Dataquest's two independent divisions—Invitational Computer Conferences (ICC) and Machinery Information Division (MID). Prior to joining Dataquest, Ms. Hamilton spent 26 years in the information technology industry in a variety of leadership positions. Most recently, she was with Locus Computing Corporation, where she was senior vice president and general manager. Previously, she was partner and national director of market development for the Information Technology Organization of Ernst & Young. Ms. Hamilton is actively involved in a number of community and business-related organizations including the Information Technology Association of America (ITAA, formerly ADAPSO) where she is currently a Board member and a Foundation Board Member. She was a founder and board member of the Los Angeles Business Network and a past member of the City of Hope Technology Board in Los Angeles and the Business Advisory Board of the New York Zoological Society. She is currently on the Board of Directors of the Applications Group, a professional services firm in San Francisco. She has been a speaker at many conferences held by organizations such as IDC, ADAPSO, Ledgeway, and Computer Intelligence. Ms. Hamilton graduated from Indiana University with a B.A. degree in history in 1966. She then went to Germany for two years where she completed all courses for a Master's degree in International Relations from Boston University in Heidelberg. Returning to the United States in 1968, she completed technical training for computer programming at System Development Corporation in 1969. In 1978, Ms. Hamilton completed the Executive program at the UCLA Graduate School of Management.

No Presentation Available

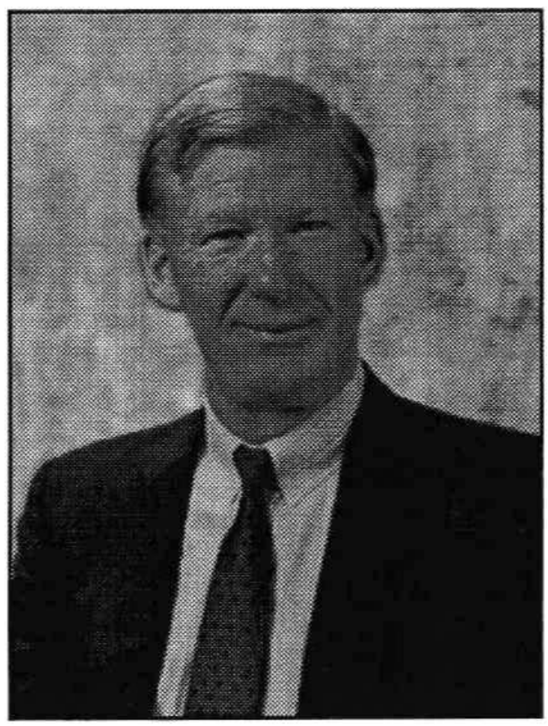
Notes:

Notes:

1994 Forecast—The Silicon Cycle Continues

Gene Norrett
Corporate Vice President and Director
Semiconductor Group
Dataquest Incorporated

Mr. Norrett is Corporate Vice President and Director of the Semiconductor group responsible for all U.S. semiconductor research and coordination of our European and Japan-based semiconductor research. Prior to this, he was Director of Marketing, responsible for the worldwide marketing strategies. Mr. Norrett was also the founder of Dataquest's Japanese Semiconductor Industry Service and served as Acting Managing Director of Dataquest Japan KK. Before joining Dataquest, Mr. Norrett spent 14 years with Motorola's Semiconductor Product Sector, serving in various marketing and management positions. Mr. Norrett's education includes a B.A. degree in Mathematics from Temple University and an M.S. degree in Applied Statistics from Villanova University.



Semiconductor Industry Conference

1994 Forecast—
The Silicon Cycle Continues

Gene Norrett

Vice President
Dataquest Incorporated

Dataquest

G3005383

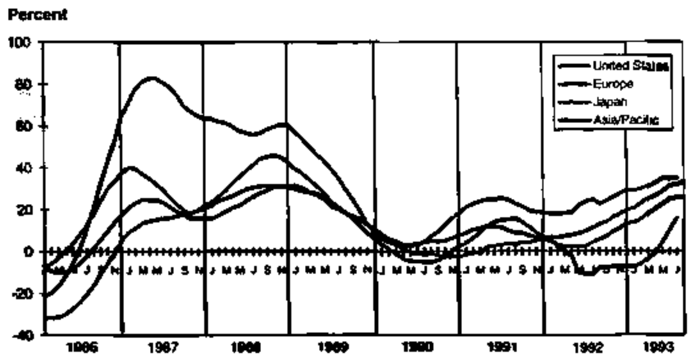
Agenda

- Historical semiconductor cycle
- Semiconductor industry status—1993
- Assumptions behind the forecast
- 1994 Semiconductor forecast
- Conclusions

Dataquest

G3005384

12-Month ROC Revenue
Regional Semiconductor Consumption



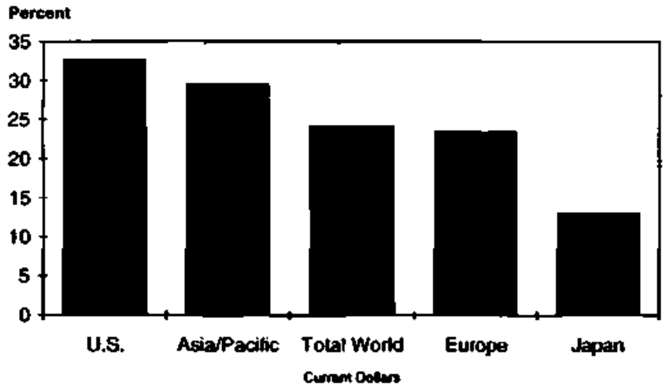
Source: Dataquest

Dataquest

G3005770

Notes:

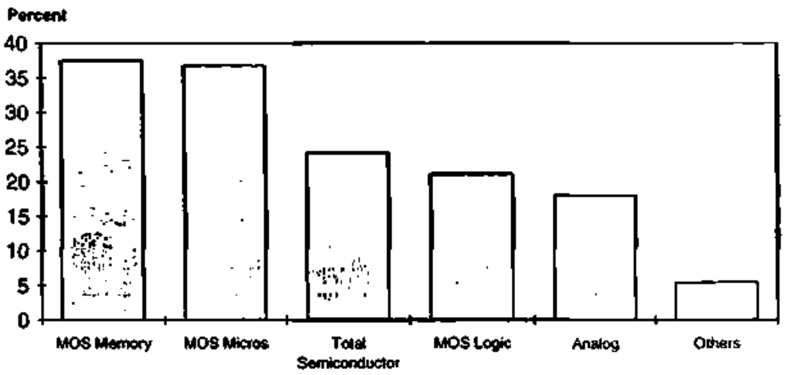
1993 versus 1992 Growth
Semiconductor Regional Growth



G3005771

Source: Dataquest

1993 versus 1992 Growth
Major Semiconductor Devices



Source: Dataquest

G3005772

1993 Industry Characteristics

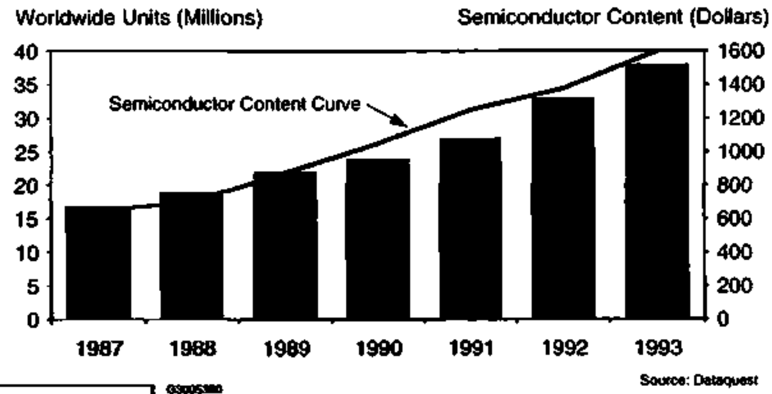
- Semiconductor industry at capacity in 1993, and slight improvement in 1994
- PC, peripherals, and networking are the main engines
- United States, Asia/Pacific, and Europe leading the growth; Japan bookings recovered in second quarter of 1993 and will grow gradually
- MPUs, MPRs, and programmable logic, to name a few, on "allocation"
- DRAMs and SRAMs in short supply because of PC upgrades to Windows
- Semiconductor stocks in most universes up 35% versus 1992
- Intel will again be the market leader, semiconductor revenue at least $7 billion
- Semiconductor content in computers rising rapidly

Source: Dataquest

Dataquest

Notes:

Personal Computers versus Semiconductor Content



G3005380

Dataquest

1994 Forecast Assumptions

G3005385

Dataquest

Macro Assumptions on the U.S. Economy

Inflation not a problem	CPI 1993 = 3%; 1994 = 4%
Inventories falling to record lows	I/S 1993 = 1.5%; 1994 = 1.5%
Capital spending	1993 = 12% up; 1994 = 7% up

Source: Dataquest

Dataquest G3005386

Notes:

Drivers of Cyclical Spending

- Lower cost of capital
- Stronger cash flow
- Corporate reengineering
- Worldwide competitive presence
- Higher return on capital

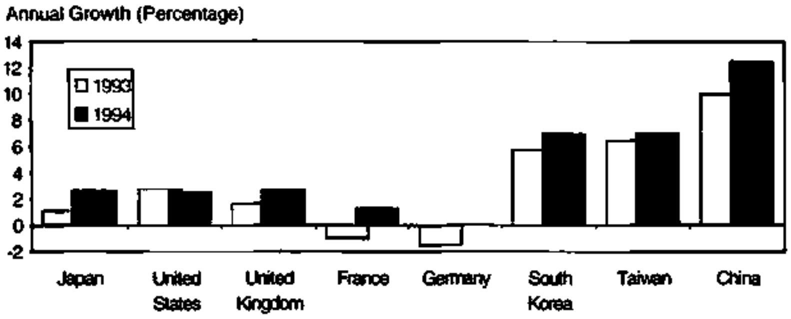
⇨ Productivity-led recovery

Dataquest

G3005367

Assumptions behind the Forecast

Real GNP/GDP Growth, Local Currencies



Source: Dataquest

Dataquest

G3005776

1994 Worldwide Electronic Equipment Production Forecast

Billions of Dollars

	1993	1994	% Growth
Data Processing	219.8	235.4	7.1
Communications	112.4	120.4	7.1
Industrial	97.2	104.0	7.0
Consumer	144.0	154.0	6.9
Military/Civil Aero	78.3	78.2	-0.1
Transportation	28.1	30.4	8.3
Total	679.7	722.3	6.3

Note: Columns may not add to totals shown because of rounding.

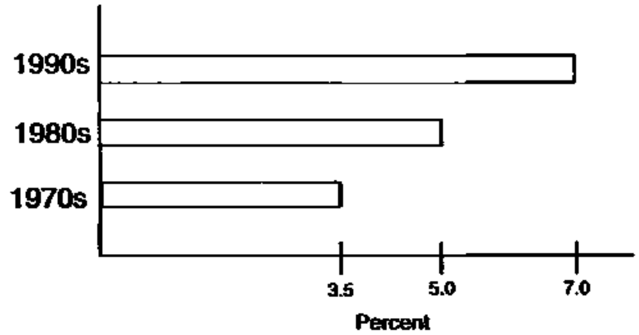
Source: Dataquest

Dataquest

G3005777

Notes:

Increasing Semiconductor Content of Electronics



Source: Dataquest

Dataquest

1994 Semiconductor Forecasts

Dataquest

1994 Quarterly Trends versus the Prior Year (Percent Increase)

	1993					1994				
	Q1	Q2	Q3	Q4	Year	Q1	Q2	Q3	Q4	Year
United States	32.8	37.4	33.7	27.3	32.7	21.4	20.2	17.9	17.1	19.0
Japan	1.9	18.9	16.2	14.9	13.1	20.4	6.3	5.5	5.3	8.8
Asia/Pacific	30.4	28.1	28.9	30.7	29.5	28.9	24.5	18.2	10.6	20.0
Europe	24.3	30.7	17.6	21.9	23.5	12.0	13.0	16.5	12.3	13.4
Total	20.8	28.6	24.3	23.1	24.2	20.7	15.5	14.0	11.6	15.2

Source: Dataquest

Dataquest

G3005773

Notes:

1994 Quarterly Trends versus the Prior Year (Percent Increase)

	1993					1994				
	Q1	Q2	Q3	Q4	Year	Q1	Q2	Q3	Q4	Year
MOS Memory	22.8	38.4	43.7	43.1	37.5	41.0	30.4	13.5	0.6	19.5
MOS Micro	43.5	51.0	34.8	22.5	36.7	17.2	16.6	26.8	33.2	23.7
MOS Logic	19.6	22.5	19.8	22.2	21.1	22.0	15.6	11.0	7.5	13.7
Monolithic Analog	21.3	20.4	14.3	16.9	18.1	12.0	8.6	11.2	9.6	10.3
Others	21.2	28.9	24.6	23.5	24.6	20.7	15.8	14.2	11.8	15.4
Total	20.8	28.6	24.3	23.1	24.2	20.7	15.5	14.0	11.6	15.2

Source: Dataquest

Dataquest G3005774

Dataquest Conclusions

- 1994 economic picture improving
- Capital spending increasing
- Semiconductor content rising
- New applications emerging
- New regions emerging
- Capacity strained, prices firm
- Profits rising

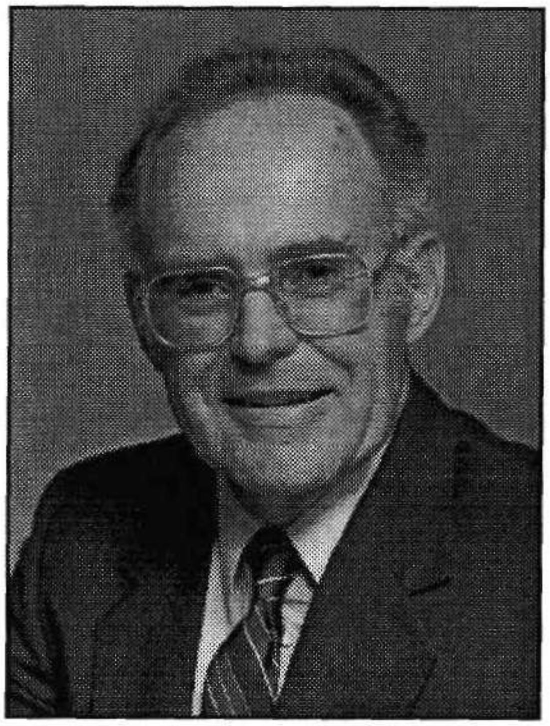
Dataquest G3005775

Notes:

KEYNOTE SPEAKER:
Which Semiconductor Industry?

Gordon E. Moore
Chairman of the Board
Intel Corporation

Dr. Moore is currently Chairman of the Board of Intel Corporation. He cofounded Intel in 1968, serving initially as Executive Vice President. Dr. Moore became President and Chief Executive Officer in 1975 and held that post until elected Chairman and Chief Executive Officer in 1979, retaining that position until 1987. Before founding Intel, Dr. Moore was Director of Research and Development for the Fairchild Semiconductor Division of Fairchild Camera and Instrument Corporation, a company that he cofounded in 1957. Dr. Moore is also a Director of Varian Associates and Transamerica Corporation. He is a member of the National Academy of Engineering, a Fellow of the IEEE, and a Trustee of the California Institute of Technology. He received the National Medal of Technology in 1990 from former President George Bush. Dr. Moore earned a B.S. in Chemistry from the University of California at Berkeley and a Ph.D. in Chemistry and Physics from the California Institute of Technology.



Notes:

No Presentation Available

Notes:

No Presentation Available

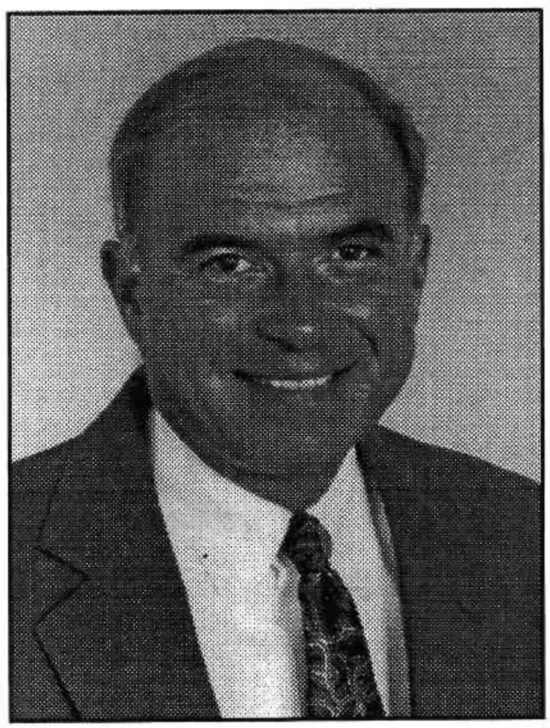
Notes:

Notes:

Merchant Market Success Strategies

Dr. Michael J. Attardo
Senior Vice President,
General Manager,
Technology Products
IBM Microelectronics

Dr. Attardo is an IBM Senior Vice President and General Manager of Technology Products. Since joining IBM in 1967, Dr. Attardo has served in a number of engineering and management positions prior to his present position. In 1982 he held the position of Director of Organization Planning; in January 1984 he was promoted to General Technology Division Vice President of Manufacturing and Development Operations and later that year became IBM's Director of Development. He was elected IBM's Vice President of Development in September 1986 and was named President of the General Technology Division in April 1987. He was promoted to General Manager of Manufacturing and Process Development in February 1992, was appointed to his current position in July 1992, and was elected an IBM Senior Vice President in January 1993. Dr. Attardo holds a B.A. degree in the arts from Queens College and B.S., M.S., and Ph.D. degrees in Metallurgy from Columbia University. He is a member of the Board of Directors of Sematech and (SIA) Semiconductor Industries Association.



Notes:

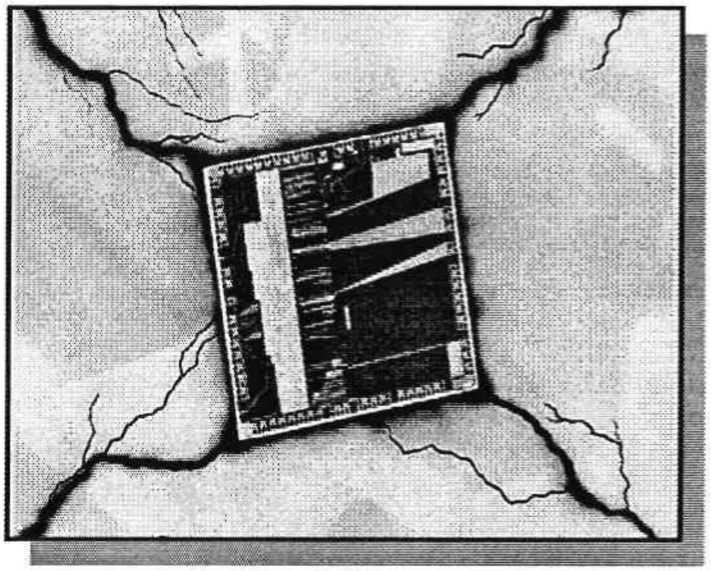
MERCHANT MARKET SUCCESS STRATEGIES

Dr. Michael J. Attardo
Sr. Vice President & Gen. Manager
IBM Microelectronics

IBM

Client: IBM Rev. Final 10-06-93 2410-01

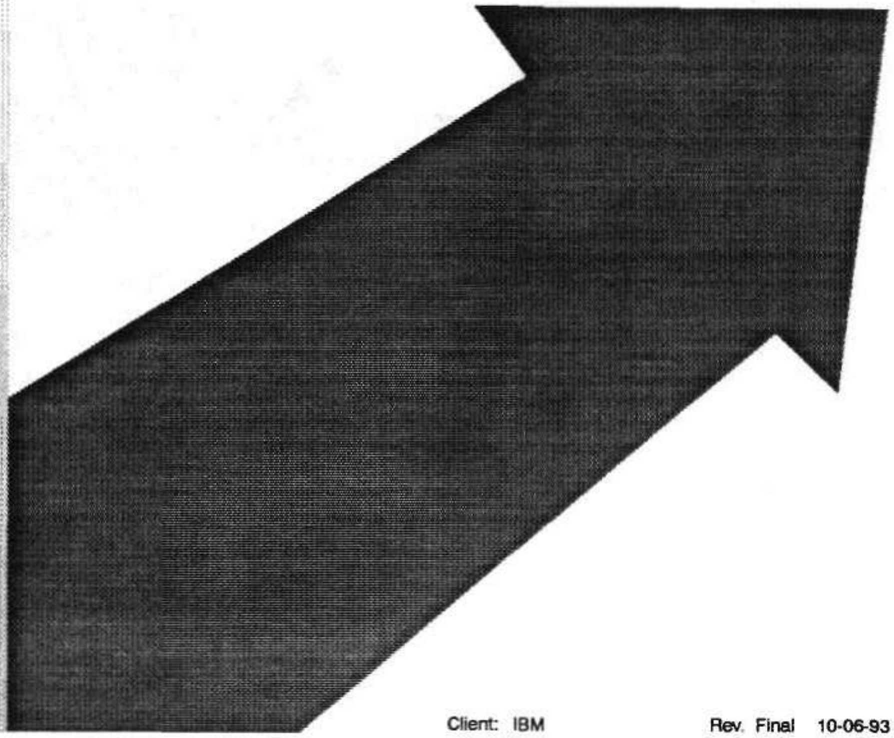
LEADING-EDGE PRODUCT



BLUE LIGHTNING

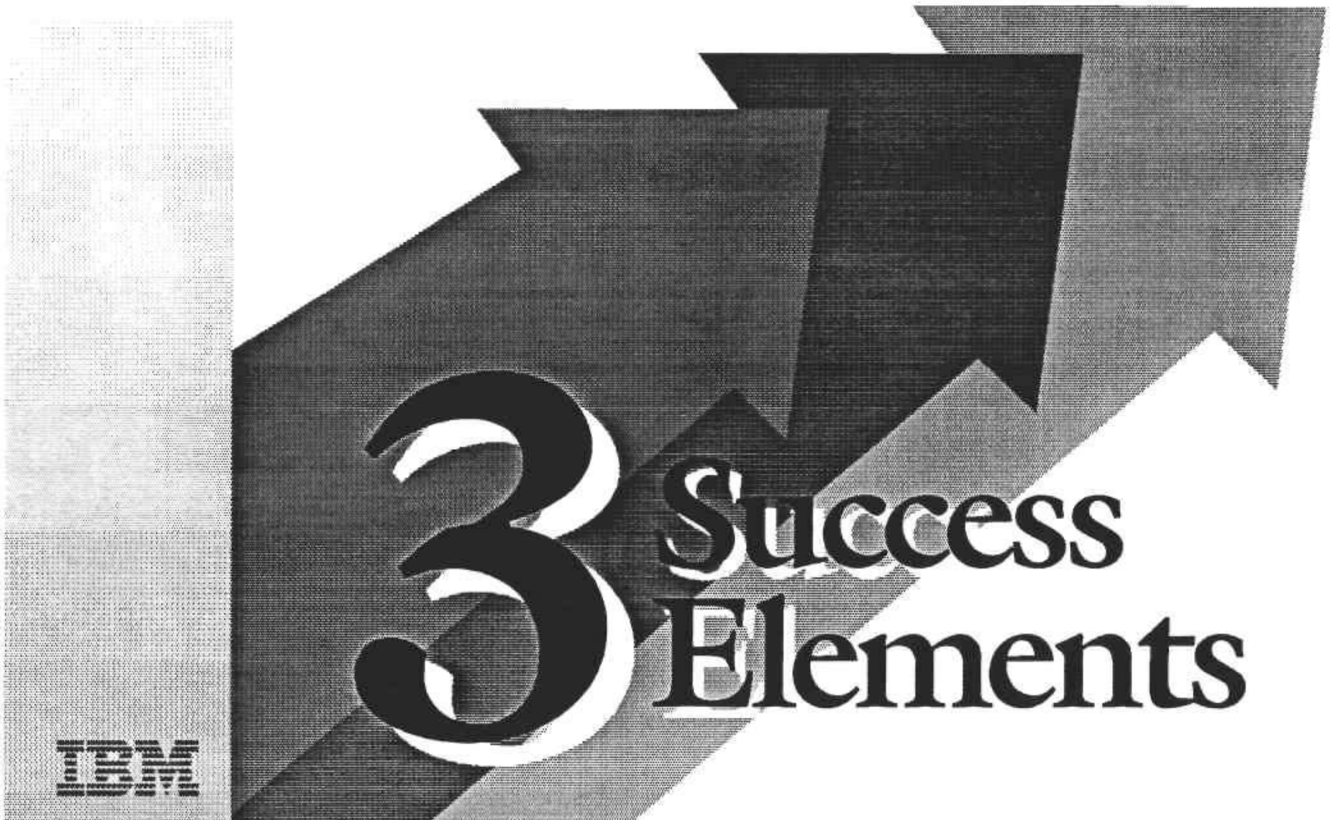
Client: IBM Rev. Final 10-06-93 2410-02

INDUSTRY DIRECTION



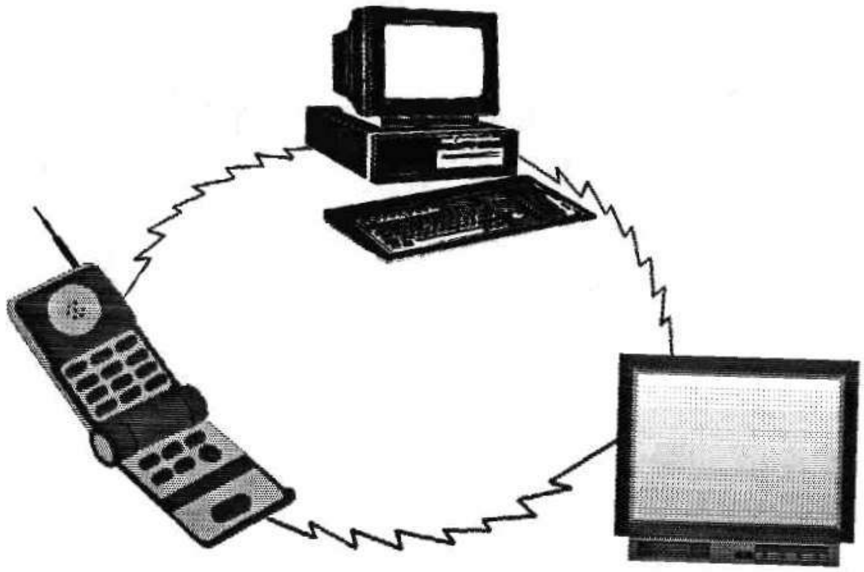
IBM

Client: IBM   Rev. Final   10-06-93   2410-03



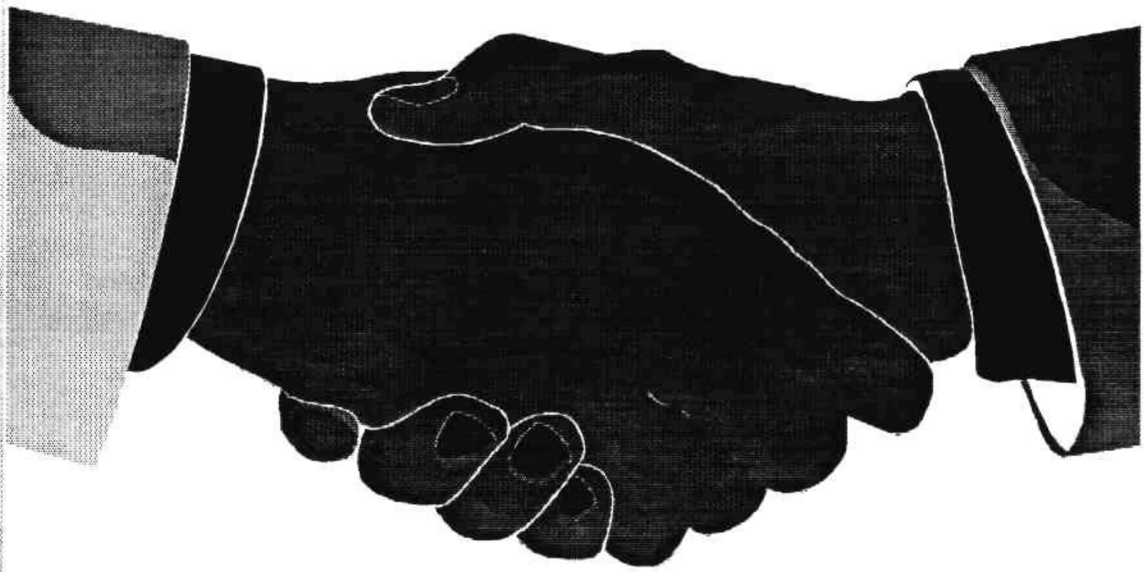
Client: IBM   Rev. Final 10-06-93   2410-04

CONVERGENCE



Client: IBM Rev. Final 10-06-93 2410-05

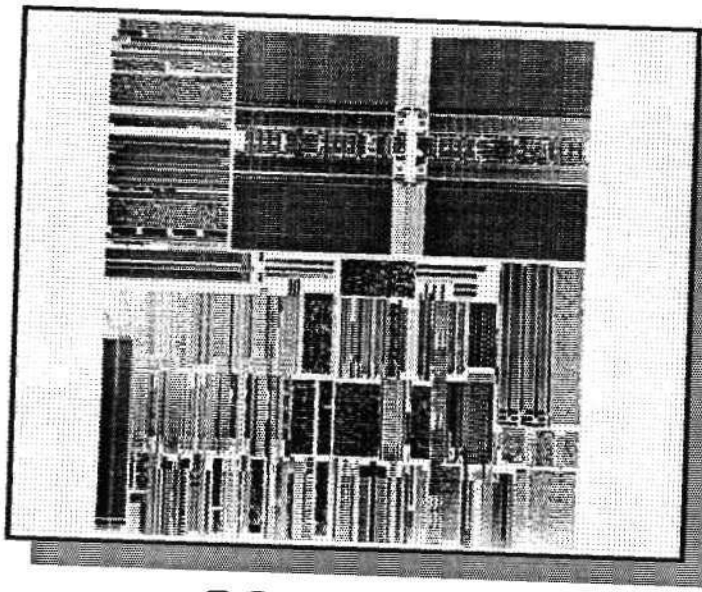
ALLIANCES



IBM

Client: IBM Rev. Final 10-06-93 2410-06

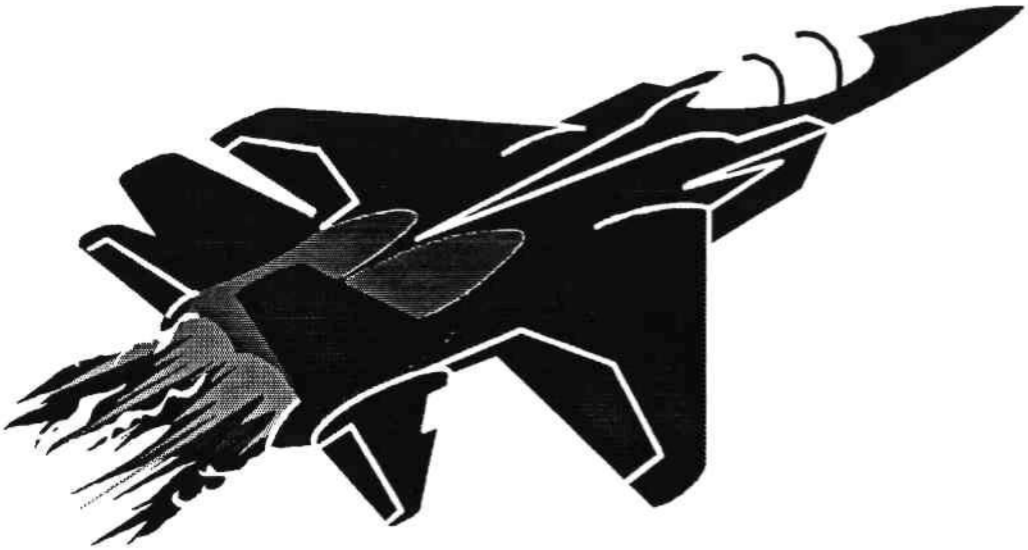
SUPERIOR PRODUCT DESIGN



POWER PC

Client: IBM Rev. Final 10-06-93 2410-08

IMPRESSIVE PERFORMANCE



Client: IBM   Rev. Final   10-06-93   2410-10

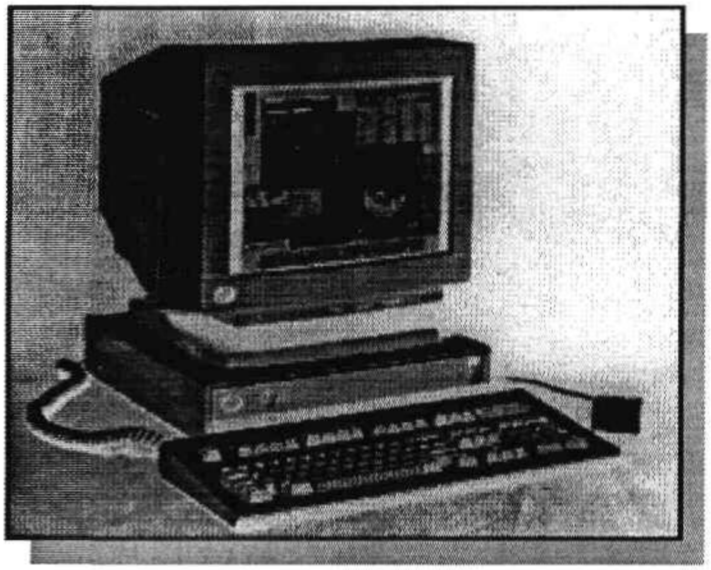
POWER PC

"...the right product,
with the right partners
at the right time."
PC Week

IBM

Client: IBM Rev. Final 10-06-93 2410-11

IMPRESSIVE PRODUCT



RS/6000

IBM

Client: IBM   Rev. Final 10-06-93   2410-12

PRODUCT PORTFOLIO

- 16MB DRAM
- Compression Products
- ASIC
- Embedded Controllers
- PCMCIA Cards
- Digital Signal Processors
- Mwave Products

IBM

OPERATING SYSTEMS

Taligent

AIX

Solaris

System 7

IBM

PRODUCT PORTFOLIO

- 16MB DRAMS
- Compression Products
- ASICs
- Embedded Controllers
- PCMCIA Cards
- DSPs
- MWAVE Products

IBM

After 30 years of leading the way in microelectronics, it's time we introduced ourselves.

Here we are.

After months of headlines and hearsay, **IBM Microelectronics**™ has entered the merchant market. With both feet and all the resources in the world.

So let's get down to business. We want to tell you, in plain English, exactly who we are. What we offer. And why we believe IBM Microelectronics is the one supplier with the strengths to meet all your technology needs.

We'll begin with the obvious. For the past 30 years, we've created and manufactured innovative products for IBM, one of the world's largest computer companies. In all that time, there isn't a design, process or packaging problem we haven't seen. Or solved.

Our latest challenge is perhaps our most demanding. But it's one we're supremely equipped to handle. Today's convergence of computers, communications and consumer electronics has created a potent need for suppliers with the vision and muscle to deliver not just parts, but integrated, leading-edge systems.

The answer is something we call *Total Technology Solutions.*℠ In a nutshell, it gives customers unlimited access to our unrivaled silicon, packaging and manufacturing technologies. And it enables us to bring superior subsystems to market faster and more efficiently.

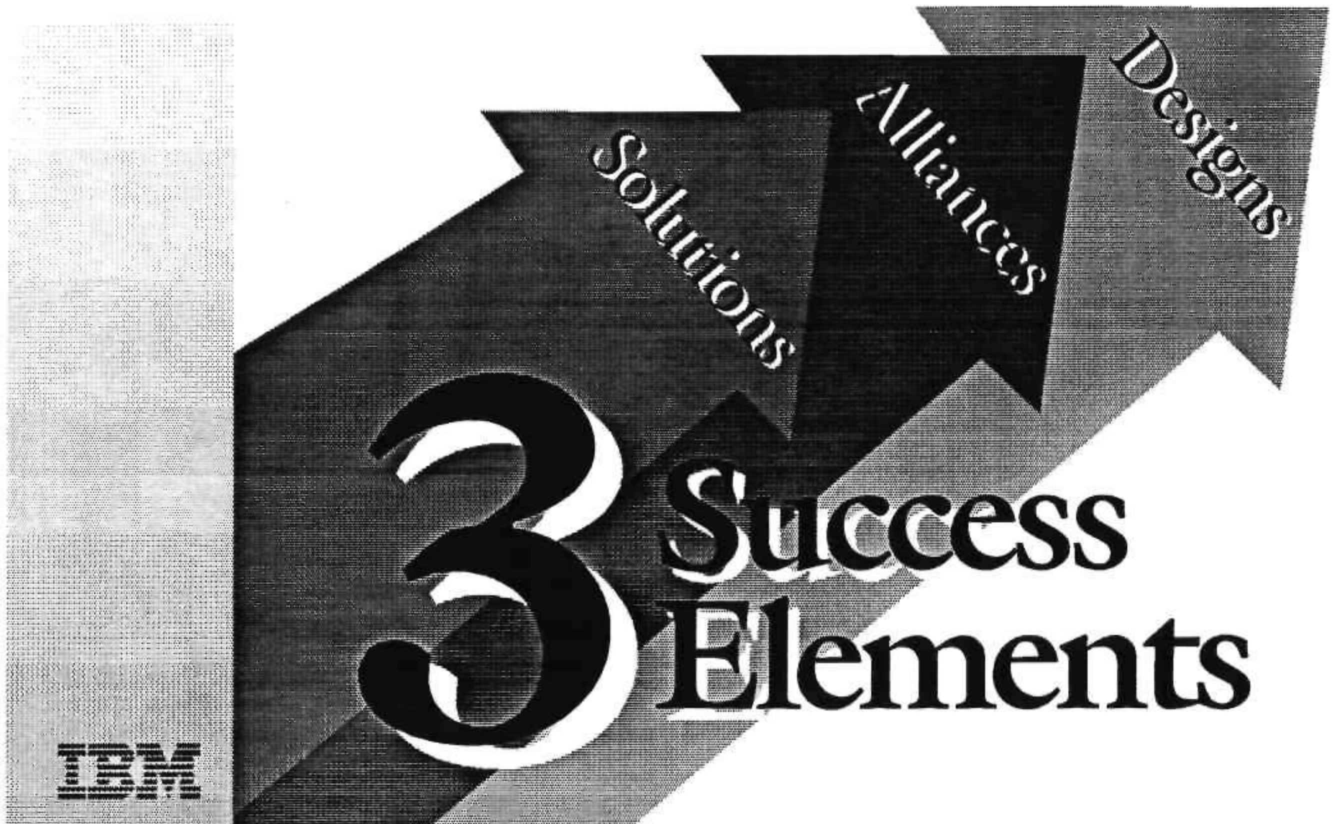
So turn the page to discover all the answers awaiting you at IBM Microelectronics. Together, there's nothing we can't accomplish.

IBM Microelectronics™

Total Technology Solutions℠

IBM

Client: IBM Rev. Final 10-06-93 2410-20



Client: IBM Rev. Final 10-06-93 2410-19

IBM Microelectronics™

Total Technology Solutions℠

IBM

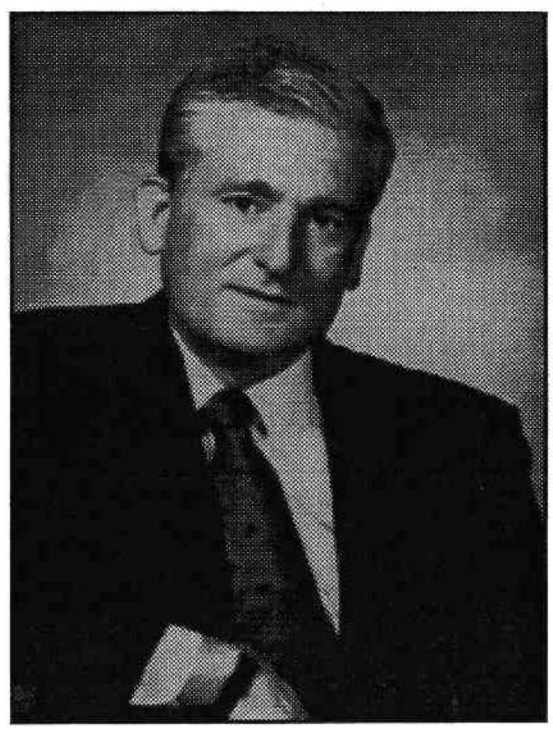
Client: IBM   Rev. Final 10-06-93   2410-18

Notes:

Multimedia and Microelectronics: Building the 21st Century Partnership

Robert M. Kavner
AT&T Group Executive
Communications Products Group
AT&T

As an AT&T Group Executive and member of AT&T's Operations Committee and Executive Committee, Mr. Kavner is one of four Group Executives who oversee AT&T's business interests. He is responsible for the Communications Products Group, which consists of five business units: Global Business Communications Systems, which provides communications systems for business customers (for example, PBX, key systems, voice mail); Consumer Products, which provides communications products to the home and mobile market; AT&T Federal Systems Advanced Technology, which is responsible for AT&T products designed to meet the needs of the U.S. Government; AT&T Ventures Corporation, which is responsible for creating new business that leverage AT&T Bell Laboratories inventions; and AT&T Paradyne, which is responsible for data communications equipment to business customers (for example, network management systems, multiplexers, and digital products). Mr. Kavner joined AT&T as Chief Financial Officer in May 1984. In 1987, he was appointed President of the Data Systems Group and became a Group Executive and member of the Management Executive Committee in 1989. In June, 1991, he assumed his current responsibilities. Before joining AT&T, Mr. Kavner spent 18 years with Coopers & Lybrand, an international accounting and consulting firm, where he was a general partner and cochairman of the firm's Information Industry Practice. He is a member of the Board of Directors of Fleet Financial Group, EO Computer, Inc., AT&T Capital Corporation, the Joint Center for Political & Economic Studies, and AT&T Paradyne. He has previously served on the Board of Sun Microsystems, Inc. Mr. Kavner graduated from Adelphi University and attended the Advanced Management Program at the Amos Tuck School at Dartmouth College.



Notes:

No Presentation Available

Notes:

No Presentation Available

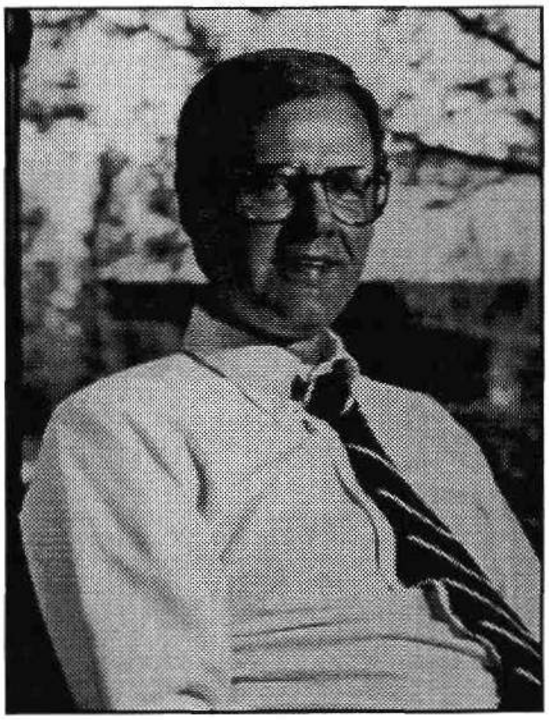
Notes:

No Presentation Available

Notes:

The Organization of the Future

Dr. Robert Johansen
Senior Research Fellow
and Director
New Technologies Program
Institute for the Future



Dr. Johansen is the leader of the Institute for the Future (IFTF) program on new information technologies. This work involves needs assessment, evaluation of new business opportunities, pilot testing, and market forecasting. Dr. Johansen has worked for more than 20 years in the fields of telecommunications and computing. He has focused on the business, social, and organizational effects of new systems. Working with vendors, he has examined the potential of specific new product concepts and assisted in the development of marketing plans. Working with users, he has assisted them in understanding their information needs and opportunities, in making judgments about which media are most appropriate for them to use, and in tracking the effects of new office systems. He was one of the first social scientists to explore the human and organizational impacts of communications and computing innovations. Dr. Johansen's ongoing research involves field studies, needs assessments, expert panels, and market research in a wide variety of forms. He is a well-known author and a frequent speaker at major conferences and executive workshops. At different times in his life, he has driven a milk truck in rural Illinois, played basketball in the Big Ten Conference, and studied comparative religions in divinity school under a special fellowship of non-ministers. Dr. Johansen has a B.S. from the University of Illinois and a Ph.D. from Northwestern University.

The Organization of the Future

What We Know
What We're Learning
What We Can't Imagine

Robert Johansen
Director, New Technologies Program

Institute for the Future
2744 Sand Hill Road
Menlo Park, California 94025
415-854-6322

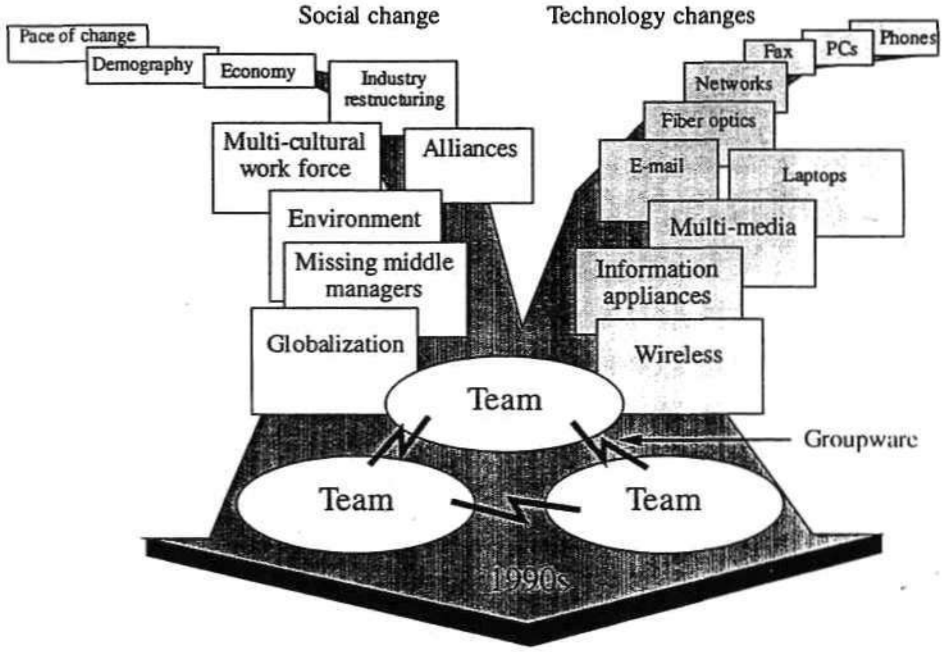
Institute for the Future (IFTF)

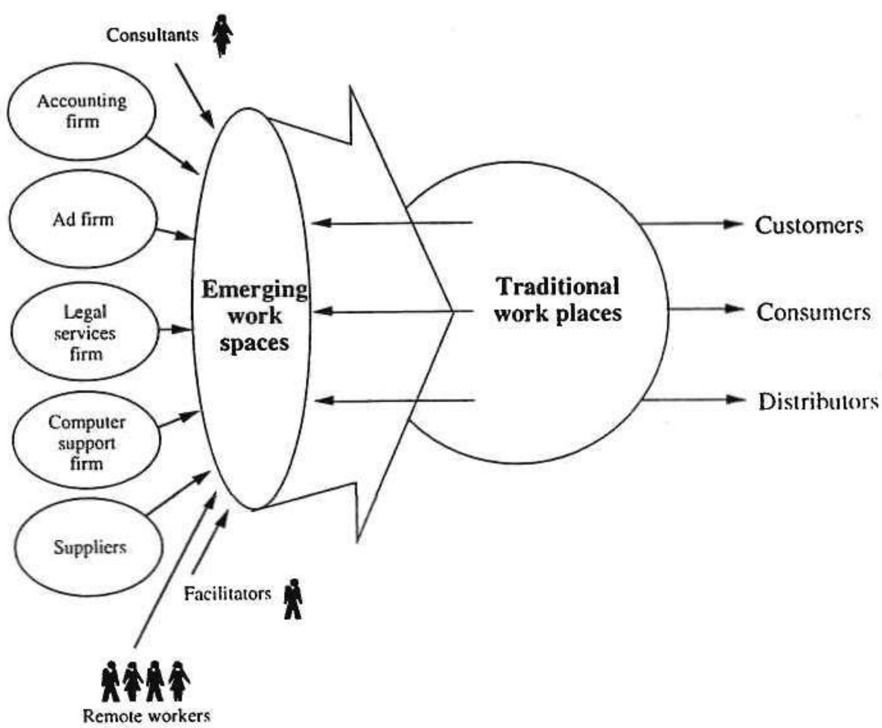
- Spinoff from Rand: 25 years ago
- Small (~25 people) nonprofit
- Very interdisciplinary
- Annual 10-year business forecast (since 1977)

IFTF Forecasts

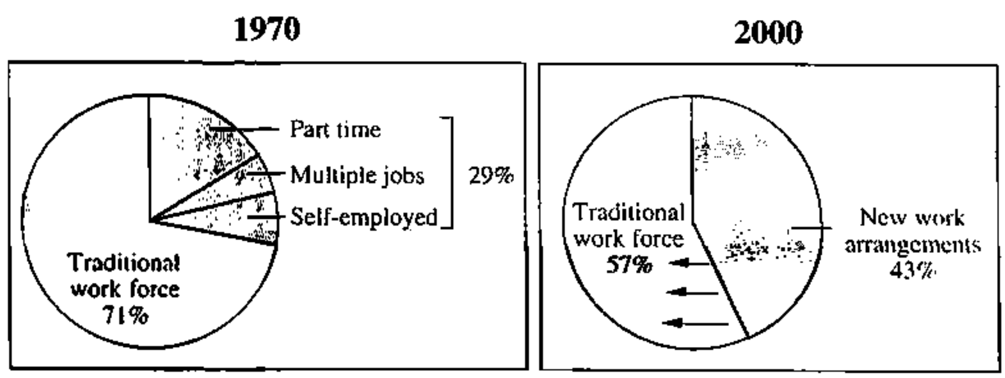
- Not predictions
- Driving trends
- Issues
- Wild cards
- In search of:
  —Discontinuities
  —Painful gaps

Notes:


Social change
Technology changes
Pace of change
Demography
Economy
Industry restructuring
Multi-cultural work force
Alliances
Environment
Missing middle managers
Globalization
Phones
PCs
Fax
Networks
Fiber optics
E-mail
Laptops
Multi-media
Information appliances
Wireless
Team
Team
Team
Groupware
1990s


Consultants
Accounting firm
Ad firm
Legal services firm
Computer support firm
Suppliers
Facilitators
Remote workers
Emerging work spaces
Traditional work places
Customers
Consumers
Distributors

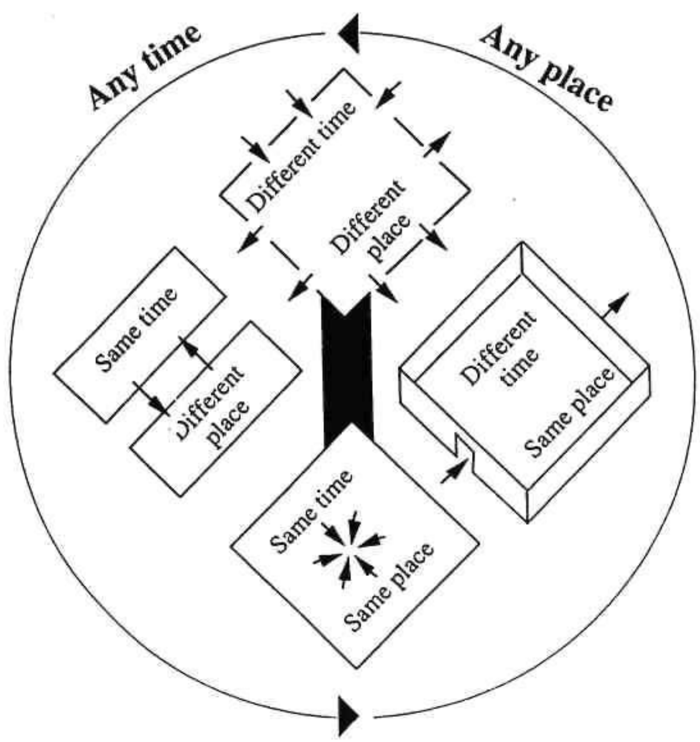
"Marginal Work Force" Grows



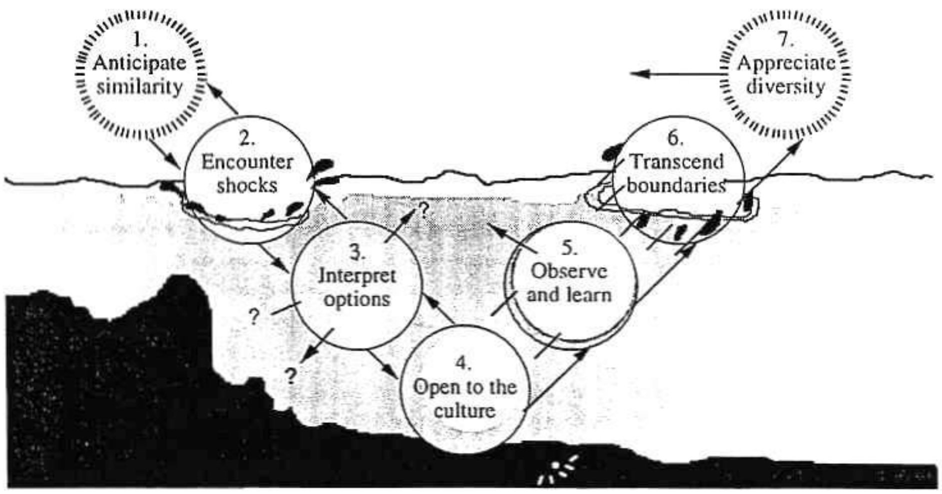
Notes:

WHAT MIDDLE MANAGERS USED TO DO

- Organizational memory
- Control
- Work processes
- Conduit (up or down)
- Coordination
- "People stuff"
- "Work the system"



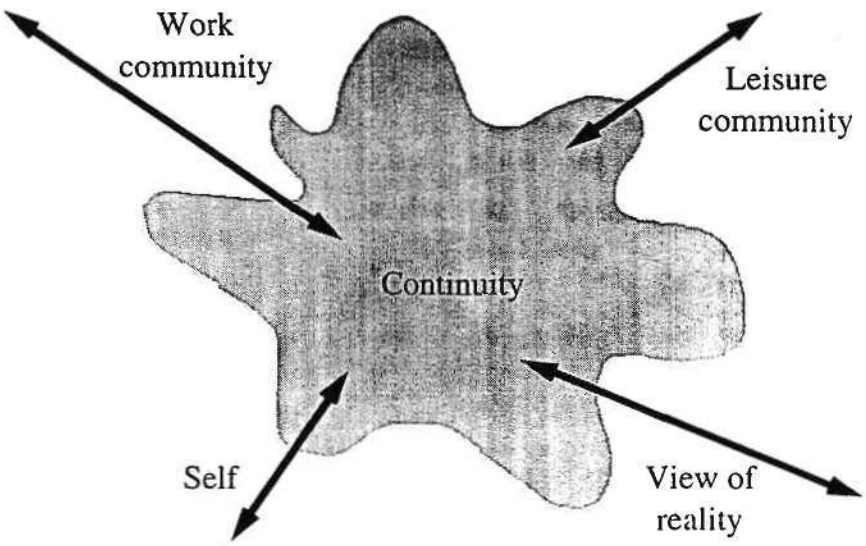
Intercultural Learning Model



Notes:

Diversity

Distance	Physical	Functional	Ethnic	National	Spiritual
Local					
Domestic					
Regional					
Global					
Cyberspace					Daemonic zone

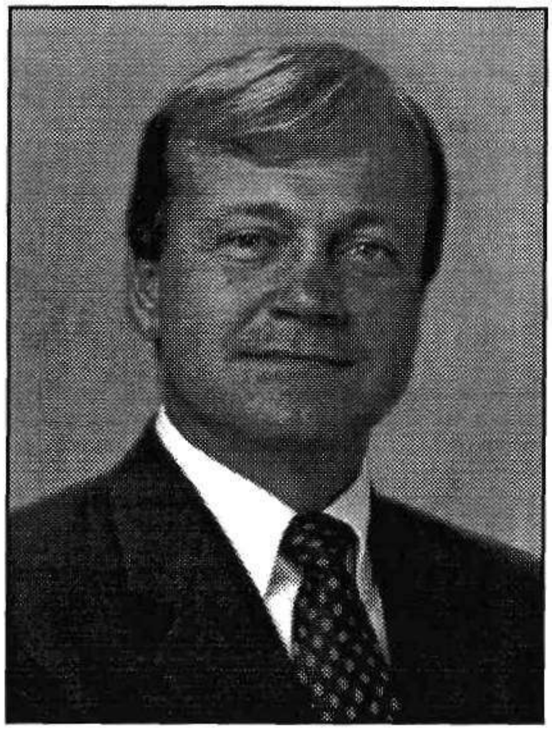


Notes:

Internetworking: Growth, Challenges, and Opportunities

John T. Chambers
Senior Vice President
Cisco Systems, Inc.

Mr. Chambers joined Cisco in January 1991 after spending eight years at Wang Laboratories, the last two as Senior Vice President of U.S. operations. He had previously been Senior Vice President of Wang's Americas/Asia/Pacific operations, and before that was Vice President of the company's central regional U.S. operations. Prior to this, Mr. Chambers spent six years with IBM. Mr. Chambers holds an M.B.A. degree from Indiana University and J.D. and B.S./B.A. degrees from West Virginia University.



Notes:

Internetworking: Growth, Challenges and Opportunities

Cisco Purpose

Shape the future of global internetworking by creating unprecedented opportunities and value for our customers, employees, investors and partners.

CISCO SYSTEMS

Cisco Mission

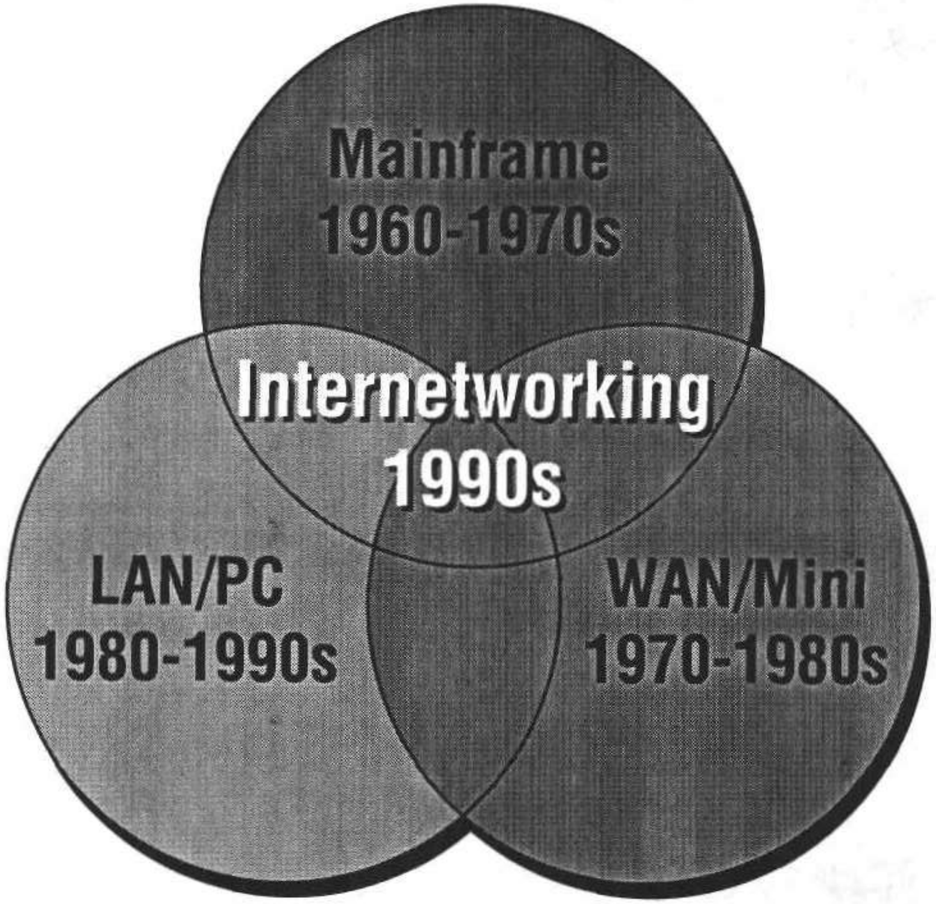
Be the supplier of choice by leading all competitors in customer satisfaction, product leadership, market share and profitability.

Corporate Strategy

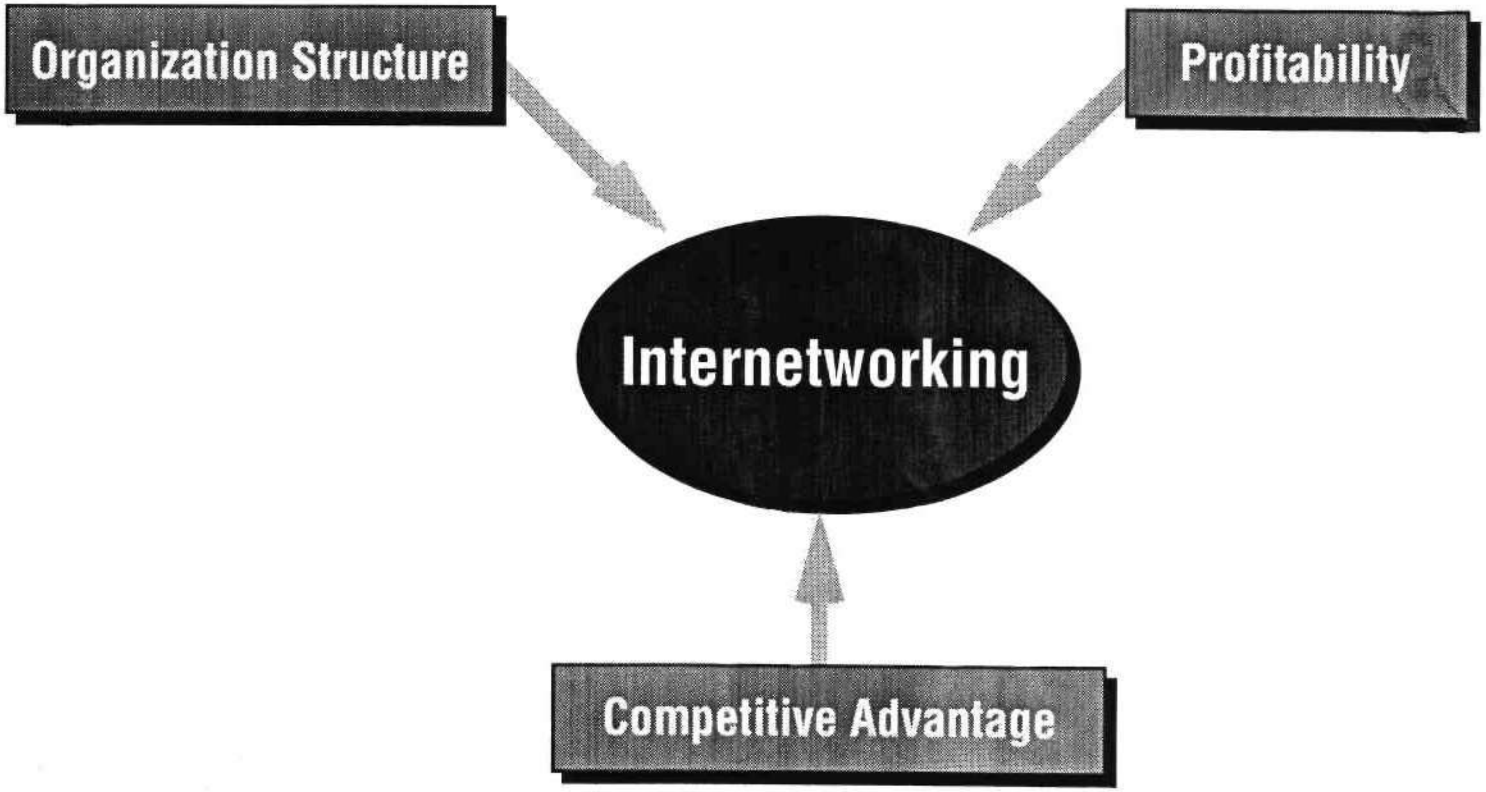
- Product leadership
- Customer satisfaction - quality
- Worldwide service/support/sales
- Focus on IBM environment
- Superior profit growth and cash flow
- Results through teamwork, process and strategic processes

cisco Systems

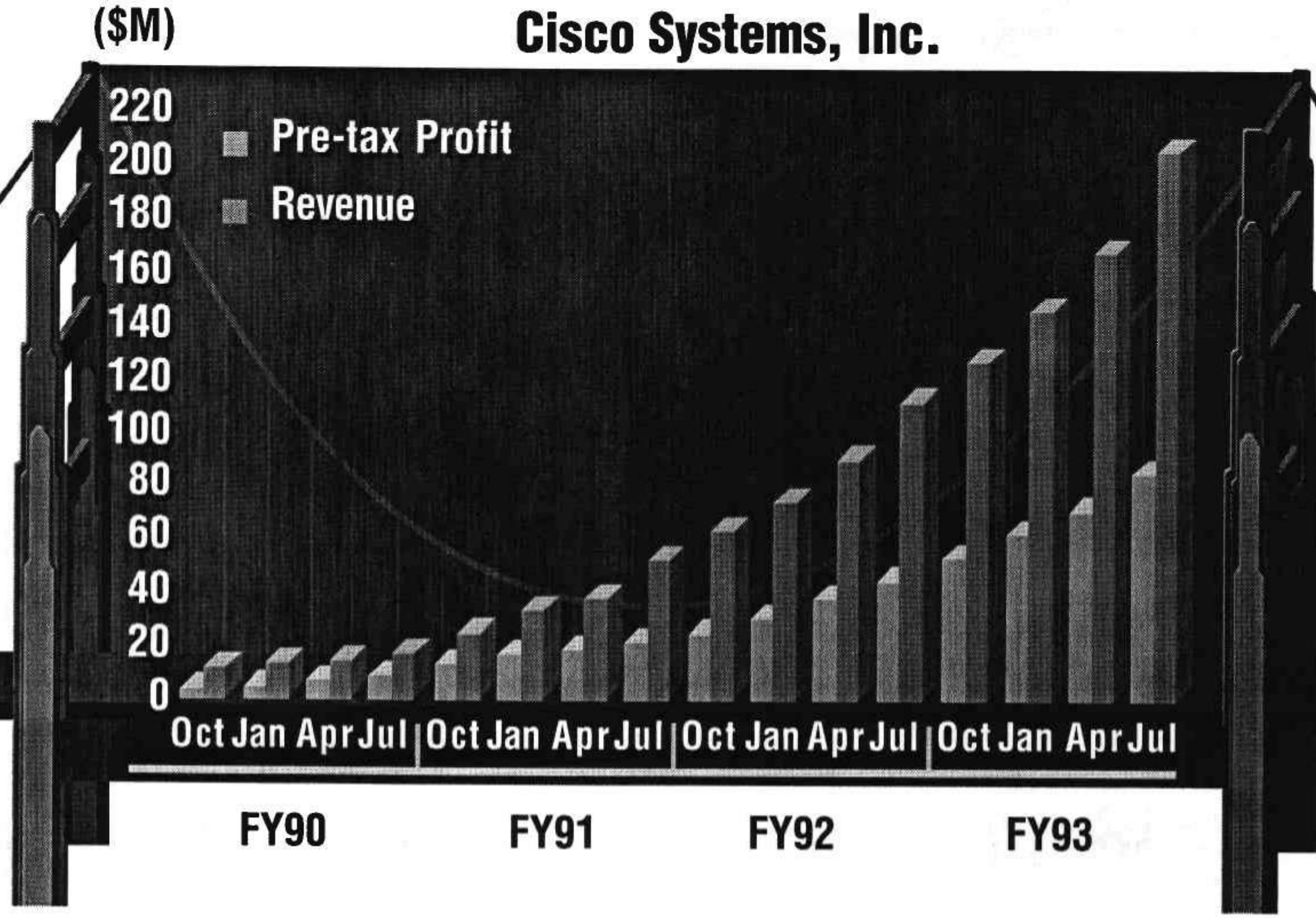
Internetworking: Technology Merging



Internetworking Business Drivers

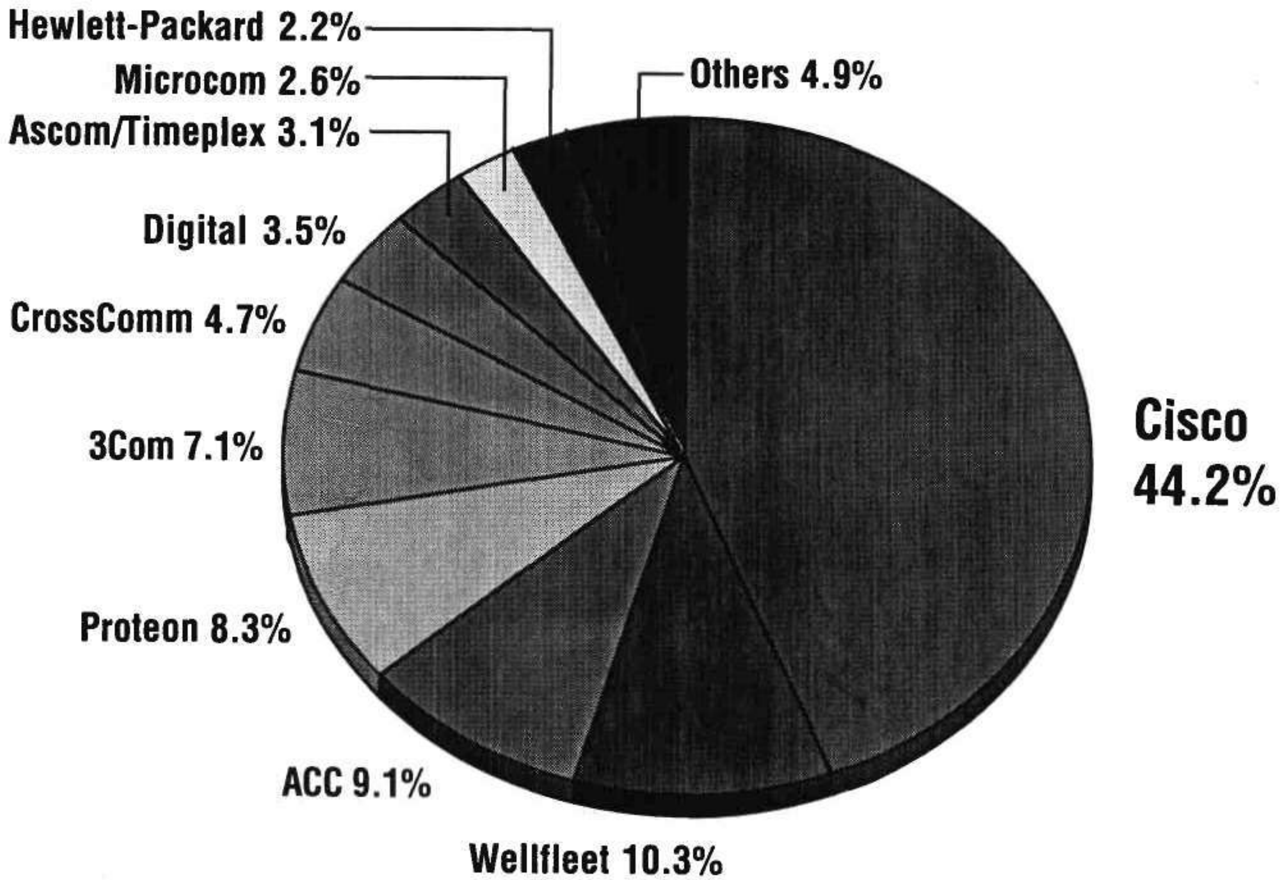


Quarterly Operating Results



CISCO SYSTEMS

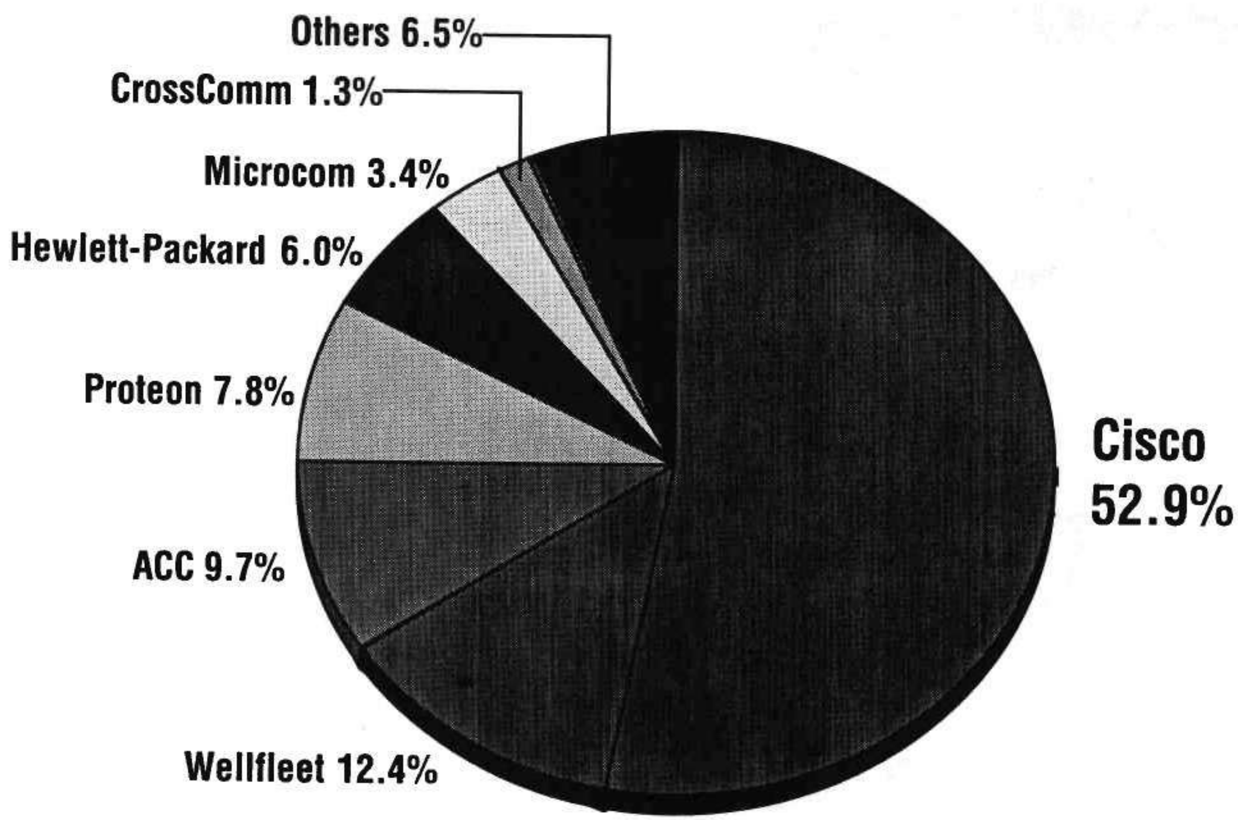
92 Market Share of Routers Shipped to the United States



Dataquest, 1993

Total = 46,859 units

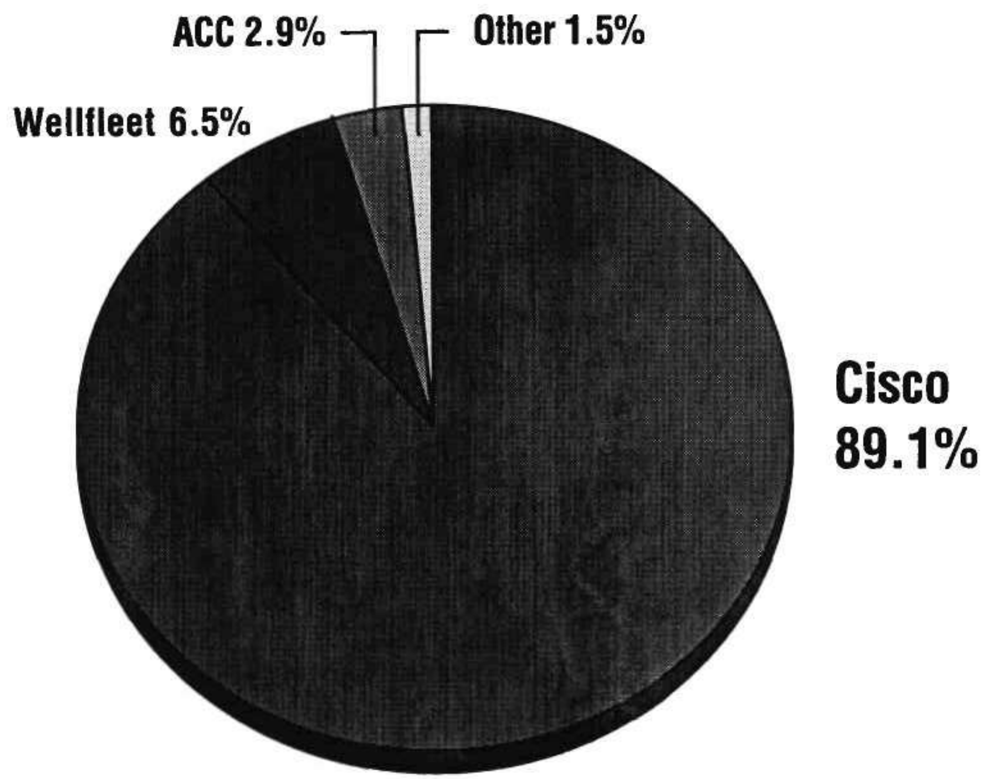
92 Market Share of Low-End Routers Shipped to the United States



Dataquest, 1993

Total = 17,594 units

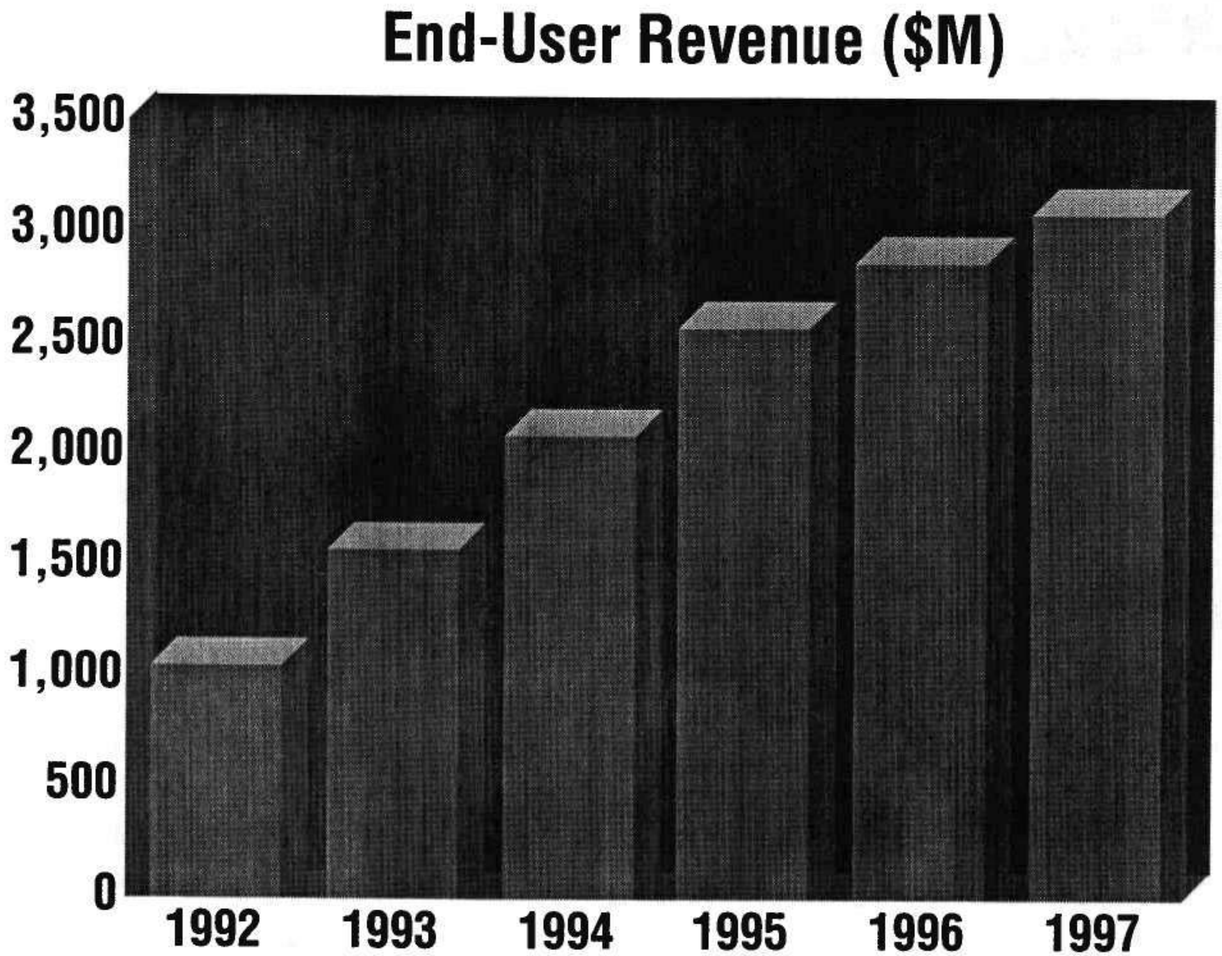
92 Market Share of High-End Routers Shipped to the United States



Dataquest, 1993

Total = 7,436 units

Worldwide Router Market



Dataquest, 1993

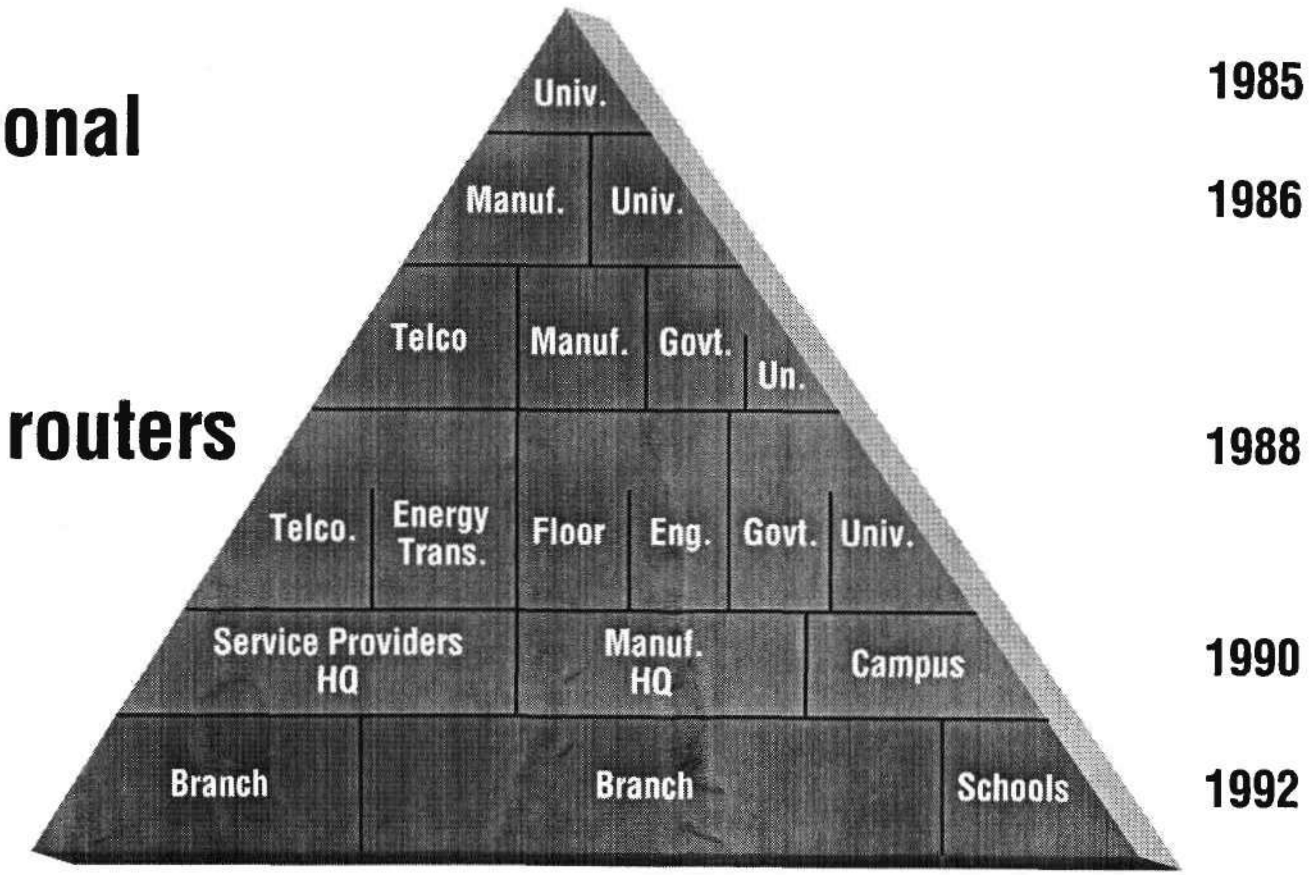
Industry Directions

Operational

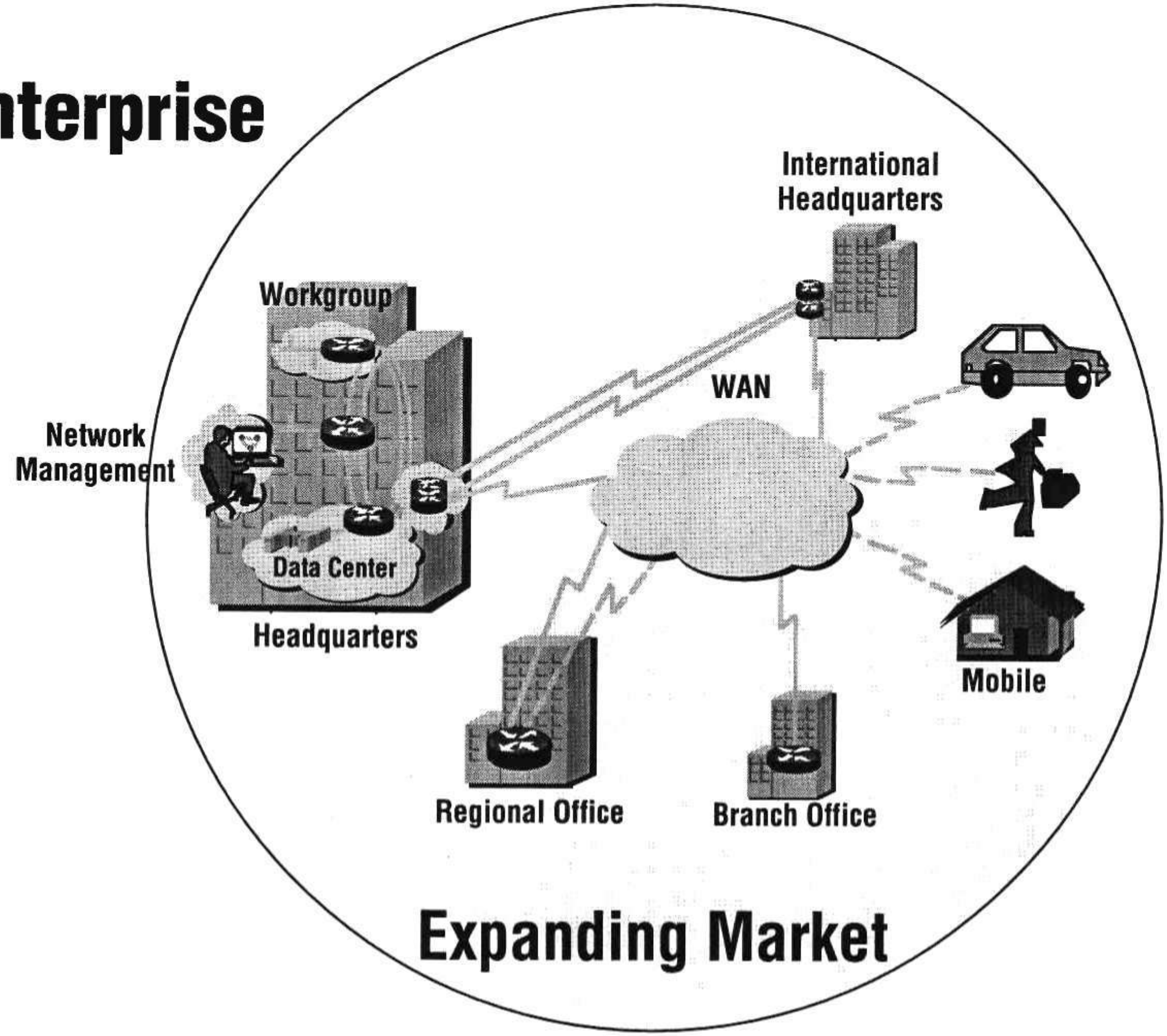
Branch

1,000+ routers

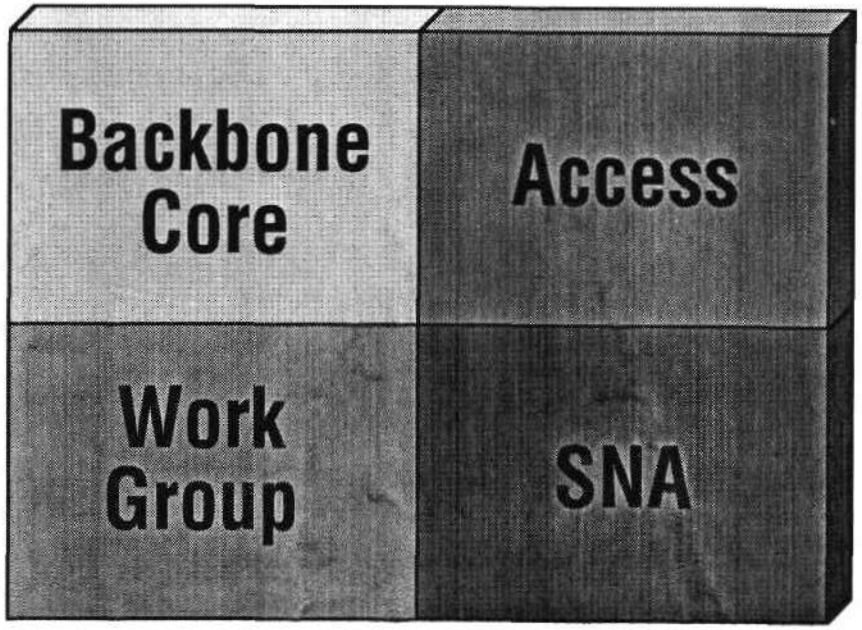
Global



Enterprise


International
Headquarters
Workgroup
WAN
Network
Management
Data Center
Headquarters
Mobile
Regional Office
Branch Office
Expanding Market

"Cisco's Future Opportunities and Competition"



Internetworking Component Technology Trends

Core

- Resembles distributed processing environment
  - More processors, more variety
  - Heavy memory requirements
  - VLSI
  - Large bus structures

Internetworking Component Technology Trends

Access

- Similar to PC market at lower volume
  - High integration with significant I/O
  - Medium performance/low-cost processors
  - Standard/high-density memory devices (no hard disks)

CISCO SYSTEMS

Internetworking Component Technology Trends

Workgroup

- Classical workstation - class technology
  - High-performance processors
  - Heavy memory requirements
  - Configurable I/O
  - Large, custom ASICS (a la workstations)
  - Low-cost power systems, packaging
  - Limited storage requirements

CISCO SYSTEMS

Internetworking Component Technology Trends

SNA

- Highest requirement in core and workgroup
  - Processor and memory intensive
  - Possible dedicated SNA processor (future)

Internetworking Technology Overview/Futures

- In general, internetworking follows classical computer market trends for processors, memory, VLSI
- Different from PCs, internetworking is a dedicated application
- No disk drive requirement (no application storage)
- Goal to provide multimedia LAN access to ATM
- Will be major participants in networking over cable/wireless
- However, homes will also be networked

Evolution of Supplier Development

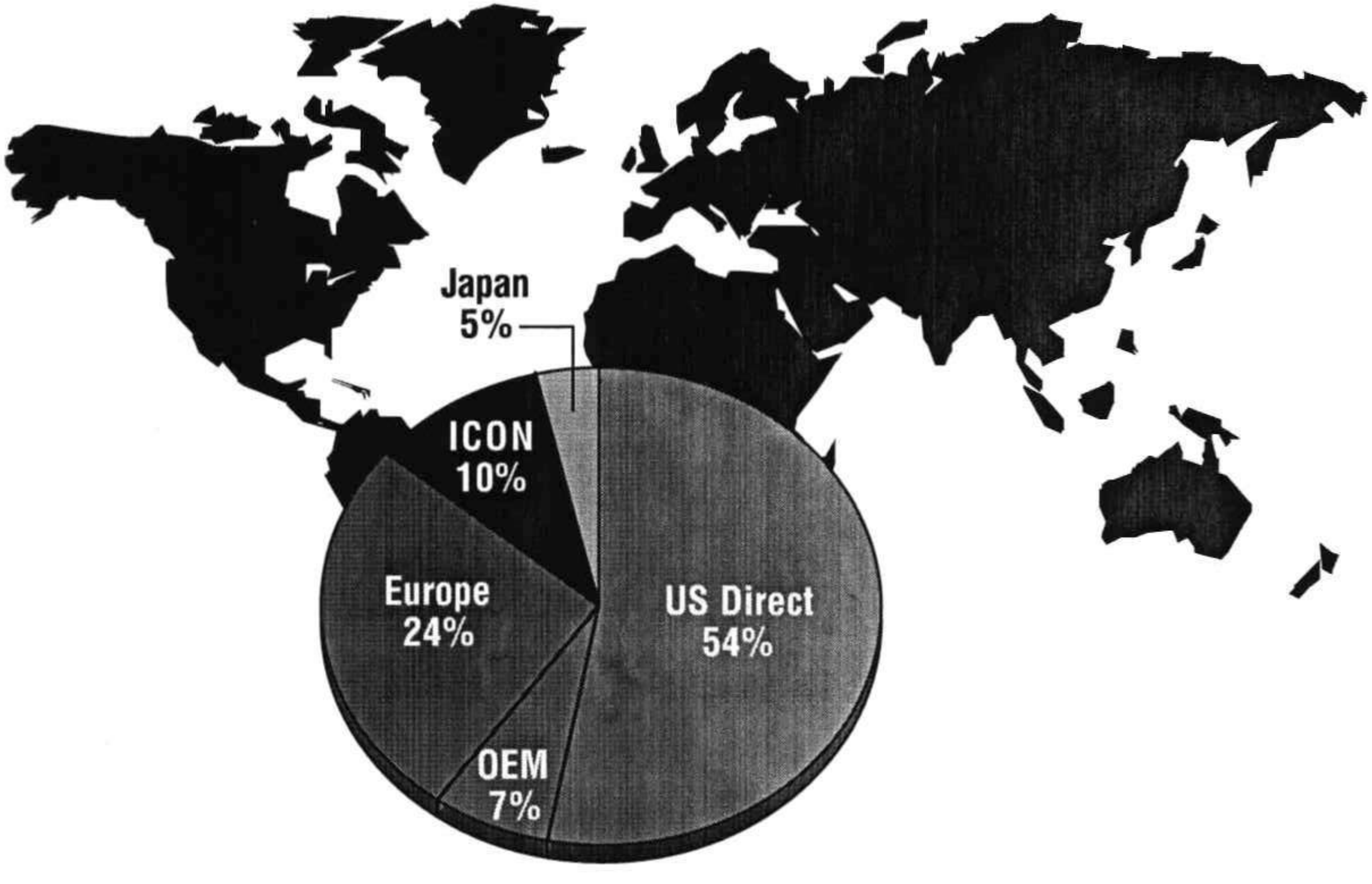
- Commodity strategy
- Performance evaluation
- Extended factory integration
- Mutual strategic leverage

Mutual Challenges

- Concurrent supply chain engineering
- Flexibility
- Solutions to technology challenge
- Insistence from the supply chain on making us competitive

CISCO SYSTEMS

Geographic Revenues YTD FY 93



Challenges

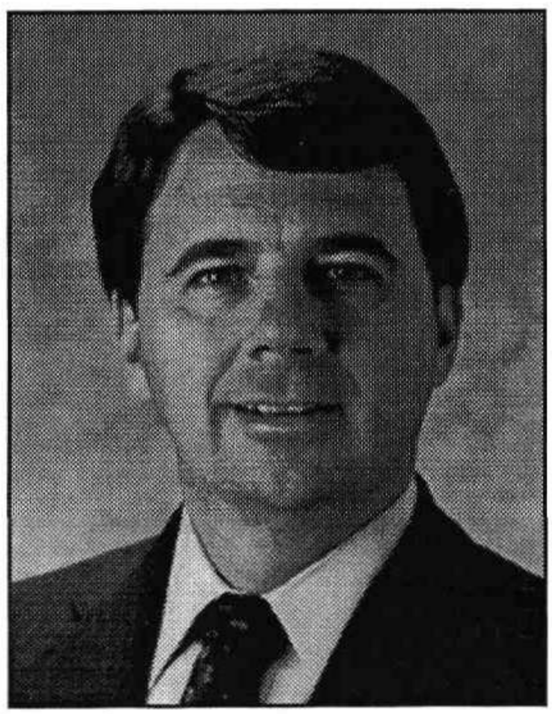
- Managing growth
- Product transition and mix
- Competition...price pressures
- Multiple channels
- New technology
- Management of large networks
- IBM environment solutions
- Customer driven

Notes:

The Promise of Pictures... Is Productivity

Richard M. Beyer
President
Communications and Computing Group
National Semiconductor

Mr. Beyer is President of National Semiconductor's Communications and Computing Group. The Communications and Computing Group is composed of the Ethernet Division, the Wide Area Networks Division, the Advanced Networks Division, and the Embedded Control Division. Prior to joining National Semiconductor, Mr. Beyer served as Vice President and General Manager of the Switching Systems Division of Rockwell International. During his tenure at Rockwell, he guided the division as they developed and launched a state-of-the-art call center switching system. He also successfully led them to several new call center markets, including international markets. Mr. Beyer brings to National Semiconductor his considerable general managerial experience and international marketing acumen in telecommunications and computer applications. Mr. Beyer was also Vice President and General Manager for Alcatel PABX Systems Corporation (formerly ITT Business Communications Corporation). He joined ITT in 1984 and spent two years in charge of marketing and sales before becoming its General Manager. Prior to his affiliation with ITT, Mr. Beyer was a management consultant with Booz, Allen & Hamilton Inc., a New York management consulting firm. He also held senior management positions with Burroughs Corporation in London and Vienna, overseeing that company's business activities in the former USSR and Eastern Europe. Mr. Beyer served three years as an officer in the United States Marine Corps. He received a B.S. and an M.S. degree in Russian from Georgetown University and an M.B.A. degree in marketing and international business from Columbia University.



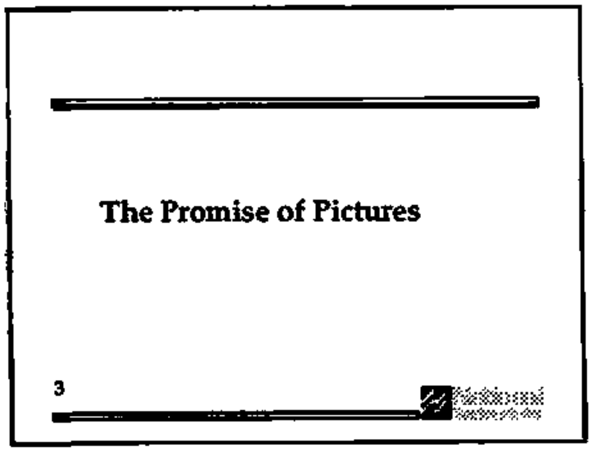
"We must not promise what we ought not, lest we be called on to perform what we cannot."

Abraham Lincoln

1

Promises. . .Promises

2



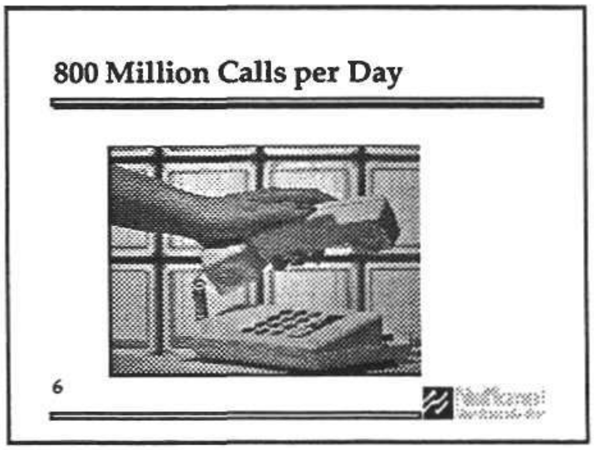
Notes:

Alexander Graham Bell

4

400 Million Telephones Worldwide

5



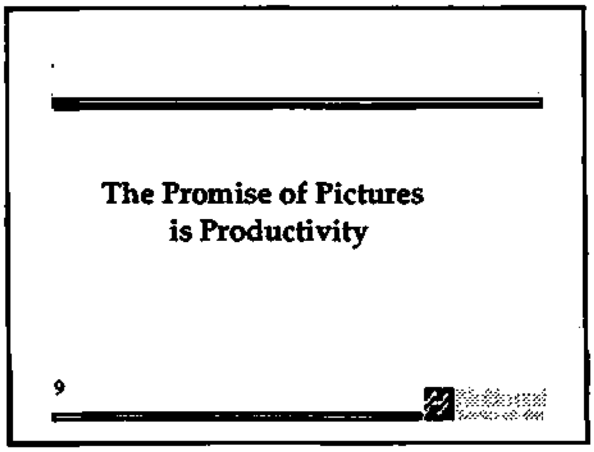
Notes:

1960's Videophone

7

The Promise of Videophones

8



Notes:

Video Conferencing Room

10

Video Conferencing Room

11

Video Conferencing Room

12

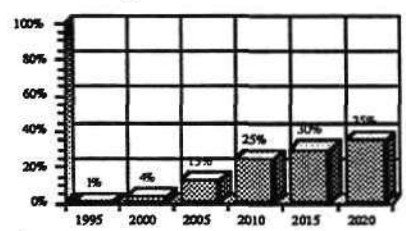
Notes:

National Conference Sites

13

Business Travel Saved by Videoconferencing

(% decrease: years 1995-2020)



14

Video Conferencing
on the Desktop

15

Notes:

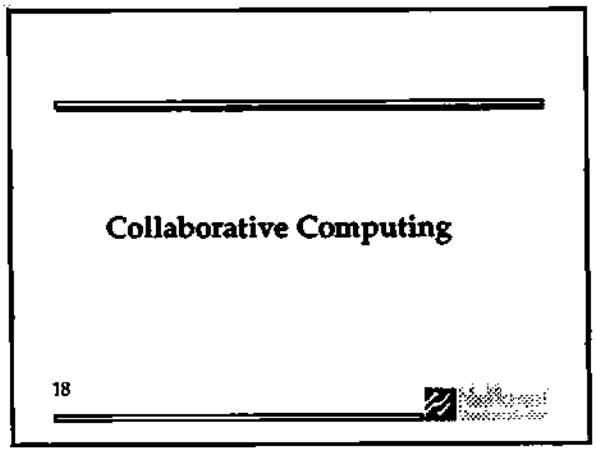
Video Conferencing on the Desktop

- Local transport infrastructure 60% by 1994
- Wide area transport: 65 million ISDN-1 by 1994
- $5,000–8,000 per user today

16

Desktop Productivity The Next Wave

17



Notes:

Collaborative Computing

What it isn't

- Not videophone
- Not just videoconferencing
- Not talking heads

19

Collaborative Computing: What it is, What it does

20

Collaborative Computing

More than two people videoconference to simultaneously share

21

Notes:

Collaborative Computing

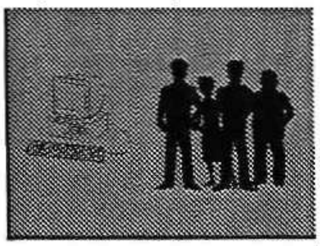
More than two people videoconference to simultaneously share

- Ideas and data
- Emotions and expressions

22

Collaborative Computing

Computing + Human Interface



23

Isochronous Services Video

24

Notes:

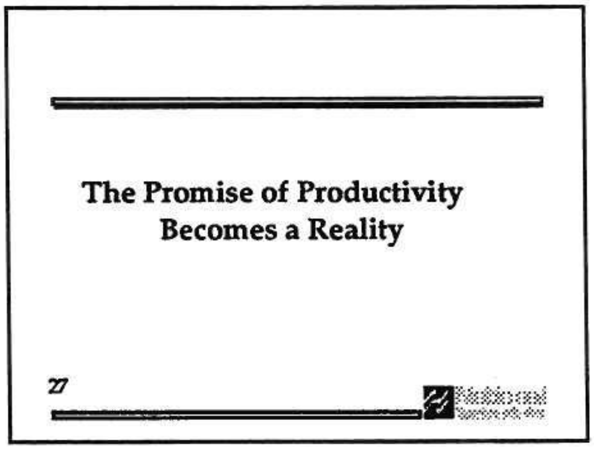
The Value of Collaborative Computing

25

The Value of Collaborative Computing

- Time = $$$
- Higher productivity
- Less time
- Higher sales
- Higher profits

26



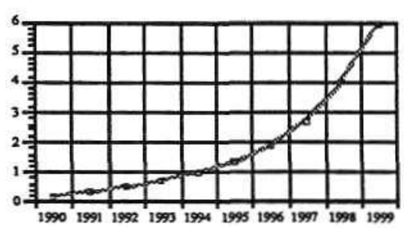
Notes:

The Promise of Productivity Becomes a Reality with Semiconductor Technology

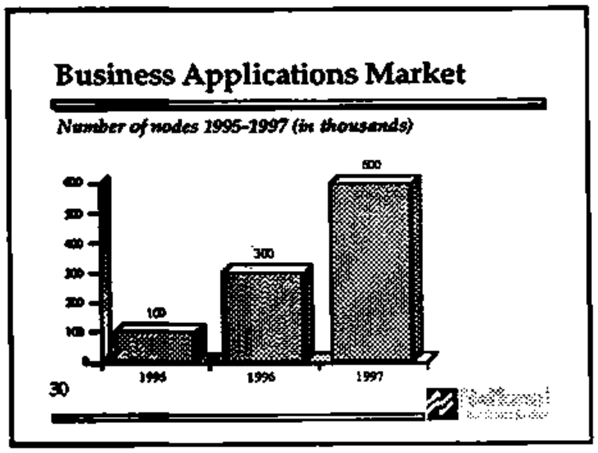
28

Business Applications Market

Videoconferencing systems sales 1989-1999 ($ in billions)



29


Business Applications Market
Number of nodes 1995-1997 (in thousands)
100
300
600
1996
1997
30

Notes:

Consumer Applications

- Remote Teaching
- Medical Advice
- Home entertainment, shopping
- Family reunions

31

Technologies Necessary for Desktop Collaborative Computing

32

Technologies

Necessary for desktop collaborative computing

- High quality image
- Applications support
- Cost effective upgrades for hardware, software
- LAN to WAN

33

Notes:

Technologies

Necessary for desktop collaborative computing

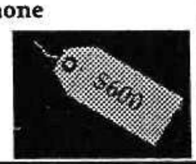
Camera

34

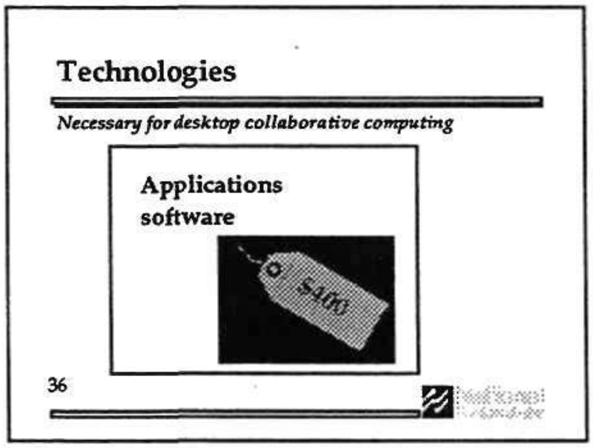
Technologies

Necessary for desktop collaborative computing

Sound board, Speakers, Microphone



35


Technologies
Necessary for desktop collaborative computing
Applications
software
$400
36

Notes:

Technologies

Necessary for desktop collaborative computing

ISDN card

37

Technologies

Necessary for desktop collaborative computing

Wide area network rates=$4,000-5,000/desktop

38

Collaborative Computing Costs

- By 1995 PC upgrade costs will drop to $2,000

39

Notes:

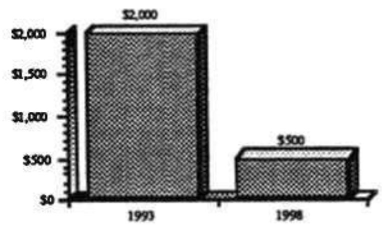
The Promise of IsoEthernet

40

National Semiconductor

Semiconductor Industry

Videoconferencing costs



41

National Semiconductor

Promise of Pictures =
Promise of Productivity

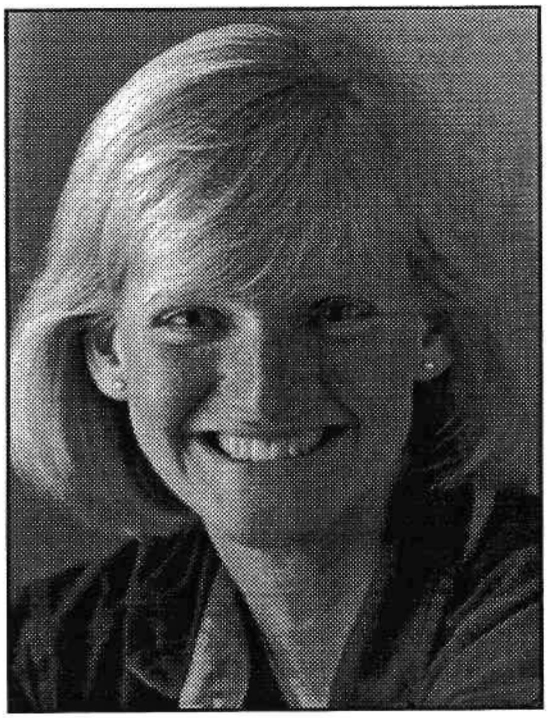
42

Notes:

Enabling Platforms for the Digital Office

Karen Hargrove
Senior General Manager
Digital Office Systems
Microsoft Corporation

Ms. Hargrove is Senior General Manager of the Digital Office Systems Group at Microsoft Corporation, responsible for all systems software found in workplace products including telephones, FAX machines, copiers, hand-held systems, and printers; and for connecting these systems to personal computers running Microsoft Windows. The charter of the Digital Office Systems Group is to integrate all of the devices and systems in the workplace with each other, with the personal computer, and with networks to make communication easier for end users. Work in this area was first started in the Advanced Technology and Development Group, where Ms. Hargrove has been since she first joined Microsoft. Prior to joining Microsoft, Ms. Hargrove was a member of the Digital Equipment Corporation West (DEC West) Engineering team, which focused on advanced hardware design and software platforms.



Notes:

Microsoft At Work™ Architecture

Backgrounder

June 1993

For more information contact:

Microsoft Corporation
Collins Hemingway
(206) 882-8080

Waggener Edstrom
June McLaren or Alison O'Brien
(503) 245-0905

Table of Contents

A Week in the Life 1

Introduction 1

What Are the Common Architectural Benefits? 3

- **Ease of Use** 3
- **Integration** 4
- **An Enabling Platform** 5

The Microsoft At Work-based Products 6

- **The Microsoft At Work-based Telephone System** 6
- **The Microsoft At Work-based Fax** 8
- **Microsoft At Work-based Handhelds** 12
- **The Microsoft At Work-based Printer** 15
- **The Microsoft At Work-based Copier** 18

What is the Microsoft At Work Architecture? 21

- **Microsoft At Work Operating System** 21
- **Microsoft At Work Communications** 22
- **Microsoft At Work Rendering** 24
- **Microsoft At Work Graphical User Interface** 24
- **Microsoft At Work Desktop Software** 25

What Is Microsoft's Role? 26

Several Years From Now 27

A Week in the Life

"Just look at these expense figures," groaned Jim. "Fax costs up more than 40 percent from last year. There goes the headcount for Marty's new associate." As the person in charge of technology services, Jim knows his legal firm could cut costs significantly by using even a few of the features on existing fax equipment or telephones. "But teaching people to use them is probably futile. I'd be happy if everyone could just figure out how to send faxes with client codes attached to the numbers." As the image of the agonizing ritual of scrutinizing the phone bill to find calls that should have been billed to clients runs through his mind, Jim wonders if there isn't an easier way.

"Would the partners be willing to learn how to use cost-saving features they've already paid for if they knew that 30 percent of the firm's fax costs could be saved if they faxed things during cheaper rate hours? That's enough savings to hire that new associate!"

The phone on Jim's desk rings — on to other issues. "Oh, you need to speak to Beverley. She's working on that part of the project," said Jim. "I know she's in her office. Let me try to transfer you. This should work, but if I lose you ... "

Introduction

No doubt you can picture yourself in a similar situation. Yet wasn't there once a vision of modern business life that was very different? The "paperless office," the "office of the future," the "global village"? These phrases were coined to describe the concept of a tightly integrated work environment incorporating the latest in sophisticated office equipment, but like most businesspeople, you probably continue to look at the overflowing pile of paper on your desk, the reminder notes stuck to your PC screen and the message light flashing on your telephone. Somewhere in all that data is valuable information: faxes showing the latest sales figures, messages from important customers and copies of new product plans.

Throughout the last decade, everyday office work has been irrevocably altered by the personal computer. Typewriters and dedicated word-processing systems are now oddities in many offices. High-quality laser printers are commonplace. Access to electronic mail systems has changed communication between millions of people. The intense pace of modern electronic product development and competition has spurred advances in every office device. Sophisticated fax machines are available for a few hundred dollars. Your telephone probably has more special-function buttons than you know what to do with. You wonder whether you could make effective use of one of those pocket-sized organizers.

Every device on your desk gives you the ability to accept and generate more data. Yet synthesizing this data into timely, valuable information and communicating it to people who can act on it, remains difficult. To edit a fax usually requires retyping into a computer, despite the fact it was probably created on a computer. You can't review your voice mail and electronic mail messages at the same time, nor sift through voice mail messages randomly to select the most important ones first. Documents are distributed in different ways depending on whether speed, quality or editability is most important. "Phone tag" and now "voice-mail tag" are daily events.

The individual devices in the modern office just don't *work together* very well. And as newer devices of higher speed and greater capacity appear for still lower prices, the dual problems of data overload and incompatibility only get worse. That's why Microsoft Corporation, supported by key representatives from the office automation, telecommunications and computer industries, is leading a multicompany initiative to build office machines and computer products that offer the following:

- **Ease of use**, allowing users to access all product features and to tailor the devices to their own preferences and the way they work.

- **A high level of integration**, allowing all devices in the workplace to communicate seamlessly with one another, in any combination (phone, fax, copier, PC, handheld, etc.).

- **An enabling platform,** allowing system developers to create a broad family of products that third parties can employ to develop a wealth of value-added software to solve real-world problems for users.

The Microsoft At Work™ architecture will be a set of software building blocks that reside in both office machines and PC products, including the following:

- Desktop and network-connected printers.
- Digital monochrome and color copiers.
- Telephones and voice messaging systems.
- Fax machines and PC fax products.
- Handheld systems.
- Hybrid combinations of the above.

In addition to the shared objectives of creating a well-integrated office, the products mentioned above will also share the following Microsoft At Work architectural components. More and more information today is being created and stored digitally on computers. Building on the existing business and technical infrastructure, the Microsoft At Work architecture focuses on creating digital connections between machines to allow information to flow freely throughout the workplace. The Microsoft At Work software architecture consists of several technology components that serve as building blocks to enable these connections. Only one of the components, desktop software, will reside on PCs. The rest will be incorporated into other types of office devices, making these products easier to use, compatible with one another and compatible with Microsoft® Windows™-based PCs.

- **Microsoft At Work operating system.** A real-time, pre-emptive, multitasking operating system that is designed to specifically address the requirements of the office automation and communication industries. The new operating system supports Windows-compatible application programming interfaces (APIs) where appropriate for the device.

- **Microsoft At Work communications.** Will provide the connectivity between Microsoft At Work-based devices and PCs. It will support the secure transmission of original digital documents, and it is compatible with the Windows™ Messaging API and the Windows™ Telephony API of the *Windows*™ Open Services Architecture (WOSA).

- **Microsoft At Work rendering.** Will make the transmission of digital documents, with formatting and fonts intact, very fast and, consequently, cost-effective; will ensure that a document sent to any of these devices will produce high-quality output, referred to as "What You Print Is What You Fax Is What You Copy Is What You See."

- **Microsoft At Work graphical user interface.** Will make all devices very easy to use and will make sophisticated features accessible; will provide useful feedback to users. Leveraging Microsoft's experience in the Windows user interface, Microsoft At Work-based products will use very simple graphical user interfaces designed for people who are not computer users.

- **Microsoft At Work desktop software for Windows-based PCs.** Will provide Windows-based PC applications the ability to control, access and exchange information with any product based on Microsoft At Work. Desktop software is the one piece of the Microsoft At Work architecture that will reside on PCs.

Microsoft believes the Microsoft At Work architecture will succeed in the market for the following reasons:

1. **It focuses on real user needs.** Information is the lifeblood of the organization, yet the principal tools people use every day to create, manipulate, analyze, exchange, present and communicate information are not connected. There is a tremendous need to move information both down the hall and across the globe. Making office equipment efficient and easy to use will permit people to get work done more quickly and cost-effectively.

2. **It is a pragmatic solution.** The world is not going to change overnight. Organizations will not discard existing, functioning equipment — much less rip out an entire installed base of systems — to get the incremental benefits of a new generation of office equipment. The Microsoft At Work architecture is a very practical, evolutionary approach. It defines a logical path to a more functional and well-integrated workplace. Microsoft At Work-based devices and products will be able to be deployed alongside of, and be compatible with, existing office products (for example, Microsoft At Work-based fax machines will communicate with existing fax machines and telephone networks). Microsoft At Work-based devices and products will build on the existing infrastructure. Of course, the architecture and devices will integrate well with the Microsoft Windows operating system, the widely used desktop operating environment. There are also compelling ease-of-use benefits to using a single Microsoft At Work-based device that is not integrated with PCs or other Microsoft At Work-based office machines.

3. **It relies upon relationships with others.** These relationships are with the leading companies in the office equipment, communications and computer industries. Thus, no single company faces the enormous challenge of producing the best product in every category to deliver on this vision; at the same time, a single, broad, and open platform will be established upon which many companies can build profitable businesses. By incorporating Microsoft At Work software, vendors can devote their resources to excellence in their own markets, and to producing high-quality, compatible products. Of course, the end result will be a wide variety of compatible products and services from which customers can pick and choose.

What Are the Common Architectural Benefits?

The Microsoft At Work architecture will make it easier for people to use office equipment in the workplace. In addition, it will let information to flow freely within an organization's information infrastructure — no matter how large or small the organization.

Ease of Use

Incorporating graphical user interfaces into common office devices will effectively increase their usability. Whether on the device itself or on a connected PC, the graphical user interface will make powerful features both accessible and useful. It will replace the cumbersome button-and-code combination on many devices today. For example, context-sensitive icons will allow far richer information to be displayed and will be shown only when appropriate to the tasks being performed. Devices will lead users step-by-step through complex operations. Users will be able to better exploit existing features as well as the additional capabilities of this new generation of office equipment. Consequently, complex machine functions, rarely exploited today, will become routine.

Simple, clean graphical user interfaces will free users so that they will not need to refer to printed operating instructions to accomplish tasks. For example, a phone could lead a caller through the process of setting up a conference call or forwarding voice mail. The current status of a print or copier job could be conveyed instantly through a visual display. Sending a fax to multiple people would be as simple as selecting their names from an on-screen list.

Once the capabilities of devices can be truly exploited, users will gain greater control over their communications, which they are too often controlled by. Many of us are enslaved by seemingly permanently illuminated voice mail lights. We spend our days walking between the printer, the copier or fax machine, and our desks — or sprinting to make overnight-mail pickup deadlines. The Microsoft At Work architecture promises to enable people to manage their communications more effectively and efficiently by prioritizing communication tasks, expediting urgent contacts or personalizing communication tasks for their own needs.

Integration

The communications capabilities of the Microsoft At Work architecture mean that all the devices in the workplace will readily and efficiently exchange digital information.

One key to achieving this cooperation between the different devices will be the storage and transmission of information in a standard digital format that each Microsoft At Work-based product will understand. What is initially sent to one office device will be able to be retransmitted to another without deterioration of information that does occur today when a document is faxed or copied repeatedly. With this format, a user will be able to send the final version of a document prepared on a PC directly to the copier and avoid any loss in reproduction quality. When viewed, these digital documents will always be of the highest possible quality permitted by the device, whether on-screen or on the printed page. In addition to the benefits of a common way to exchange documents, this digital format has other advantages as well. Documents will be able to be sent in editable form, ending the need to retype faxes, while other documents such as invoices may be sent as inalterable "published" documents. Confidential documents will be able to be sent in a secure format that only the intended recipient can read.

Devices will also cooperate to complete tasks so that users can combine the capabilities of different devices or effectively share devices. For example, a PC will be able to provide the phone number for a telephone to dial. When jammed, a printer will be able to notify a user waiting for a print job. A copier low on toner will be able to send a message to an administrator. A fax machine connected to a PC will be able to scan images into the PC without sending a fax. With network administration services and communication between devices, network administrators will be able to oversee the operation of all devices connected to the network. For example, instead of having to manually update the phone directories in every fax machine, administrators might download them electronically.

Users will also benefit from a single integrated "inbox." They will be able to access and manage all messages — e-mail, voice mail, pager messages or fax — from a common interface, whether on a PC or other devices.

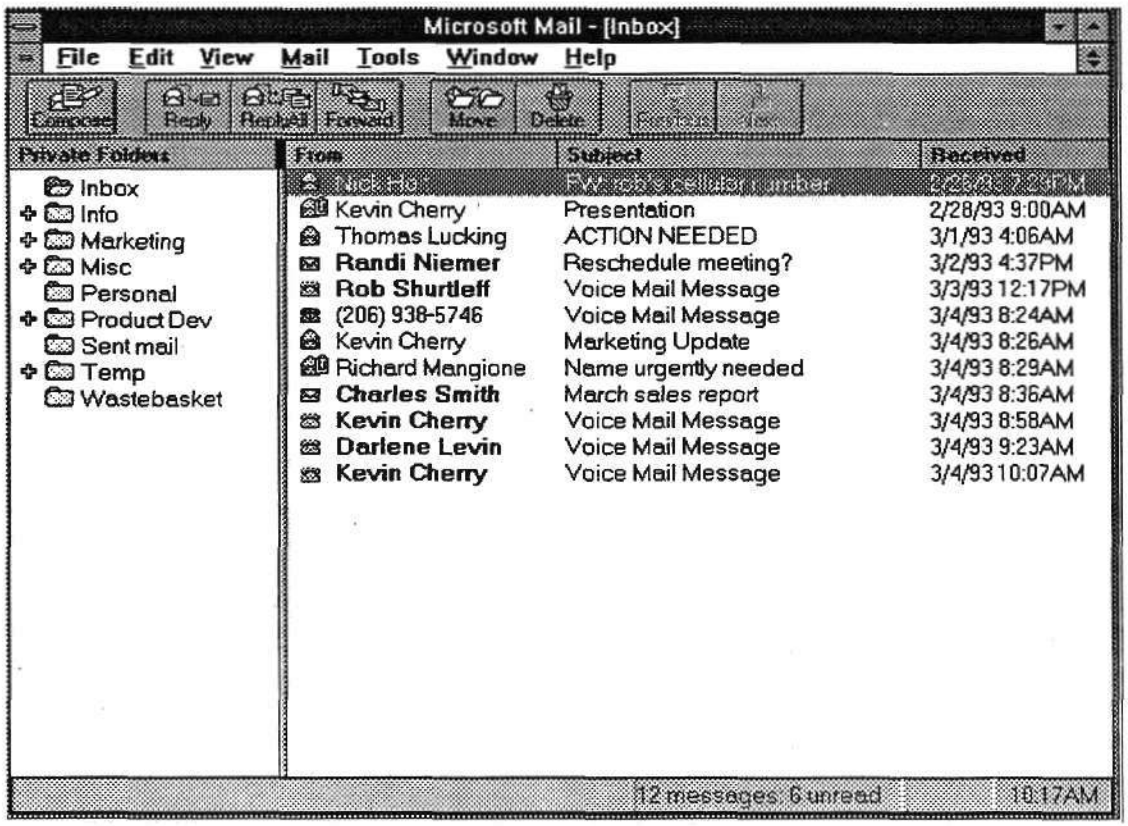


Figure 1. PC-based Integrated Messaging.
Illustration of what an integrated messaging system may look like. Note the telephone and envelope icons that distinguish voice and visual messages.

An Enabling Platform

The Microsoft At Work architecture introduces a new concept for office equipment: These devices will become an open *platform* upon which to build a broad range of customer solutions. This notion means devices are configurable, upgradable, scalable, extensible and programmable. A platform with these attributes will allow corporate developers, manufacturers, independent hardware and software developers and anyone else to contribute, configure, modify and add value to the core products. A broader base of vendors building solutions on a common platform ensures more innovation and more customer needs will be fulfilled. Consumers will not be dependent on a single vendor to conceive of, much less deliver, every possible enhancement.

Office equipment would be a more cost-effective investment if it were upgradable or scalable. The ability to upgrade products solves two problems. First, when users outgrow a machine's capacity, they won't have to buy a new one. Second, organizations purchase a variety of product brands or models to address different usage patterns within an organization, and organizations frequently end up with devices that work differently. Machines have different user interfaces, feature sets and set-up procedures.

The Microsoft At Work architecture will allow manufacturers of office equipment to offer a full family of devices that can be upgraded and changed as users' needs change. For example, a user could buy a standalone fax machine and later decide to add a LAN connection module. He or she could buy additional memory or even a hard disk. When traffic increases, a second line could be added. This all adds up to a much more economic investment for the consumer.

In addition to being upgradable and compatible across a family of products, devices need to be extensible over time. The Microsoft At Work architecture is forward-thinking and by virtue of a modular design can accommodate the addition of new capabilities over time. As fax standards extend to cover the transmission of color documents, for example, the Microsoft At Work architecture would maintain compatibility with existing devices while incorporating new capabilities through upgrades.

Microsoft At Work-based devices, such as PCs, would include a microprocessor and would therefore be "programmable." Applications could be constructed that exploit the capabilities of the device to solve specific problems. This capability will provide a level of flexibility not found in today's office equipment, which cannot perform tasks beyond the basic set of functionality packaged into the device. For example, a law firm might add an application to its telephones that tracks calls by client and automatically forwards that information to the billing system, eliminating the need for the manual logging of calls. A retail outlet might put its inventory system on a handheld device so that employees could easily access the system while checking actual stock on the shelves. Or an organization might make commonly requested information, such as product price lists, available via fax to anyone who calls.

Applications such as these allow ordinary office equipment to be tailored to individual requirements and integrated into business systems. But to see the benefits of applications, they must be easy to develop. Fortunately, all systems based on Microsoft At Work are completely open to software developers and hardware systems manufacturers. Microsoft At Work-based devices will follow the same programming model of Microsoft Windows, a widely used applications development environment. Consequently, hundreds of thousands of programmers, already familiar with Windows, already know how to develop applications for devices based on Microsoft At Work. Third-party developers will create applications and services for both PCs and Microsoft At Work-based devices using the same standard Windows-based development platform and tools they use today to develop PC applications. The Windows-compatible APIs in devices based on Microsoft at Work allow developers to write and test new applications and services on PCs and then download them to new devices.

The Microsoft At Work-based Products

The Microsoft At Work-based Telephone System

The telephone is the most pervasive communications tool. In the United States alone, the volume of calls runs in the hundreds of billions each year. Despite its integral and ubiquitous role in the daily business routine, there have been few changes in how the telephone is used. It remains isolated from computers and other information devices, despite the fact it manages related information. New time-saving network features are available, but few people exploit them because they are so difficult to use. Innovations such as voice mail have become indispensable, but at the same time they have introduced their own set of frustrations.

The Microsoft At Work architecture offers a range of capabilities to enhance and integrate telephone systems. An array of products will give users greater access to the capabilities of different telephone networks, more flexible control over their communications and the ability to tailor phone systems to particular requirements. Future Microsoft At Work-based phone products include the following:

- **Microsoft At Work-based telephones.** The latest evolution of the telephone. Users will be able to truly exploit rich networks to communicate more effectively and efficiently. These devices will include desktop, public and portable phones, and will be able to be integrated with PCs.

- **Microsoft At Work-based PC phones.** Users of Windows-based PCs will also be able to tap rich communications when their PCs are connected to telephone networks. Microsoft At Work desktop software will be a standard component of the Windows operating system and will allow users to tap telephone networks connected via an add-in board, locally connected telephone or a LAN.

- **Microsoft At Work-based visual voice messaging servers.** LAN-connected voice messaging solutions will allow access to voice messages via a visual interface on both Windows-based PCs and Microsoft At Work-based telephones. Users will be able to bypass time-consuming and confusing audio menus and access their voice messages with the push of a button. Messages will be able to be retrieved in any order and even delivered to a single mailbox along with other messages such as e-mail and faxes. These servers can provide applications beyond basic voice messaging, such as supporting voice annotation of PC documents or reading electronic mail over the phone to a traveler.

Key Benefits

The key benefits of the different varieties of Microsoft At Work-based telephone systems include the following:

Far Greater Ease of Use
Making a telephone call today is as simple as dialing the number. But for operations beyond dialing a call, telephone features are difficult to access. Today's telephone networks offer a rich variety of valuable features, but research consistently shows most go unused because the features are so hard to access. Some require users to remember complex activation codes. Others require immense dexterity, and errors result in losing the call. Even the most basic operations like conference calling or transferring a call are often preceded by the instructions, "If I lose you ... ," which illustrates how uncomfortable people are with using these features.

Phone systems using the Microsoft At Work architecture will allow users to control their phones from a graphical display, either on the phone itself or on a neighboring Windows-based PC. The graphical user interface will be able to make every feature easier to use and will present features in context and guide users through each step to accomplish a task. For example, the phone will let users easily specify urgent calls to take and forward all others to a receptionist.

Flexible Communications Management
The telephone does nothing today to help users manage their communications — they have little say in who they talk to or when they talk. There is almost no flexibility to handle callers in different ways.

Phone systems based on the Microsoft At Work architecture will help people to prioritize and expedite communication tasks, saving both time and money. Not all calls are equally valuable at any given moment. The need to prioritize communication is evident in the use of answering machines and receptionists — people even pretend to be their own receptionists to screen calls. The Microsoft At Work architecture will provide phone systems that let users decide which calls to take and will even handle specific calls automatically. A Microsoft At Work-based phone system will help complete connections between people so that they can conduct their desired communication. The goal is to win at "phone tag" and reduce the length and number of callback cycles.

The Microsoft At Work software will empower users to configure their phones to work the way they work, saving time and effort. If users choose to, they will be able to easily define and organize their communication capabilities based on personal preferences. For example, they would be able to record and save multiple outgoing messages for repeated use ("I'm out today but checking messages ... ," "I'm out today and will NOT be checking messages ... ," "I'm in today and will return your message as quickly as possible ... ").

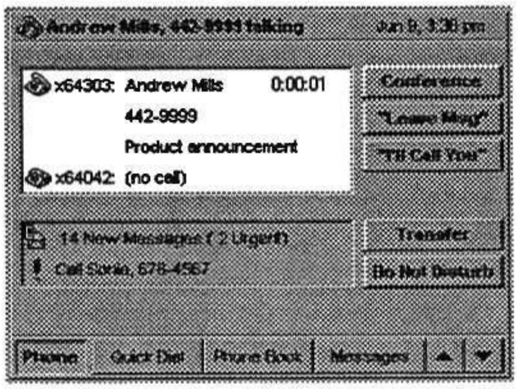


Figure 2. Communications Management.
Illustration of how a graphical user interface will make all telephone capabilities accessible and truly useful. Features will only be presented in context and users will be lead through operations step-by-step, such as setting up a conference call. There will be no more codes or difficult-to-remember sequences of buttons.

Visual Voice Messaging

Voice-mail and answering machines are becoming ubiquitous for an obvious reason: A successful telephone call requires both parties to be available at the same time, which happens in only a minority of calls, hence the need for messaging. Despite their popularity, today's messaging systems are very inflexible. Messages are only accessed in sequence; there is no way to first check for messages from a boss or co-worker on an urgent project. It is also difficult and time-consuming to navigate through menus of features. In addition, voice messages are difficult to save and retrieve at a later date. All callers are handled in the same way. One of the results of these inconveniences is "voice-mail tag."

The solution is *visual voice messaging*, which will provide graphical management of voice messages. Messages will be able to be displayed in a list, much like electronic mail, including the caller's name or number, the time he or she called and the length of the call. This information would let the user browse all messages and select the order for listening to the messages. Administrative options, such as creating a new greeting, will be accessed with a single button. Operations that are difficult today, such as forwarding a voice message to multiple people, will be dramatically simplified. One will simply select the recipients from the phone book and broadcast the message.

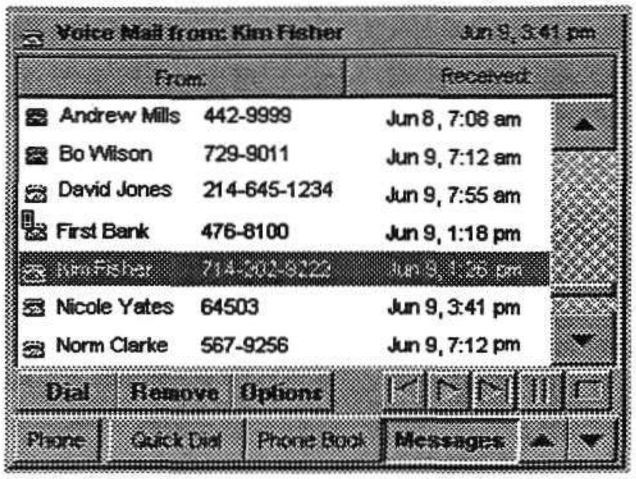


Figure 3. Visual Voice Mail.
An illustration of how a visual interface for voice mail on telephones will allow users to listen to messages in any order, easily archive and retrieve messages and manage their voice messages with the click of a button. Navigating through complex and time-consuming audio menus will not be necessary.

Visual voice messaging will be delivered on telephones incorporating the Microsoft At Work architecture or on Windows-based PCs. Moreover, the Microsoft At Work architecture allows voice messages to be integrated with electronic mail, fax or other message types so that users will be able to access and manage all their different message systems from the same place in the same way.

Telephone Communications United With Information Systems
Telephone calls are transitory events. There is no record of what occurs in a phone call except what the people on each end record manually. Yet telephone calls rarely exist in a vacuum. More than 60 percent of all calls occur during business hours[1] and are usually part of a broader business process, such as a transaction, consultation or teleconference, where important information is at each end of the call. Integration of telephone communications with information systems will both record and provide important contextual information.

For example, a phone or neighboring PC could automatically "pop" information related to the caller, such as reminders of things to discuss. Providers of professional services, such as lawyers, could automatically track their calls by client for billing purposes. Customer service representatives could use related information to offer faster and better service. Other applications might do banking and other financial transactions, access white or yellow pages or anything else done over the phone today.

The Microsoft At Work architecture will transform the telephone from a closed, proprietary device into a platform that a wide range of people can build applications for and integrate with other parts of the information infrastructure.

The Microsoft At Work-based Fax

According to a recent Gallup poll, fax traffic grew 43 percent last year[2]. According to network traffic studies, faxes currently account for 10 percent of all network traffic and nearly 50 percent of traffic between the United States and the Far East[3]. Yet, despite this dramatic growth in usage, the fax is still a fairly primitive communications tool. Difficulty using machine features, low-quality printing, lack of integration with the work environment and lack of security are all commonly identified problems.

---

[1]Source: Northern America Telecommunications Association
[2]Gallup, 1993
[3]AT&T Network Traffic Study

Microsoft At Work-based fax capabilities will address these deficiencies with a broad spectrum of fax solutions that will transform the fax from an independent tool to a powerful, integrated part of the modern communications process. Microsoft At Work-based fax products include the following:

- **Microsoft At Work-based departmental fax machines.** A standalone multifunctional machine (fax, print, scan, copy) will be able to be used by a single person or an entire department of people. In addition to being great standalone devices, they will be able to be integrated completely with PCs. They will also be sharable via direct network connection or via direct PC connection.

- **Microsoft At Work-based fax servers.** High-volume, LAN-connected fax solutions will offer the ideal platform for automating wide-area communication tasks, such as forms automation, billing and invoicing with suppliers, distribution of information to a field organization, etc. A host of new applications will be possible when users and developers can count on a widely deployed, secure, anywhere-to-anywhere messaging platform that will be provided by Microsoft At Work-based systems that are also integrated with Windows-based PCs.

- **Microsoft At Work-based PC faxes.** Any user of Windows with an industry-standard fax board will benefit from rich document transmission through Microsoft At Work desktop software that will become a standard part of the Windows operating system and other Microsoft At Work-based products and services.

- **Microsoft At Work-based fax-enabled network.** Public networks will be adding support for Microsoft At Work communications, allowing users to benefit from their high-volume broadcasting capabilities and the ability to access integrated, public mailboxes from any location.

Key Benefits

Key benefits of Microsoft At Work-based faxes (as implemented in any of the above products or services) will include the following:

Far Greater Ease of Use
While today's fax machines have dozens of advanced features, few are ever used. In fact, many users do not even know these features exist. The problem is that the small, cryptic display on today's fax machines makes these features inaccessible to users. To compound the problem, owners' manuals are rarely available when a problem occurs.

Microsoft At Work-based fax machines will use a graphical, touch-sensitive display to make every feature simple to use. Context-sensitive features will help guide users through tasks. For example, if a jam occurs, a picture showing users how to clear it will be displayed.

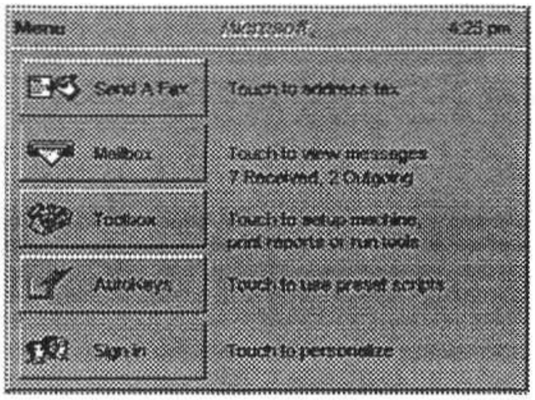


Figure 4. Mail Fax Screen.
Illustration of how clearly labeled buttons and context-sensitive help will make all features easy to access. Screens will be designed to make every fax operation fast and straightforward for the user.

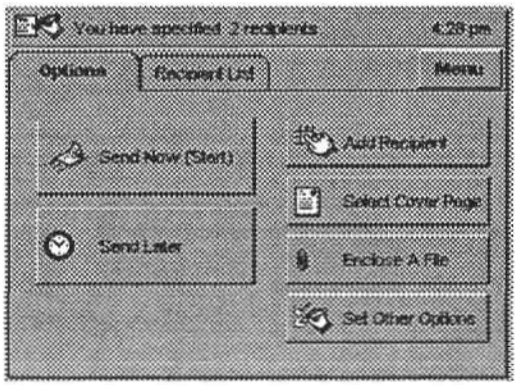


Figure 5. Fax Send Screen.
Illustration of how a Send Fax screen will clearly list the number of designated recipients and display additional options for sending faxes, including Delay Send and Security.

Ability to Send Original-quality "Published" and Editable Documents
Today's fax machines send fuzzy pages that are often difficult to read. As a result, people either don't use a fax when the document has to look professional, or they send another "good copy" via courier. Today's machines also don't allow users to send editable documents, which would enable wide-area joint authoring and the automation of many communication tasks.

Using Microsoft At Work rendering technology, a fax machine will become a remote publishing tool, allowing users to distribute final, laser-quality versions of documents directly from PC applications. Users will also be able to send editable versions of documents to reviewers and co-authors so that changes can be made directly without re-keying information, and then be returned to the author.

Full Document Security
The most frequently faxed documents include contracts, internal correspondence and purchase orders[4]. Despite the sensitive nature of these documents, anyone can walk by and read or pick up received faxes, and there's no guarantee that the document will even get to the proper recipient. Some fax machines advertise security features, but these machines are not really secure. Passwords are included in the message, but the encryption method is easy

---

[4]BISCAP Fax Usage Study, 1992.

to break. Moreover, all of these methods require both sending and receiving machines to be from the same manufacturer, a rare occurrence in today's market.

Microsoft At Work-based faxes will have strong built-in security that will allow users to encrypt messages so that documents aren't read by others. It will also be able to ensure that documents are delivered to intended recipients and verify document contents as authentic. By implementing Microsoft At Work security in both Windows-based applications and in devices from a broad base of manufacturers, secure messaging could become as commonplace in the future as regular fax transmissions are today.

Strong PC Connectivity

While the vast majority of all documents today are created on PCs, most users still print documents and manually feed them into fax machines. Users who choose to investigate PC fax alternatives find them unreliable and not well-integrated into their PC environment.

The Microsoft At Work-based fax is designed to fully integrate faxes with the rest of a PC's messaging environment by integrating this functionality into the operating system. Users will be able to send fax messages in the same way they send other messages, simply by selecting "Send" from their mail package or their favorite application. Received faxes will be automatically delivered into the user's mailbox — the same mailbox where e-mail and voice-mail messages are received. They will be able to forward and reply to the message with a single button click.

MIS Support

Today's fax machines are a nightmare for MIS professionals. They can't be centrally managed, so someone has to walk around to every machine to update fax numbers, change settings, collect activity reports and fix problems. Most machines don't support "default settings," so they can't set up machines to do things such as automatically send faxes when telephone rates are lowest. Users frequently can't enter accounting codes to track costs, and even when they can, the resulting reports can only be printed out, so the data must be manually entered into the accounting system. Finally, fax machines represent a network entirely distinct from the advanced data networks that they pay every month to maintain. MIS professionals should rightly wonder why they can't send all that "charged-per-minute" fax traffic over the data lines for which they pay a fixed monthly fee.

Microsoft At Work-based fax machines are designed to let MIS manage fax services in the same way as other corporate communication resources. They will be centrally administrable so that any settings can be changed directly, and common resources such as address books will be able to be maintained and downloaded automatically. They are programmable so that faxes queued up after 4 p.m., for example, will be able to automatically be sent at discount rates, saving between 25 percent and 40 percent on toll charges[5]. Activity reports will be able to automatically be sent in binary format to accounting, where they could be entered into accounting systems directly. They will automatically send trouble reports when problems occur. They will easily route traffic over existing corporate data networks, saving 95 percent of the transmission costs[6].

Features to Reduce Fax Costs

Long-distance charges and the employee time required to send and receive faxes account for more than three-fourths of total fax costs, while the cost of the fax machine accounts for only 15 percent[7]. Yet today's fax machines do little to address these costs. Moreover, the few features that manufacturers have added are virtually unused because they are so difficult to access. For example, while most mid- to higher-end machines offer the ability to delay fax transmissions until rates decrease, few people know how to use this feature today.

Microsoft At Work-based fax machines will have features to dramatically reduce fax costs. In addition to making cost-saving features easy to find and use, Microsoft At Work rendering will reduce file sizes and, as a result,

---

[5] Based on AT&T® After Hours discount rates. Other long distance carriers have similar discount programs.

[6] Based on a comparison of average per-minute toll charges to amortized T-1 transmission charges between Redmond, Wash., and New York City.

[7] Based in part on internal calculation of average toll charges per machine and lost labor walking to and from the fax machine, and is corroborated by BISCAP's finding that toll revenues for fax are three times the revenues from fax machine sales.

transmission times. Digital cover sheets can decrease the cost of a typical four-page fax by up to 25 percent[8]. As noted above, simple access to discount transmissions can reduce toll charges by 25 percent to 40 percent and integration with corporate networks would reduce toll charges by as much as 95 percent.

Microsoft At Work-based Handhelds

The promise of a new generation of small, powerful computing devices that will help you do everything you want, anywhere you want, is an alluring vision that has received a great deal of attention over the past year. Microsoft and others wishing to build products based on Microsoft At Work agree that there is incredible potential for such systems — but only if they are fully integrated with the rest of the existing information infrastructure. As with all Microsoft At Work-based systems, the handheld will provide a pragmatic solution. We have concentrated on the following:

- Focusing on connecting users to their desktop work environment, where the vast majority of useful business information resides.
- Providing an open, well-defined and accessible development environment that draws on the wealth of software talent embodied by more than 300,000 programmers for the Windows operating system.
- Leveraging existing infrastructure such as the current phone system, while providing a well-architected system that can integrate new capabilities as they come online.
- Providing centralized, comprehensive communications management for fax, e-mail, pager and other mobile information sources.
- Offering a highly customizable platform for quick, simple vertical and personal software solutions.

Key Benefits

Key benefits and attributes of the Microsoft At Work-based handhelds include the following:

Strong Personal Information Management
The modern office is evolving rapidly, giving people access to a wealth of information. Yet this information is largely unavailable when it is probably needed the most — when the worker is away from the office. A Microsoft At Work-based handheld is designed to fulfill the needs of a variety of mobile workers. The target system will be extremely small, encouraging the user to carry it always. Intrinsic software will allow complete management of personal information by providing address book, calendar, to-do list, note taker, clock and calculator applications. Communications will be supported by built-in mail connectivity as well as special features for sharing information with desktop computers efficiently and accurately. Additional applications will be added easily through the Microsoft At Work open architecture and development tools — by OEMs for market segmentation purposes and corporate developers who want to create custom solutions.

Desktop Connectivity
While creating a device that will provide rich information to the mobile user is valuable in its own right, some of that value is lost if the device does not cooperate with the other tools of the modern office. The most important of these is the desktop PC, which holds the majority of information and around which work centers in most offices. For instance, if meetings are added to the schedule on a handheld, they should be reflected on the desktop seamlessly. If notes are made about tasks that need to be completed, they should be reflected in the priorities list on the PC. Microsoft At Work-based handhelds will reflect these kinds of messages by providing transfer and synchronization software for both the handheld and the PC. In addition, users will need the ability to access spreadsheets, word processing and other files created on the PC or stored on the network from the handheld.

[8] BISCAP Fax Usage Report, 1992. Cost savings assumes that digitally transmitted header eliminates the majority of cover sheet data that is currently sent in bitmap form.

Microsoft At Work-based handhelds will enable users to access any desktop file, allowing spreadsheets and word-processing files to be downloaded, viewed, annotated or even sent via fax or public e-mail.

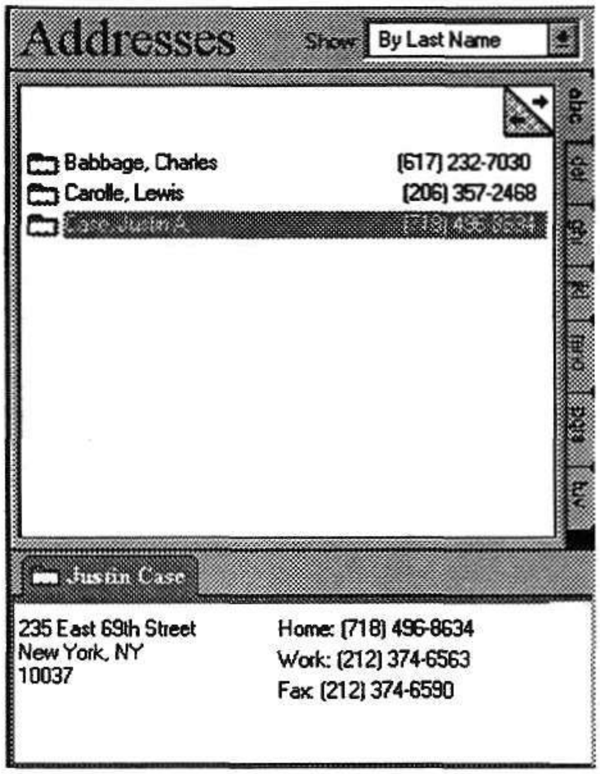


Figure 6. Mobile Address Book.
An illustration of how the Microsoft At Work-based handheld system address book will hold the fax number and e-mail address for important contacts and clients, all of which will be accessible by communications applications. Additions and changes while on the road will be synchronized with a desktop personal computer.

Integrated, Modular Communications
When working away from the desktop, communication is clearly the key. Microsoft At Work-based handhelds will provide for communications through a number of mechanisms. The built-in e-mail client and underlying modular connectivity layers will allow for simple, centralized management of e-mail, fax, pager and informational messages from a variety of sources. A fax from a supplier, e-mail from a co-worker and a page from the boss will all appear on a single screen from which the user can reply appropriately, with automatic support for the varied transmission methods. The Microsoft At Work-based handheld will include connectivity to a variety of popular networks. The modular nature and open architecture of this system will allow for simple development and integration of drivers to support additional services or new technologies.

Pragmatic Solutions for Today and Tomorrow
Microsoft is building handheld solutions that will make the best use of existing technology to provide real solutions for users. Microsoft has designed these systems to evolve with technology so that they remain the optimal solution. Two examples are in communications and user interface.

Today's data communications are predominantly over wireline networks, providing low-cost transmissions at a respectable speed. Wireless communications hold great promise, but are currently costly, and standards are still being set. The modular communications architecture in Microsoft At Work-based handhelds will make efficient use of both wireline and existing wireless networks immediately, while being flexible enough to accommodate new approaches as they develop.

The Microsoft At Work-based handheld user interface will also develop with technology. By making use of many metaphors familiar to the Windows-based user, this pen-centric system is being custom-crafted to provide intuitive, reliable usage of highly portable devices. A fundamental problem with pen-based computing continues to be the low acceptability of handwriting recognition. While handwriting recognition is expected to improve in time, the Microsoft At Work-based handheld device will be highly usable before such improvements occur. Design goals include a simple navigation and selection system, which will allow most operations to be complete with the touch of a pen. The system will be trainable by the user, and background learning and explicit training sections can be made available. All of these factors make the handwriting recognition in the Microsoft At Work-based handheld a functional, reliable system today.

Extensive Third-party Support

Microsoft realizes the success of a computing system is dependent on its ability to provide solutions to a wide range of customers, and that encouraging third-party software and hardware support is the most effective way to do this. Microsoft will encourage such development through several channels. First, applications will be able to be built using the Microsoft At Work-based handheld software development kit (SDK) on any desktop PC. Second, the Microsoft At Work-based handheld SDK will support desktop development of mobile applications under all the most popular languages, including C, C++ and Assembler. Finally, the familiarity of Windows constructs will allow companies to port existing software to Microsoft At Work-based handhelds with a minimal amount of redesign or reeducation.

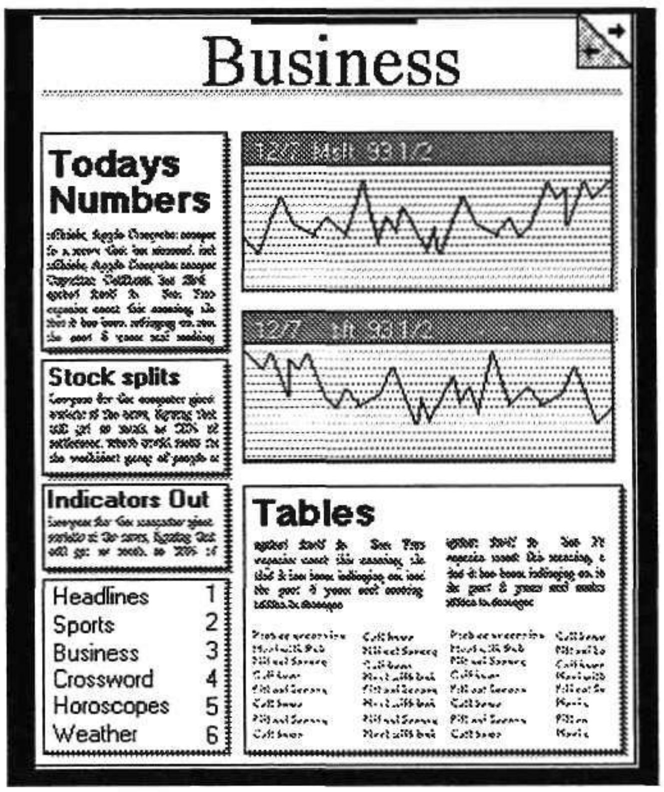


Figure 7. Electronic Newsletter.
An illustration how public information such as news stories will be obtainable via telephone line or wireless carrier. Users will be able to obtain general information, such as headline stories, and personalized data, such as particular stock quotes and local sports scores.

The Microsoft At Work-based Printer

With more than 25 million new PC printers introduced into the workplace in 1992 alone and an avalanche of more than 90 billion original paper documents created annually, it's no surprise that the advent of the "paperless office" has been yet again delayed[9]. Undoubtedly, occasions will always exist when there is no substitute for having information literally at your fingertips in the form of a paper document.

While the volume of paper we produce continues to grow year by year, the complexity of those documents has also increased dramatically. The widespread acceptance of the Windows operating system and its graphically oriented applications has made it easier than ever for users to enrich the design and appearance of their documents by integrating scalable type, graphics and photographic images. But the process of printing these high-quality documents has not kept pace with rapidly escalating user expectations. At Microsoft, more than 25 percent of all calls received by the product support organization involve printing problems of one type or another — difficulty installing printers and their associated software, inability to access sophisticated printer features, lengthy delays in printing documents and mismatches between what appears on the PC display and what the printer actually produces on paper. Once again, the Microsoft At Work architecture offers solutions, effectively streamlining communication between the PC and the printer; greatly simplifying users' control and access of printer features; and enabling faster, higher-quality and less costly printing products.

Key Benefits

Fast, Bidirectional Communications
Unlike many of today's copiers and fax machines, printers are already connected to PCs. The vast majority of these printers and PCs communicate over Centronics® or parallel ports. Unfortunately, given the increased sophistication and complexity of many office documents and the increased performance capability of laser printer engines, transferring data over the parallel port has become a key performance bottleneck, severely limiting the speed and robustness with which the PC and printer can exchange information. Even more limiting is the fact that the parallel port has historically been a one-way communication path, meaning that the PC could transfer information to the printer, but the printer could never supply information about its status or operation back to the PC to inform users. The Microsoft At Work architecture for printers will resolve both of these problems, dramatically improving the speed at which data can be transferred over the parallel port and using new software components in both the PC and printer to enable full bidirectional communication, regardless of whether a printer is connected over the serial port, the parallel port or over a network.

Sound and Visual Feedback
Using bidirectional communication, the Microsoft At Work architecture will allow information to flow from the printer back to the PC, enabling users to monitor such things as the time required to finish the current print job, precise error conditions, and paper and supplies status on the PC screen. Exploiting the sound and graphic capabilities of Windows, Microsoft At Work-based printers provide users with rich audio and visual feedback directly from the printer, forever eliminating the guesswork typically associated with printer operation. Users of Microsoft At Work-based printers will get instant, visual notification of vital printer information, such as low toner, no paper or jammed paper, as well as information about what to do about the problem in order to continue printing.

[9]Source: Dataquest

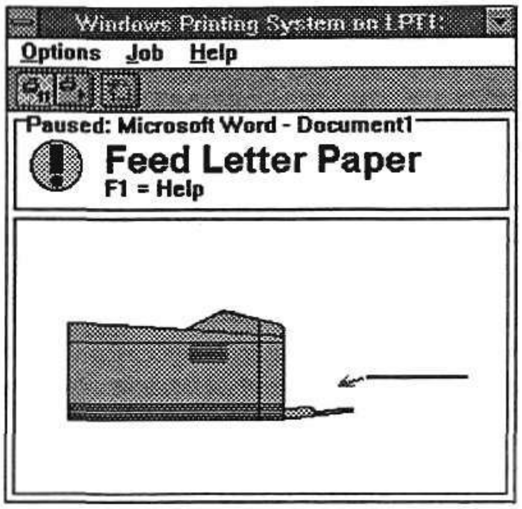


Figure 8. Printing Status Screen.
After the user initiates a print job, a graphical screen will provide continuous status on time remaining to complete a print job, including prompts to add paper to the cassette or the form-feed tray.

Simple Installation
By exploiting bidirectional communication capabilities, Microsoft At Work-based printers will deliver benefits to their owners even before the first page is printed. Once connected to a Windows operating system, the printer will be able to automatically instruct the host system to load the required printer driver and choose the optimum communication protocol. Thus, users will be liberated from having to choose from a myriad of installation options, and true plug-and-play functionality will be assured.

An Intuitive Graphical User Interface
Microsoft At Work-based printers will be tightly integrated with their Windows PC-based counterparts, using the PC's high-resolution graphics display to provide an interactive graphical user interface. Access and control of all printer features will be as easy as pointing and clicking a mouse, representing a dramatic improvement over the traditional printer control panel with its single-line liquid crystal display and confusing online and nested Menu buttons. Directly from the PC screen, users will be able to easily select and verify the printer's active paper source from simple dialog boxes; manage formatting options, such as print resolution, collating, informative header or trailer pages, and long- or short-edge binding; choose two-sided printing; and enhance images with multiple halftone settings, each with brightness and contrast options.

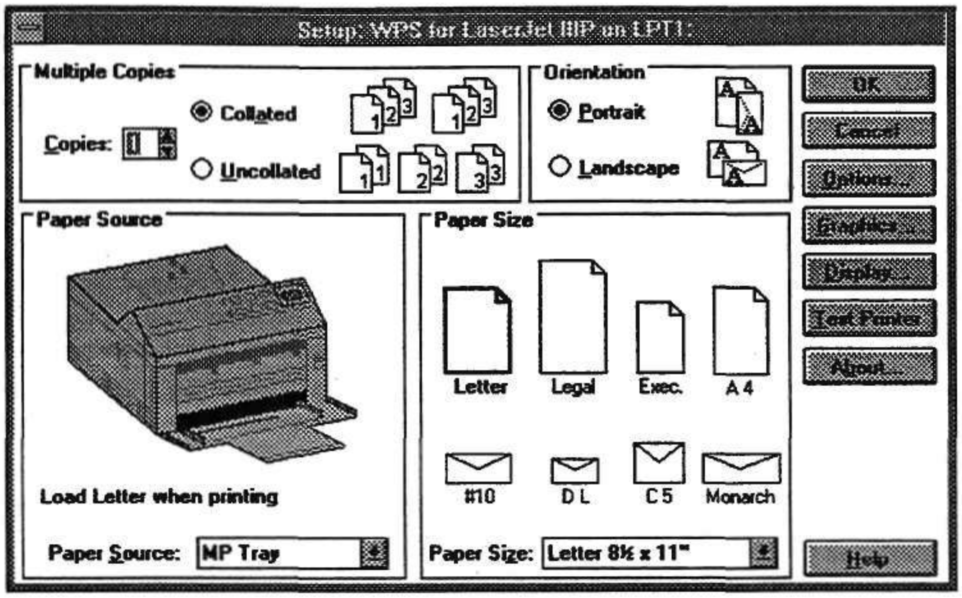


Figure 9. Printer Set-up.
From a graphical screen on a personal computer, users will be able to point and click to select paper options and cassettes on the printer, check printer status, and select advanced options such as document collation. PC-based control of the printer is enabled through bidirectional communications between the two devices.

Faster Performance
By fully integrating the printing subsystem with the PC operating system, the communications channel and the Windows imaging model, Microsoft At Work-based printers will exploit Microsoft At Work rendering to enable PCs and printers to share work and information several times faster on the average than traditional page-description languages can do.

True What You See Is What You Get (WYSIWYG)
To guarantee true WYSIWYG, where the type, graphics, and colors that appear on the screen are the same as those printed on the page, Microsoft At Work-based printers will use the same font and imaging technology that Windows itself uses. This guarantees the highest level of fidelity between display and printed output, avoiding the inconsistent appearance and slow performance that some printers generate when forced to translate from the Windows imaging model to their own proprietary imaging language before printing requested documents.

Lower Cost
Microsoft At Work-based printers will do more than improve performance, simplify operation and expose new functions to their owners. They will also exploit tight integration with PCs to yield substantial cost savings to both users and manufacturers. The efficiency of the overall architecture will allow printers to be designed with less processing power, less memory, fewer buttons and controls and generally less expense — all while providing printer manufacturers with an enabling platform for new features and models.

Compatibility
The benefits of the Microsoft At Work architecture for printers are not just limited to future printer designs. As with other Microsoft At Work-based devices, Microsoft and others are already hard at work extending the benefits of this new technology to the large installed base of existing printers. In fact, the first implementation of a Microsoft At Work-based printer is already shipping: the Microsoft Windows™ Printing System cartridge is specifically targeted to extend the benefits of Microsoft At Work-based printing to the more than 7 million HP® laser printers that customers already own.

The Microsoft At Work-based Copier

The copier is a ubiquitous device in the office. The majority of documents that reach someone's hands in final form have gone through a copier to get there. Yet little attention has been paid to how the copier is used or how it *could* be better used in the modern office. Part of the reason for this is the analog nature of today's copiers. Copiers today literally take a photograph of a document and reproduce it over and over again. While efficient, this process has a number of shortcomings:

- Since the print engine in the copier doesn't take digital input, users must print documents before copying. This is a time-consuming process, especially if the printer is occupied.

- There is no way to integrate communications into today's copiers so that they function as document distribution tools, because they cannot receive, print, store or send image data in the same way a fax machine does today. As a result, the typical mail room has a copier and a fax machine standing side by side, when one device could easily play both roles.

- Little special processing can be done on the documents beyond simple reduction and enlargement. For example, users today who want to create numbered copies must do so by hand, stamping each page of each copy, when overlaying this information on each copy of a digital document could be a simple task.

This process will change in the future. Digital technology is finding its way into the world of copiers, and with it comes a wealth of new functionality. Microsoft At Work-based digital copiers will be a family of monochrome and color copiers that will enhance the copier's existing role as a focal point for document distribution in the modern office. Key features include the following:

Key Benefits

Ease of Use
As with other Microsoft At Work-based devices, copiers will use a touch-sensitive graphical user interface to give users access to advanced document imaging and output management functions. Online, context-sensitive help will eliminate annoyingly common experiences, such as putting letterhead paper stock in upside down and backward. Users will be able to preview document appearance on the screen before printing, avoiding errors such selecting the wrong output paper size.

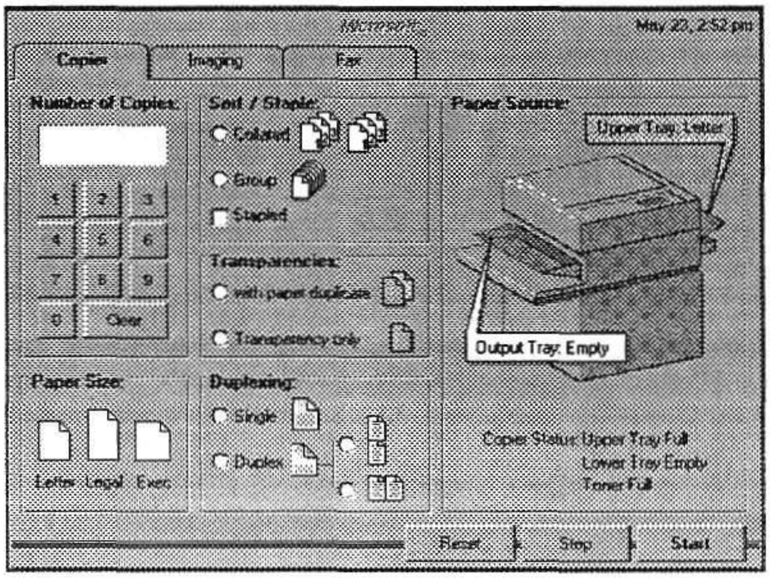


Figure 10. Copier Screen.
An illustration of how both simple and advanced options, including device diagnostics and copier service needs, will be clearly marked on-screen. A paper source picture will help users make sure they have selected the right paper size and cassette before copying begins.

Desktop Connectivity
From their favorite word processor, users will be able to print 10 copies, double-sided, stapled and sorted. All imaging and output handling options will be directly and easily accessible. Users will also be able to save a copy of the document on a copier's mass storage so that others can walk up and make a quick reprint from the digital original whenever they need to.

Document Distribution
Users will be able to publish documents to all recipients directly from a PC application. For example, users will be able to create a cc: list in their word-processing document. When users select "publish," the job will be sent to the copier. Copies for local recipients will be printed on the copier with a header that identifies the recipient. Copies for people in offsite locations will use the messaging functionality shared with Microsoft At Work-based faxes to transmit the document to fax machines or other remote copiers for final printing and distribution.

True WYSIWYG Color and Monochrome Reproduction
Today's printing devices often produce output that looks significantly different from what one sees on a computer screen. This is caused by at least one of two potential problems. First, output may be transformed into a page-description language, and sometimes information gets lost in the process. Second, there may be no calibration between the different output devices. This second problem is particularly prevalent in color devices, where the capabilities of different input and output devices vary greatly. Microsoft At Work rendering solves these problems. First, it will use an imaging model that is compatible with the Windows imaging model. Second, it will use a color model that is compatible with the color model being added to Windows. By implementing imaging and color models that are compatible with Windows, the Microsoft At Work-based copier will be able to guarantee that colors you see on your screen or in the original document will be exactly matched on the printed page.

Image Editing
Digital imaging, coupled with a well-structured software environment, will greatly increase the types of special document-processing features that are possible on Microsoft At Work-based devices. For example:

- Image filters will eliminate stray marks on documents.
- It will be possible to insert overlays to automatically number copies, stamp documents as confidential or add company logos.
- Color accenting or other techniques will be available to emphasize a selected portion of the document.
- Edge-detection algorithms will be available to blow up a portion of a document. For instance, users will be able to select an article in the newspaper by circling it. The copier would identify the area to be enlarged and would reprint the circled area as a full-page image.
- Optical character recognition filters (typically from third parties) will convert analog text information into digital information.
- It will be possible to cut and paste areas from one document into another. Other areas can be deleted.
- It will be possible to merge two documents into one at high speed; for instance, in a mail merge, addresses will be placed at the appropriate point in form letters.

- more -

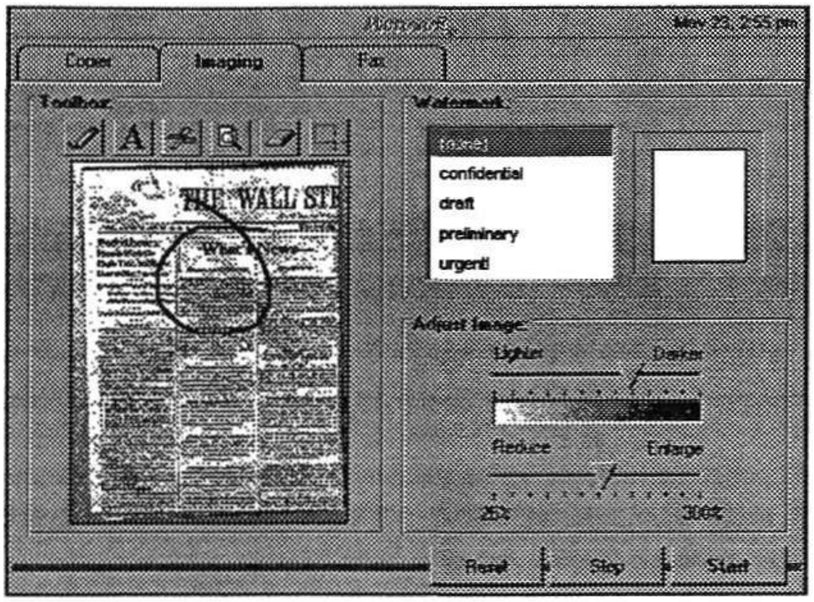


Figure 11. Copier Imaging Application — Document Segmentation and Smart Article Abstraction. An illustration of how an imaging screen might be developed for a copier based on Microsoft At Work. Microsoft At Work-based copiers will include standard support for watermark stamps, such as "confidential," and image enhancement.

On-demand Reproduction

Users will be able to store copies of documents in the copier's mass storage media or on other LAN-connected servers. When a quick copy is needed, users will be able to walk up, access the document and print the number of copies required. This capability will be used by companies to maintain frequently used documents, such as expense forms, time sheets, product catalogs and employee procedures, for easy access and storage. With PC file systems and file formats on all copiers, walk-up users also will be able to insert a floppy disk into the copier to get copies.

Remote Administration and Diagnostics

As with other Microsoft At Work-based office machines, copiers will be managed remotely using simple PC administration tools. Administrators will be alerted whenever a problem such as a paper jam or paper outage occurs. The copier also will have a built-in diagnostic engine that uses a powerful inference model to determine the most likely cause of trouble and shows users how to resolve the problem. Technicians also will be able to access the copier and run diagnostics remotely.

- more -

What is the Microsoft At Work Architecture?

The Microsoft At Work architecture is the foundation for a new line of intelligent office machines comprising many hardware configurations and many product feature packages. Product lines based on this architecture will grow and change over time, so the architecture must accommodate both the creation of products in the near term that will excite buyers and accommodate future products.

The Microsoft At Work architecture is a layered, modular software architecture: Each major software element has a well-defined applications programming interface (API) and communication paths between elements are minimized where possible. A small software layer of abstraction has been built between the hardware and the great majority of the software elements, permitting hardware changes to be made invisibly to the software above the abstraction layer. The operating system provides real-time services, such as pre-emption, and its interfaces are compatible with those of the Microsoft Windows operating system. So the applications that provide Microsoft At Work architecture-based machines with new features will be created just like PC applications: quickly, easily and cost-effectively. The combination of modularity, speed and Windows-based compatibility make the Microsoft At Work architecture an excellent platform for office machines today and in the future.

The architecture components consist of an operating system, communications, rendering, graphical user interface and desktop software.

Microsoft At Work Operating System

The Microsoft At Work operating system is a modern operating system that will support the real-time communications needs of office automation and telephony systems. It has the following key features:

- **Pre-emptive, real-time support.** Communication devices such as fax machines and phones are distinct from personal computers in that they have critical real-time needs. Consequently, the software in these devices must attend to communication hardware such as modems very frequently, so that pieces of the communication are not lost. To support this need, the operating system was designed to be able to put other processes "on hold" temporarily in order to service the communication hardware before continuing other functions.

- **Small footprint.** The operating system has been designed to be very small so that the memory requirements of these devices are kept as small as economically possible.

- **Compartmentalized.** Like the Windows operating system, the Microsoft At Work operating system is designed so that interfaces to hardware, such as printers, scanners and touch screens, are well-defined and so that software unique to the particular hardware is collected together in special "device driver" software routines, providing two benefits to developers and to end users. First, it provides a simple way to deliver a very broad array of products to the marketplace. For example, it makes it easy to create a Microsoft At Work-based telephone product line with a low-end model that makes use of a small, monochrome display and a more full-featured model that might make use of a larger display or even a color display. The second advantage is that the operating system allows developers to very quickly introduce new models when new hardware becomes available, because they need to modify only a single piece of software. These two benefits translate into broader product lines and more cost-effective solutions for end users.

- **Extensible.** The software is designed to allow both manufacturers and customers to add new features. For example, local area network connectivity will be able to be added easily by installing an optional LAN hardware module and a software driver. Additional memory will be able to be added to the system, and the system will automatically make use of this memory. New image-processing software and communications protocols will be able to be added on the premises, and it will even be able to be done over the phone line, allowing manufacturers to create basic models that can be enhanced in many different ways to fit the needs of different user groups.

- **Windows-based, PC-compatible development environment.** The operating system presents APIs that are compatible with those found in the Windows operating system. Consequently, the more than 300,000 software developers that know how to develop software for Windows will know how to develop software for Microsoft At Work-based devices. In addition, the broad array of tools available to develop software for Windows can be used to develop software for these devices. In fact, software can even be developed on the PC and then downloaded to Microsoft At Work-based devices for testing.

  Having a Windows-compatible programming environment also means that the Microsoft At Work operating system can leverage software from the Windows environment. For example, Microsoft At Work-based handheld systems will include the run-time library of the Microsoft Visual Basic™ programming system, which allows software developers to create software applications simply. Additionally, software from the Windows operating system can be integrated into the Microsoft At Work operating system. For example, the Open Database Connectivity interface can be added to give these devices rich database connectivity.

Microsoft At Work Communications

Microsoft At Work communications will provide two important capabilities:

- Rich, secure transmission of digital documents (messaging) between any two Microsoft At Work-based devices, whether office machines or PCs.

- Strong control and feedback capabilities between Microsoft At Work-based devices and PCs.

The actual communication methods used to carry out these functions can be divided into two categories: message-based communication (used to store and forward messages between devices) and interactive communications (used to communicate back and forth in real time). Both of these methods are discussed below. The elegance of the Microsoft At Work communication services is that either method will be able to be employed on any communication media that is available, including serial ports, parallel ports, fax modems, data modems, LAN connections, etc.

Message-based Communication

The Microsoft At Work message protocol will provide for the exchange of messages and documents from anywhere to anywhere over any communication media, including the public-switched telephone network. It will allow any two users with a PC fax board, fax server or fax machine to exchange either editable or high-quality "published" documents with the following key features:

- **Digital document transmission.** The message protocol will allow users to exchange digital documents that do not degrade over time. These documents will be in one of two forms: either high-quality "published" form using the Microsoft At Work rendering technology (described below), or as an editable document. The ability to send any editable, binary file to other Windows-based users over simple phone lines is a powerful enabler of wide-area workgroup computing. For example, corporations could send invoices and billing information in editable form to their suppliers, which would enable those suppliers to automatically download that information into their accounting systems. Companies could also send automatic updates to online product catalogs for their sales forces.

- **Security.** The Microsoft At Work message protocol employs a powerful form of security called public key/private key encryption, which will allow users to encrypt documents before transmission, so that only the intended recipient can read the document when received. It also will allow users to request that the recipient be "authenticated" before the message is delivered to ensure that the document is delivered only to the intended recipient. Finally, users will be able to include a "digital signature," which can be used to verify that the document sent is authentic.

- **Capabilities exchange.** When a Microsoft At Work-based device connects to another Microsoft At Work-based device, the capabilities of those devices, the capabilities of the communication hardware, support for color or not, etc., will be exchanged so that the sender can create the best possible document format for the recipient. These capabilities will be stored by the sender so that they can use them in future transmissions. We've also defined the capabilities exchanged in an extensible fashion so that as printing devices, scanners, personal computer and communication hardware capabilities expand, so will the capabilities of the message protocol.

- **Compatibility with standard fax machines.** Any solution that ignores the 20+ million fax machines worldwide will be much less useful. That's why the message protocol is designed to be backward-compatible with existing fax machines. If a message is sent to such a machine, the document will be converted into a form understood by those machines. Of course, some capabilities, such as high-resolution rendering and security, are lost in communications with these machines.

- **Integration with Windows messaging.** The Microsoft At Work message protocol interfaces with the Windows Messaging API (MAPI). Consequently, users will be able to send and receive messages to and from Microsoft At Work-based devices through any MAPI-enabled e-mail software. Microsoft At Work-based message recipients are just a different recipient type whose address happens to be name plus phone number. Another important benefit of this integration is that users will be able to send messages to e-mail and Microsoft At Work-based recipients seamlessly. Finally, integration with MAPI means that all mail-enabled applications will be able to automatically make use of the Microsoft At Work message protocol with no modifications.

  The same MAPI technology is implemented on Microsoft At Work-based devices as well, so we will be able to leverage advances in messaging that are added to MAPI on the desktop (e.g., the ability to have multiple communication "transports," or communications methods, operable at the same time) on Microsoft At Work-based devices. In addition, software developers will be able to leverage their understanding of MAPI on the desktop to develop applications for Microsoft At Work-based devices.

- **Device control and feedback.** The Microsoft At Work message protocol will also be able to be used to control any functions of the Microsoft At Work-based devices over LAN connections, serial connections and even phone lines, allowing users to download new address books, change options and settings, and even load new software remotely. The protocol also supports the return of device status to the user. For example, a Microsoft At Work-based device can inform a user that it is experiencing difficulties such as paper jams or persistent communication problems.

Bidirectional, Interactive Communication
Interactive communication will provide real-time device control and diagnostics. It will allow users and software to control all functions of the Microsoft At Work-based system remotely and provide feedback on system status. For example:

- A Microsoft At Work-based fax machine will also be able to operate as a desktop scanner. A scanning application operating on a user's PC would instruct the device to scan the paper and return the scanned image to the application over a serial, parallel, enhanced parallel (i.e., Enhanced Call Processing), or even a LAN connection.

- The Microsoft Windows Printing System uses interactive communication to determine printer capabilities, to tell users the current status of print jobs, and to inform users of current printing problems.

- Microsoft At Work-based fax machines and copiers will use interactive communication to perform remote diagnostics so that repair specialists and even users can determine the source of system problems.

Microsoft At Work Rendering

The dream of the "paperless office" will probably remain just a dream. Even in the most highly integrated modern office, documents will continue to play a key role. Therefore, printing is critical to the efficiency of the entire office. The most important requirement is the ability for any office device (fax, copier or PC) to efficiently and cost-effectively produce high-quality printed output. Regardless of the actual output device, the best printing technology is of vital importance.

After carefully examining developers' and end users' needs, Microsoft decided to approach the challenge from an overall system perspective, looking at how PCs and printing devices can cooperate to produce better results. The solution is Microsoft At Work rendering, which is at the core of both the Microsoft Windows Printing System and the Microsoft At Work architecture. Essentially, rendering extends the definition of "the system" to encompass the Windows operating system, the Windows imaging model, the CPU/memory on the PC, the CPU/memory on the printing device and the communication channel. Microsoft At Work rendering has been optimized for the capabilities and limitations of all of these elements. Key attributes include the following:

- **Harnesses the CPU and memory on the host.** Rendering improves performance and reduces printer costs by harnessing the CPU and memory resources on both host and printer. By optimally dividing the print job between host and printing device, performance will be maximized, and any printer will be able to print any page, no matter how complex.

- **Creates a more efficient document printing and transmission format.** Rendering describes pages in terms of "resource primitives," which will closely mirror the internal graphics routines, referred to as "GDI," used by the Windows operating system. This will have three key benefits to the user:

  1. Eliminates the majority of the processing required to translate from GDI to PostScript®, PCL®, bitmap or other page representations, decreasing processing time on the PC.
  2. Because the "resources" are readily executable on the printing device, rendering will eliminate the inefficiencies of parsing and interpreting a more complex printing language on the printing device, which will increase printing speed and reliability.
  3. Because rendering takes full advantage of the redundancy found in most documents (for example, the letter "e" is found over and over again in a document), it will create fax messages that are much smaller than those generated by traditional fax machines (sometimes by a factor of ten), drastically reducing transmission time and line charges.

- **What You Print Is What You Fax Is What You Copy Is What You See.** Since Microsoft At Work rendering is so much more efficient than other page representations, there will be no need to sacrifice drawing in order to improve performance. In addition, rendering leverages the font technology that Windows has built in. The result is true WYSIWYG — always.

Microsoft At Work Graphical User Interface

Microsoft At Work-based devices will use a common graphical user interface so that they are easier to use and so that all device features are accessible. The guiding principles in the design of these user interfaces include the following:

- **Use graphics to provide more information to the user.** A picture replaces a thousand words. Through the use of graphics, Microsoft At Work-based systems will be able to rapidly show the user exactly what is happening. For example, the Windows Printing System can already provide rich information about the effect of different printing options by showing that effect on a sample document. A Microsoft At Work-based phone will provide a view into users' voice mail boxes, showing them how many messages have been received, who each message is from and any special handling instructions that were requested.

- **Use graphics to provide context and feedback.** Microsoft At Work user interfaces will change based on the tasks that users are performing. Only options that are appropriate to a particular activity will be presented. Visual feedback will tell users what is happening and will prompt them for more information where appropriate.

- **Provide a consistent look and feel across devices.** Using a common set of controls and graphical metaphors across all devices will mean users who are familiar with one device will be familiar with them all, saving training and task execution time.

- **Use graphics in a way that is appropriate for the application.** Some applications will reside on the device, some on the PC and some on both. The key is to use the interface in the most appropriate, cost-effective manner to help users.

Microsoft At Work Desktop Software

All Microsoft At Work-based products will include desktop software that fully integrates these devices into users' desktop computing environments. For example:

- Remote administration applications will let users change system options and download new software and other system resources remotely.

- Windows Messaging API and Windows Telephony API-compatible drivers and transports will integrate devices' rich communication functions into the desktop.

- Printer drivers will give users access to all printing options available on the devices.

- Handheld software will synchronize the information on handhelds with the information on PCs.

What Is Microsoft's Role?

In November 1990, Microsoft Chairman Bill Gates described the company's vision for the future of Microsoft and its corporate mission. Entitled *Information At Your Fingertips*, this statement of direction embodies the vision of the personal computer as an indispensable information appliance. However, *Information At Your Fingertips* involves far more than personal computers. Its far-reaching goals imply change and innovation in all aspects of technology. Above all, *Information At Your Fingertips* speaks to the integration of many diverse information sources into an accessible and easy-to-use communications infrastructure. Stated simply, it is the ability to get the information we need quickly and easily, when and how we need it, from wherever it resides.

The Microsoft At Work architecture is the next logical step in Microsoft's effort to deliver on the *Information At Your Fingertips* vision. Microsoft At Work-based devices will concentrate on the enhancement and integration of familiar office products into an underlying information framework.

Microsoft will contribute its software expertise and its understanding of the form and importance of industry standards to the Microsoft At Work architecture effort. Clearly, Microsoft alone cannot bring about the necessary level of product innovation and development to make the Microsoft At Work architecture successful. Those building Microsoft At Work-based products are an equally important element in the overall success of the effort.

Microsoft's expertise to this end is in software technology and usability. Microsoft is in a unique position to help tie all the diverse elements of the Microsoft At Work architecture together. The company's broad view of industry requirements will be invaluable in making the Microsoft At Work architecture practical.

Microsoft fully expects the depth and strength of product innovation based on the Microsoft At Work architecture to result in the development of a wide variety of high-quality products. Many existing companies will be successful in this market. Many new companies with products that we cannot yet envision will also make a significant market impact.

Microsoft believes the workplace of the future will be a more efficient, cost-effective and functional place — one in which the talent and creativity of individuals will be truly enhanced by the immense technological capabilities that the Microsoft At Work architecture can deliver.

Several Years From Now

"Jim, I faxed you the purchase order this afternoon. Sign it and fax it back, so we can get going. Talk to you soon." Jim turns to his PC and checks his message box. Sure enough, there's the fax. He double-clicks on the document and reads through it. At the end of the document, Jim embeds a copy of his digital signature in the designated space. A couple of more clicks and the document is queued for transmission back to the vendor tonight. He checks his watch. It is already 7 p.m. on the East Coast. They won't see it until tomorrow. He clicks on the Use Cheap Rates option and sends the document. It used to be a lot harder than this...

Jim stands at a pay phone in the airport, handheld system open and ready. He taps his way through the dialog boxes on the screen and waits for the connection to his office computer. Because it is almost time to board his flight, he sets the filter to look for specific messages to reduce transmission time and costs. Any other messages can be dealt with first thing in the morning when he is back in the office. The list of messages pops up on the screen. Bob says Carol needs a quick call this afternoon. Jim smiles. He used to have to shuffle through pockets, travel documents and briefcase looking for slips of paper with people's phone numbers. He touches the Phone Book button on his handheld and holds his thumb on the scroll bar. N ... P ... R ... Ra ... Re ... Robinson. There it is: 212.555.5555. Second message. The partners need a copy of the Memphis proposal routed to everyone tonight, in order to get it read and approved by the end of the week. Jim sends a copy of the document from his handheld to the office copier, addressed to each team member. Time to get on the plane. Jim taps the Hang Up button and slips the handheld into his pocket. It used to be a lot harder than this ...

Founded in 1975, Microsoft (NASDAQ "MSFT") is the worldwide leader in software. The company offers a wide range of products and services for business and personal use, each designed with the mission of making it easier and more enjoyable for people to take advantage of the full power of computing every day.

#########

Topic to Be Determined

Dr. Lani Spund
Chief Technologist
Enterprise Systems Division
Apple Computer, Inc.

Dr. Spund is a Distinguished Engineer, Scientist, and Technologist (DEST) for Apple Computer, Inc. He is currently the Chief Technologist for Apple's Enterprise Systems Division (ESD) and formerly the Chief Technologist and Chief Architect for Apple's Information Systems and Technology (IS&T) Division. Dr. Spund is a seasoned veteran in systems engineering and management. He has 24 years of experience as both a line business manager and systems developer, and as a deployment director in manufacturing/distribution and financial service industries. Since the early 1970s, he has been successfully addressing sensitive multinational situations requiring business reengineering, systems integration, and information sharing. Today, Dr. Spund is recognized as an industry leader in the design of innovative and strategic business systems in client/server environments. Known as "the father of VITAL," Dr. Spund was influential in creating a Virtually Integrated Technical Architecture Lifecycle (VITAL) plan. VITAL is Apple's software engineering blueprint for creating platform independent enterprise systems that are human centered, database enabled using client/server techniques. It is composed of portable, reusable, message-based modules existing in a network of mixed hardware and software platforms. VITAL was created by individuals within Apple's own systems organization, under the leadership of Dr. Spund, to support the dynamic business growth at Apple. It has since been validated and adopted by many of Apple's large system customers. Dr. Spund's prior experience includes both direct business and systems management, including: Senior Vice President and founding member of Citicorp's "Corporate Technology Office"; Principal of a large "ACME" rated financial systems consultancy; MIS Director for Campbell Industries; Director of Manufacturing and Systems for Max Factor's West Coast Operations; and owner of an auto parts inventory software company that helped launch the Honda CIVIC automobile in the late 1960s. Today, he is working to evolve Apple Computer's own business systems and its client/server products into a logically integrated set of information services, which are designed to be available worldwide as an intuitive extension of the familiar Apple desktop interface.

Notes:

No Presentation Available

Notes:

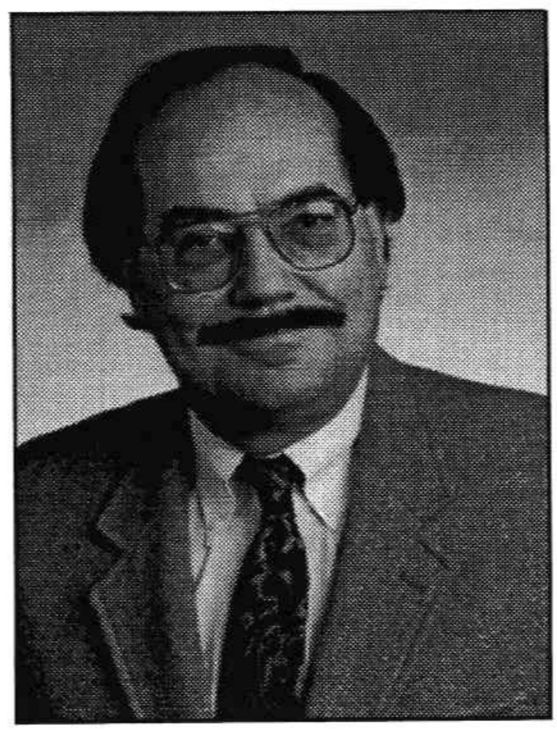
No Presentation Available

Notes:

Notes:

Introduction

Joseph Grenier
Vice President
Semiconductor Manufacturing and Applications Service
Dataquest Incorporated



Mr. Grenier is Vice President of Dataquest's Semiconductor Manufacturing and Applications group. He is responsible for managing the research activities of the Semiconductor Equipment, Manufacturing, and Materials service; the Semiconductor Application Markets service; and the Semiconductor Procurement service. In addition, he is responsible for promoting consulting activity and new product ideas for the Worldwide Semiconductor group. Prior to joining Dataquest, Mr. Grenier was Product Marketing Manager at GCA Corporation where he managed marketing activities for the reactive ion etch program. He was also International Marketing Manager at GCA and was responsible for the overseas marketing of wafer-processing equipment. Previously, he worked as a Product Manager at Varian Associates/Instrument Division, as a Systems Engineer at the USAF Satellite Test Center, and as a Test Engineer at General Motors' Noise Vibration Laboratory. Mr. Grenier received a B.S.E.E. degree from the University of Detroit and an M.B.A. degree from the University of Santa Clara.

Notes:

Notes:

Global Trends Seen From a European Perspective

Pasquale Pistorio
President and
Chief Executive Officer
SGS-Thomson Microelectronics

Mr. Pistorio has been President and Chief Executive Officer of SGS-Thomson Microelectronics since May 1987. The new Semiconductor Group was created in order to better meet the challenge of international competition by joining forces between SGS and Thomson Semiconducteurs. For the last 12 years, Mr. Pistorio has actively devoted himself to the role of spokesman for the semiconductor industry in order to make known the strategic importance of semiconductors, the worldwide stake, and, most of all, the danger of losing the battle within any macroeconomic system. His role has not been limited to a purely conceptual level, but, thanks to the support of the company's shareholders, has been translated into relevant industrial consequences, primarily the effective integration of Thomson Semiconducteurs and SGS Microelettronica, which has brought SGS-Thomson to a leading edge technological level and to revenue of more than U.S.$1.6 billion worldwide in 1992, 45 percent of which are outside Europe. Mr. Pistorio began his career selling Motorola transistors for a Turin agent and then moved to Milan to join an Italian distributor as Sales Manager for Motorola products. In 1967, he was hired as a salesman by Motorola and was appointed Regional Manager for Italy after 18 months in that position. In June 1970, Pistorio moved to Geneva as Motorola's Marketing Manager for Europe and five years later became Motorola's General Manager for Europe. In July 1977 he was appointed Director of World Marketing, based in Phoenix, Arizona, responsible for all marketing and sales activities, worldwide. At the same time he was elected Vice President of Motorola Corporation. In November 1978 he was appointed General Manager of the International Semiconductor Division of Motorola, still based in Phoenix and responsible for all design, manufacturing, and marketing activities for all of the world's regions outside the United States. In July 1980, he returned to Italy to become President and Chief Executive Officer of the SGS Group. Mr. Pistoria received an M.S. degree in Electrical Engineering from the Polytechnic of Turin in 1963.

Notes:

No Presentation Available

Notes:

Federal Technology Policy: A New Era

Lionel "Skip" Johns
Associate Director
Office of Science and Technology Policy
Executive Office of the President
Office of Technology Assessment (OTA)

Mr. Johns is the Associate Director designate for Technology, Office of Science and Technology Policy, Executive Office of the President. Mr. Johns previously served as Assistant Director of the Office of Technology Assessment (OTA) in Washington, D.C. Mr. Johns joined OTA in 1975 and was responsible for forming and managing the Energy Program. In 1978, he was named Assistant Director of the Energy, Materials, and International Security Division. Under his direction more than 100 assessments were submitted to Congress on such diverse issues as MX missile basing, effects of nuclear war, technology and Soviet energy availability, U.S. vulnerability to an oil import curtailment, and industrial and commercial cogeneration. Mr. Johns went to OTA with experience in the management of high-technology industries and corporate finance. He was a corporate finance representative of the investment banking firm, Alex Brown & Sons, and was Eastern Regional Manager and Director of Corporate Marketing for Oceans Science and Engineering, Inc. (OSE). Prior to joining OSE, Mr. Johns worked for five years as Project Engineer for Hazeltine and the Magnavox Company on projects involving the design, development, and production of radars, communications, sonar, and command and control equipment. Mr. Johns represented OTA at numerous meetings on arms control, energy, trade, and Third World Development in Asia, Europe, and Africa. Mr. Johns is a member of the Council on Foreign Relations. In 1985, Mr. Johns was elected as a Fellow of the American Association for the Advancement of Science. He served as a member of the Committee on Population, Resources, and the Environment and as Chairman of its subcommittee on technical change. Mr. Johns received a B.S. degree in Corporate Finance from the University of Virginia and served as an aviator in the United States Navy.

No Presentation Available

Notes:

No Presentation Available

Notes:

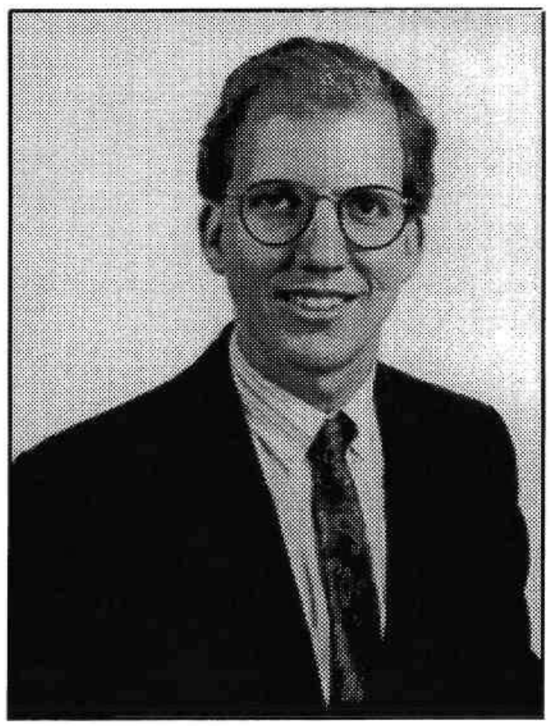
No Presentation Available

Notes:

Notes:

China: A Newcomer in Asia

Dan Heyler
Manager, Semiconductor Research
Dataquest Asia/Pacific



Mr. Heyler is the Senior Industry Analyst and Manager for Dataquest's Asia/Pacific Semiconductors group. Mr. Heyler is responsible for the market/industry coverage and electronics equipment research with regional focus on Taiwan, Hong Kong, Singapore, China, Malaysia, Thailand, and the Rest of Asia region. Mr. Heyler has more than seven years of related industry experience. As part of Dataquest Asia operations, based in the Dataquest Taipei office, Mr. Heyler is responsible for managing the Semiconductors Asia service. Prior to relocating to Dataquest Taiwan, Mr. Heyler worked for three years as an Analyst at Dataquest World Headquarters in San Jose, California, where he helped initiate and expand Dataquest's earliest research and service activities in Asia/Pacific. Before joining Dataquest, Mr. Heyler worked for the U.S. Department of State, where he was assigned to conduct macroeconomic research and analysis while employed by the American Institute in Taiwan and previously by the U.S. Embassy in Beijing. Mr. Heyler graduated from Bowdoin College with honors in Asian Studies and has completed advanced coursework in International Business and Management at the University of California, Berkeley, in addition to related field work at Beijing University and Tunghai University in Taichung, R.O.C. He is fluent in spoken and written Mandarin Chinese.

China: A Newcomer in Asia/Pacific

Dan Heyler
Manager and Senior Industry Analyst
Semiconductors Asia/Pacific

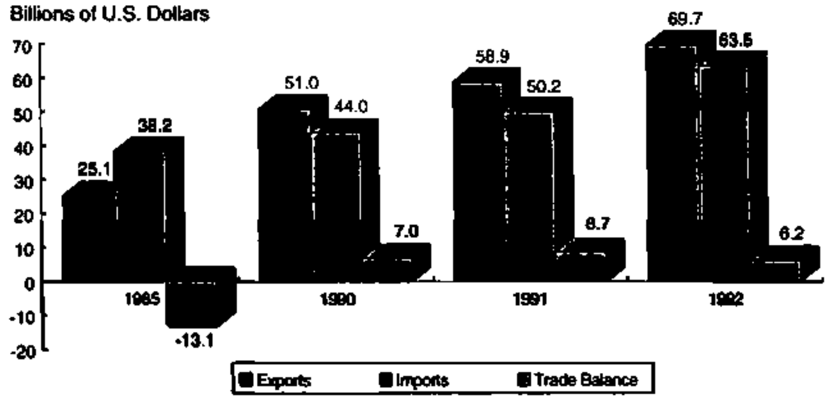
Dataquest

Agenda

- **China's economic prospects**
- Electronics equipment forecast
- Semiconductor demand
- Semiconductor manufacturing capabilities
- Dataquest conclusions

Dataquest

China's Worldwide Trade Performance from 1985 to 1992



Source: Official customs statistics, Dataquest

Dataquest®

Notes:

China's Economic Performance and Outlook

	1991	1992	1993*	1994*
Real GNP (billions of RMB)	2,693	3,250	3,695	4,117
— Annual growth rate (%)	7.0	11.5	13.7	11.4
Inflation (consumer price) (%)	3.4	5.4	8.5	8.1
Industrial output (billions of RMB)	2,693	3,250	3,705	4,076
— Annual growth rate (%)	12.9	20.7	14.0	10.0
Agricultural output	758	786	808	829
— Annual growth rate (%)	3.0	3.7	2.8	2.5
Trade balance (billions of RMB)	8.7	6.2	5.8	NA
Current account balance (billions of RMB)	13.8	10.9	10.3	8.3
Exchange rate (RMB/U.S.$1)	5.33	5.51	5.77	NA

* = Forecast
NA = Not applicable

Conclusion: Industrial output 5x agricultural output and growing

Dataquest® G3005749 Source: Dataquest

33527.4

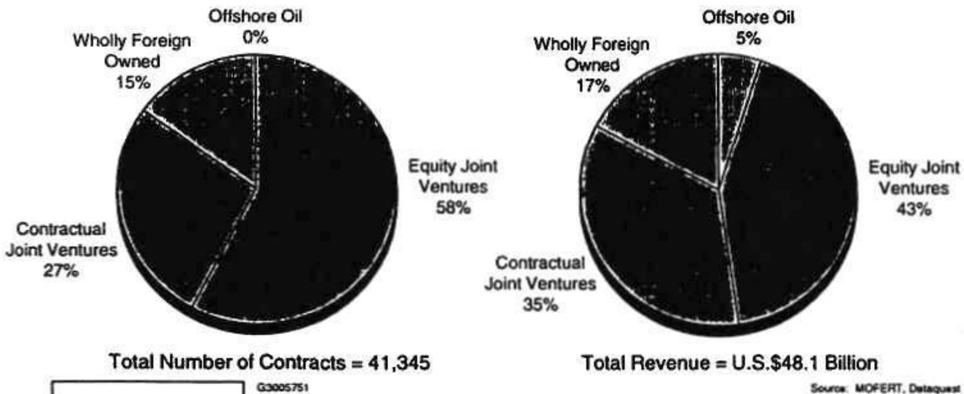
Where Have Investments Been Made?

	1990 (%)	Total 1983-1990 (%)
Guangdong	37	20
Liaoning	13	5
Fujian	8	3
Beijing	7	2
Shanghai	6	2
Jiangsu	5	2
Shandong	4	2
Rest of China	21	63
Total (billions of U.S. dollars)	10	40

Dataquest® G3005750 Source: Dataquest

Total Foreign Investment by Type from 1979 to 1991

Number of Contracts and Dollars Committed



Dataquest®

33527.6

Notes:

The Progress of China's Economic Reforms

Sector	Time Frame	Comments
Agriculture	1980 to 1985	Very successful
Industry/manufacturing	1986 to present	Moderately successful
Financial: banking and taxes	1993 to 1995	Critical to all sectors

Dataquest

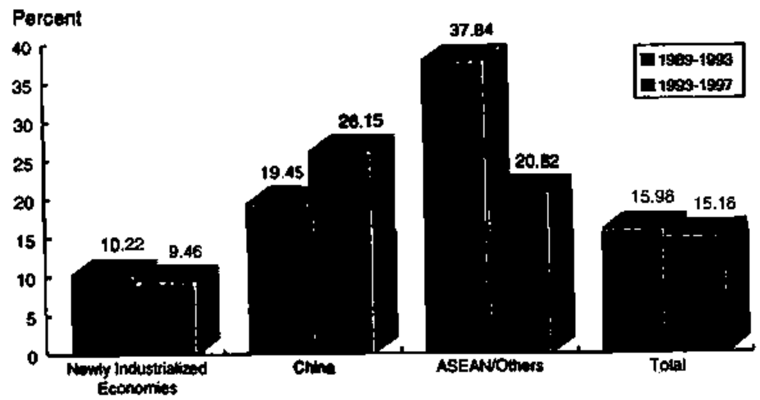
Source: Dataquest

Agenda

- China's economic prospects
- **Electronics equipment forecast**
- Semiconductor demand
- Semiconductor manufacturing capabilities
- Dataquest conclusions

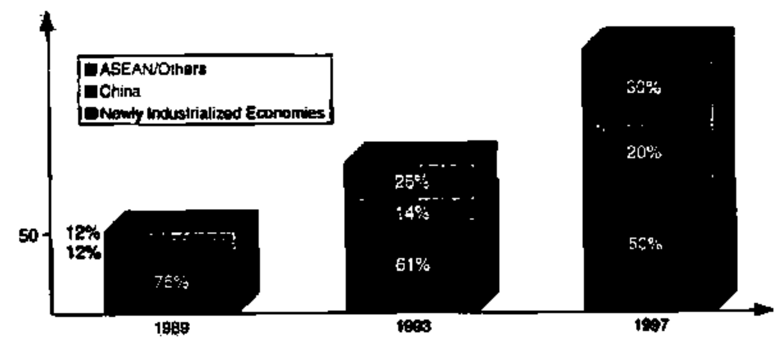
Dataquest

Asia/Pacific Electronic Equipment Production
Five-Year Compound Annual Growth Rates by Region



Notes:

1989 to 1997 Electronics Equipment Production



Dataquest

Source: Dataquest

33527.10

Ten Major Chinese Electronics Equipment Companies

Company Name	Main Products
China Electronics Corporation	Color TVs, computers, communications, components
China Zhenhua Electronics Industry Corporation	Color TVs, radios, broadcast
China Great Wall Computers	PCs, workstations, display cards, printers, CAD software
Changjiang Computer Union Group	PCs, mainframes, workstations, peripherals, chipsets
Zhongshan Group	Communications, peripherals, military, aerospace
Shenzhen Electronics Group (SEG)	Picture tubes, instruments, appliances, electronic games
China Magnetic Recording Equipment Company	PCs, floppy disk drives, communications, appliance parts
Rainbow Group	Color picture tubes
Huanghe Electronics Enterprises	Military, TVs, refrigerators
China Hongguang Electronics Enterprises	TVs, microwave components, audio, instrumentation

Dataquest

G3005756

Source: Dataquest

33527.11

Agenda

- China's economic prospects
- Electronics equipment forecast
- **Semiconductor demand**
- Semiconductor manufacturing capabilities
- Dataquest conclusions

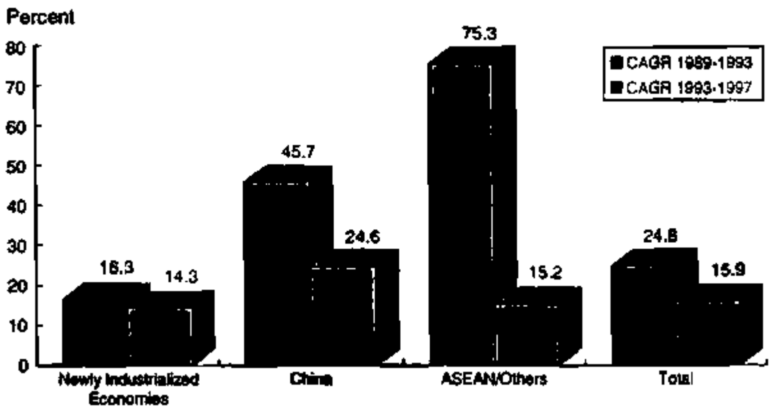
Dataquest®

G3005757

33687.12

Notes:

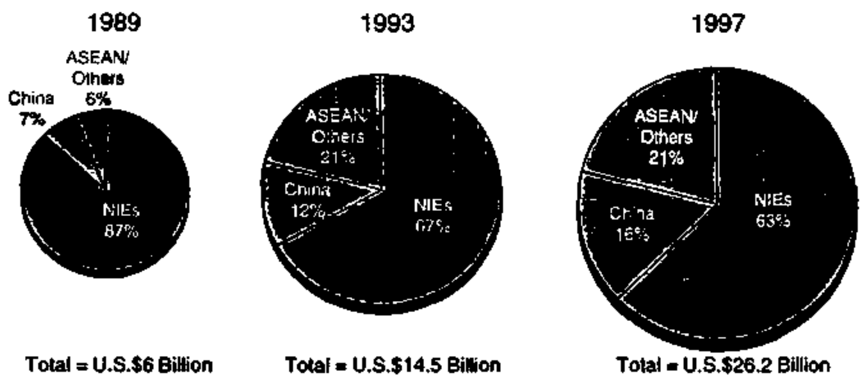
Asia/Pacific Semiconductor Consumption Five-Year Compound Annual Growth Rates by Region



Dataquest

Source: Dataquest

1989 to 1997 Asia/Pacific Semiconductor Consumption by Region



NIEs = Newly industrialized economies

Dataquest

Source: Dataquest

Agenda

- China's economic prospects
- Electronics equipment forecast
- Semiconductor demand
- **Semiconductor manufacturing capabilities**
- Dataquest conclusions

Dataquest

Notes:

Semiconductor Manufacturing Centers in China (Number of Fab Lines and Strengths)

Areas	Fab Lines	Strengths
Beijing	20	University, research, government
Shanghai	19	University, research, industry
Wuxi/Nanjing	9	Close to Shanghai, industrial center
Tianjin	7	Port city, close to Beijing
Northeast	6	Microcomponents
Guangzhou	5	Guangzhou market
Hong Kong	4	Port city, Guangzhou market
Xian	3	Central China, central Asian market
Total	73	

Dataquest

G3005761

Source: Dataquest

33527.16

Agenda

- China's economic prospects
- Electronics equipment forecast
- Semiconductor demand
- Semiconductor manufacturing capabilities
- **Dataquest conclusions**

Dataquest

G3005762

33527.17

Ongoing Contentious Issues between the United States and the PRC

- Human rights reports
- China's missile and nuclear technology sales
- Trade surplus, market access, MFN
- Hong Kong's future
- Intellectual property rights

Dataquest®

Source: Dataquest

33527.18

Notes:

The Progress of China's Economic Reforms

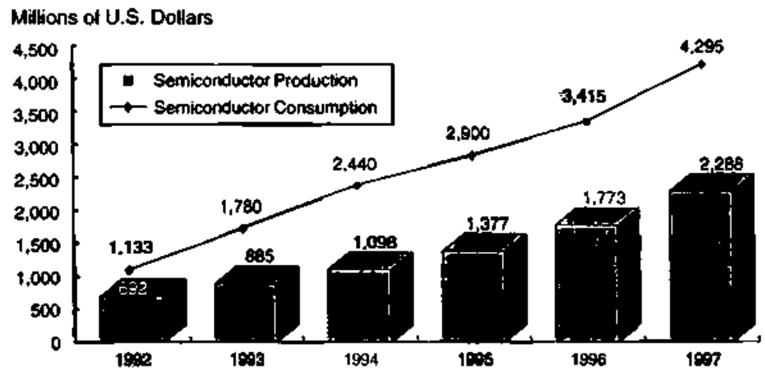
Sector	Time Frame	Comments
Agriculture	1980 to 1985	Very successful
Industry/manufacturing	1986 to present	Moderately successful
Financial: banking and taxes	1993 to 1995	Critical to all sectors

Dataquest

G3005764

Source: Dataquest

China's Semiconductor Production and Consumption Comparison Forecast



Dataquest

G3005765

Source: Dataquest

Key Economic Hurdles

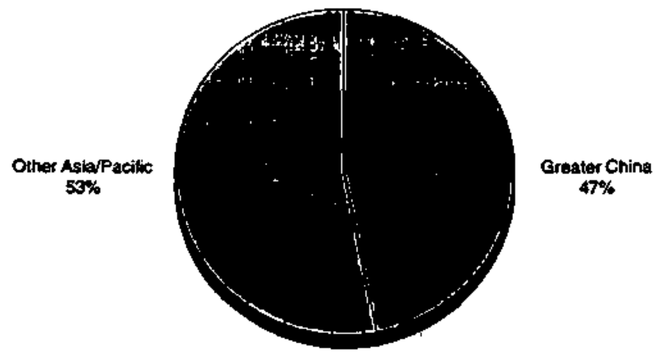
Tactical Concerns	Long-Term Issues
Inflation	Deng Xiao Ping's successor
Infrastructure	Corruption
Reforms	MFN, trade issues
	Increasing power of provinces

Dataquest

Source: Dataquest

Notes:

1993 Asia/Pacific Semiconductor Consumption (Percentage Share)

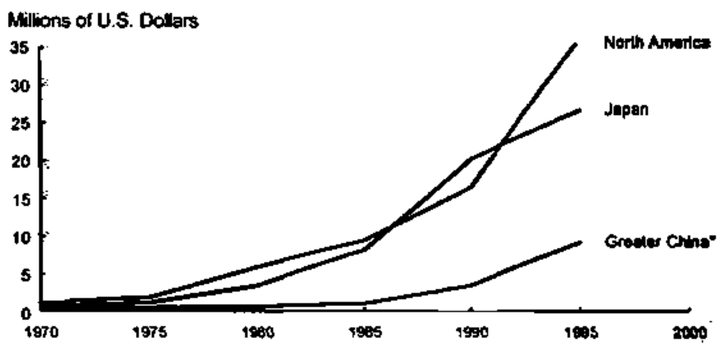


Total Revenue = U.S.$14.5 Billion

Source: Dataquest

Dataquest®

Worldwide Semiconductor Consumption



* China, Hong Kong, and Taiwan

Source: Dataquest

Dataquest®

Dataquest Conclusions

- The economy is fundamentally strong
- The equipment market is driving domestic manufacturing and regional integration – 1993-1997 CAGR of 26%
- Semiconductor demand will take off – forecast CAGR of 14%
- Reforms and government investment will advance semiconductor manufacturing, investing U.S.$2 billion for a $600 million industry
- Understand and prepare for the new Asian order driven by the emergence of China

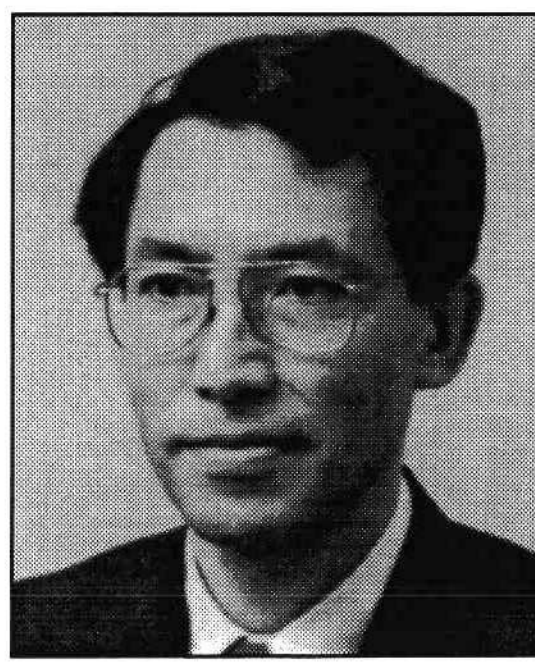
Dataquest®

Notes:

Computer Market Trends in Japan

Junichi Saeki
Director
Computer and Peripheral Research
Dataquest Japan

Mr. Saeki is Director of the Information Systems Group at Dataquest Japan. He is responsible for supervising all research and analysis performed by the Japan Information Systems Group and also for his specialty areas of technical computers and superperformance computing, particularly in the Japanese computer market. Before joining Dataquest, Mr. Saeki was Manager of the Computer System Section at Schlumberger K.K. in Japan, where he was responsible for developing scientific computer systems and international computer networks. Prior to joining Schlumberger, Mr. Saeki was an Assistant Professor at Numazu College of Technology for 10 years, where he studied numerical computational methods for mathematical problems, applied mathematics, and computer science. Mr. Saeki received a B.S. degree from the Nagoya Institute of Technology and an M.S. degree from the Engineering Division of Nagoya University.



Computer Market Trends in Japan

Junichi Saeki

Director
Japan Information Systems Group

Dataquest

G3005783

Agenda

- Overview of the Japanese computer market
- Personal computers and workstations
- Large computers
- Networking and communication
- Software
- Culture and management style: changing?
- Conclusions

Dataquest

G3005784

Overview of the Japanese Market

- Economic situation is pessimistic
  - Consumer: lower activities, cars, and home electronics
  - Manufacturer: lower spending for capital investment
  - Exchange rate: too fast, enough to hurt industry
  - Overseas production and fear for unemployment
- Political situation is changing
  - Power change: shifting to young generation
  - Practical government: expected

Dataquest

G3005785

Notes:

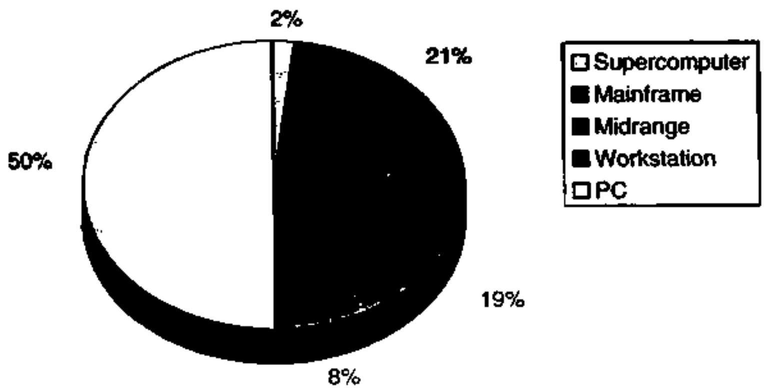
Overview of the Japanese Market

- Financial system
  - Deregulation
  - Improper loans
  - Lower interest rates: discouraging pensioners
- Official corruption: construction industries

Dataquest G3005786

Worldwide and Japan: Comparison

Worldwide Computer Market Revenue Share



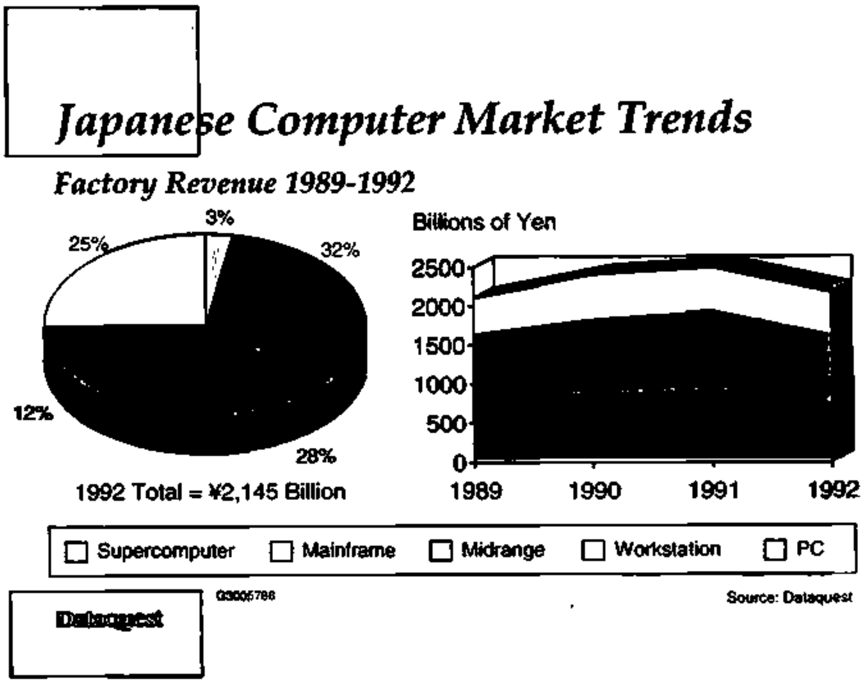
Total = $113 Billion

Source: Dataquest

Dataquest G3005787

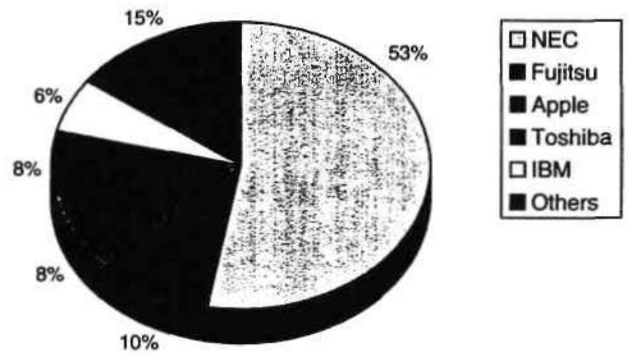
Japanese Computer Market Trends

Factory Revenue 1989-1992



Notes:

Personal Computers



Total = ¥552 Billion; 2.23 Million Units

Dataquest

G3005789

Source: Dataquest

Personal Computers

- Dominated by NEC: more than 50 percent
- Apple: getting share from DOS market
- Drastic price cuts triggered by Compaq
- Windows 3.1: just introduced
- "Japanization" is preventing penetration
  - Application
  - Performance
  - Font: artistic output for printer

Dataquest

G3005790

Personal Computers: Low Penetration? Yes

佐伯
sa eki

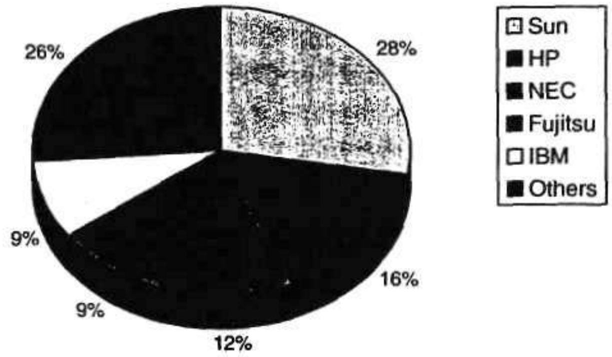
- Nonkeyboard culture
- Kanji characters: more than 2,000 in everyday use
- Pricing: too expensive to get productivity
- Software is not as sophisticated as "Wa-a-puro"
- Large computers could not provide connectivity
- Education and computer literacy
- LAN and printer

G3005791

Dataquest

Notes:

Workstations: Japanese Vendors Are Struggling



Total = ¥243 Billion; 125,000 Units

Source: Dataquest

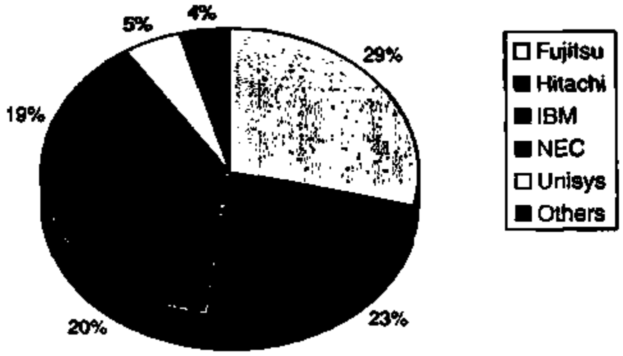
Dataquest G3005792

Workstations

- Only segment dominated by the U.S. vendors
- Technical-oriented application
- "Japanization" is behind the PC
- 19-inch CRT monitor for workstation is too large for the office
- Vendor issues: cannot catch up with fast-moving technology
  - Microprocessor
  - Operating system
  - Network, graphics, and applications

Dataquest G3005793

Large Computers: Mainframes



Total = ¥681 Billion

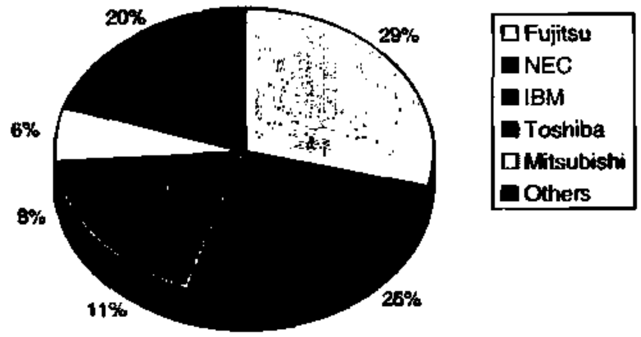
Source: Dataquest

03005794

Dataquest

Notes:

Large Computers: Midrange
(Office Computers and Minicomputers)



Total = ¥613 Billion

Source: Dataquest

Dataquest G3005795

Networking

- Low penetration
  - Only 7 percent of PCs have NIC
  - E-mail is not used as a business tool
  - Associated with host-dependent systems
- Lack of computer network staff and experience
- Proprietary systems prevent networking
- Very strong interest backed by new computing style

Dataquest G3005796

Software: Culture-Dependent Software Is Free?

- Developing large and sophisticated systems for manufacturing
- Software blue-collar worker? Hierarchy of software vendors
- More focused on improvement
  - "Japanization"
  - Tuning: compiler and language
  - Real-time process control and embedded system
- Game software

Dataquest

Notes:

Management and Culture: Changing?

- Fond of stable organization and income
- Face-to-face communication is the best way for business
- Doing the same thing as the neighborhood is the safe way
    - "Pyramid structure" allowed everywhere
    - Mainframe computer was the ideal tool to support them
- Economical, political changes result in a new way of business
- Individual power supported by computers may accelerate

Dataquest

G3005790

Conclusions
Slow Growth and Rebound

- Bad economy may accelerate the computer revolution
- Individuals will be more independent from organizations
- Personal computers will support those shifts
- Japanese computer vendors will rely on more U.S. technology
- "Japanization" and its implementation is forever

More business opportunities for foreign companies, and cooperation with Japanese organizations

Dataquest

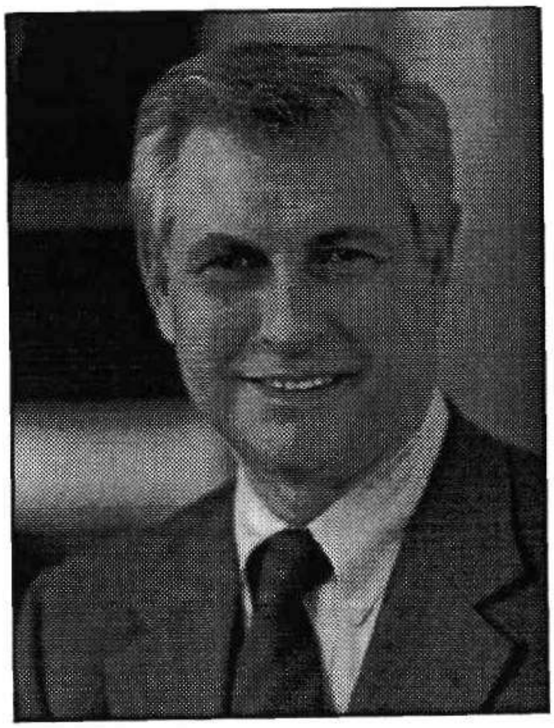
G3005789

Notes:

Cooperation and Competition in Converging Markets

William P. Weber
Executive Vice President
Texas Instruments, Inc.

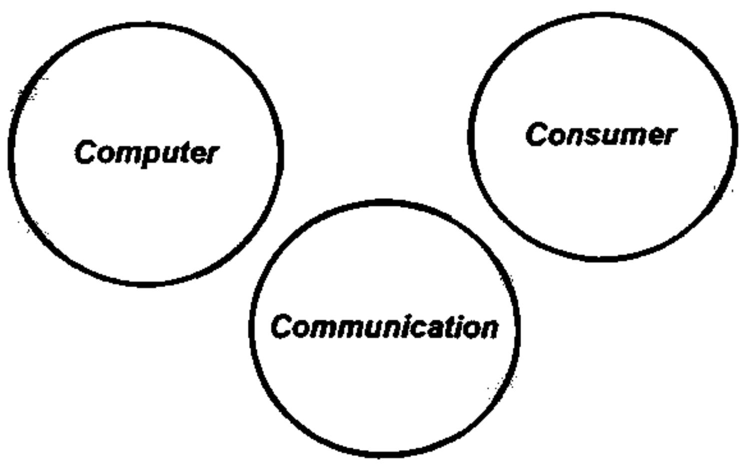
As TI Executive Vice President and President of the company's Components Sector, Mr. Weber is responsible for managing TI's semiconductor, materials, controls, and consumer businesses, in addition to semiconductor research and development and TI International operations. He has been a member of TI's Board of Directors since 1984. Since joining TI in 1962, he has held a number of positions in TI's defense electronics, digital systems, and semiconductor businesses, as well as corporate assignments.
Mr. Weber serves on the Board of Directors of the Semiconductor Industry Association and the University of Texas at Dallas Development Board. He is also a member of the U.S.-Philippine Business Council.
Mr. Weber holds a B.S. degree in Engineering from Lamar University and an M.S. degree in Engineering from Southern Methodist University.



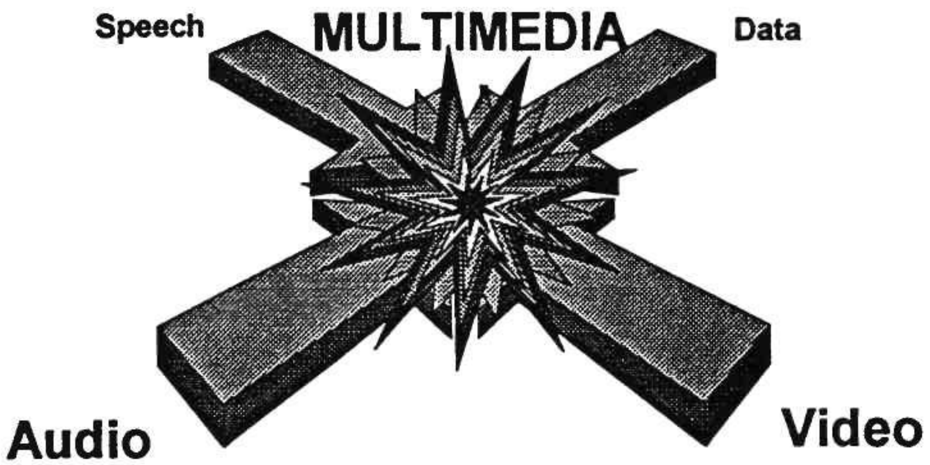
Cooperation and Competition in Converging Markets

Pat Weber
Executive Vice President
President, Components Sector
Texas Instruments

THE PEACEFUL COEXISTENCE OF INDEPENDENT MARKETS IS OVER

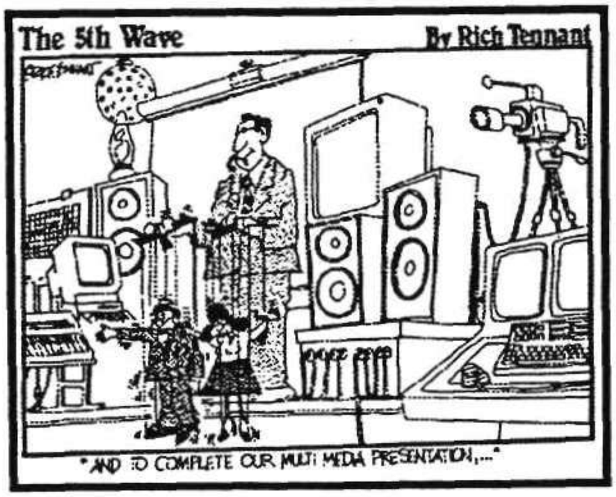


MULTIMEDIA MANIA MERGES MARKETS

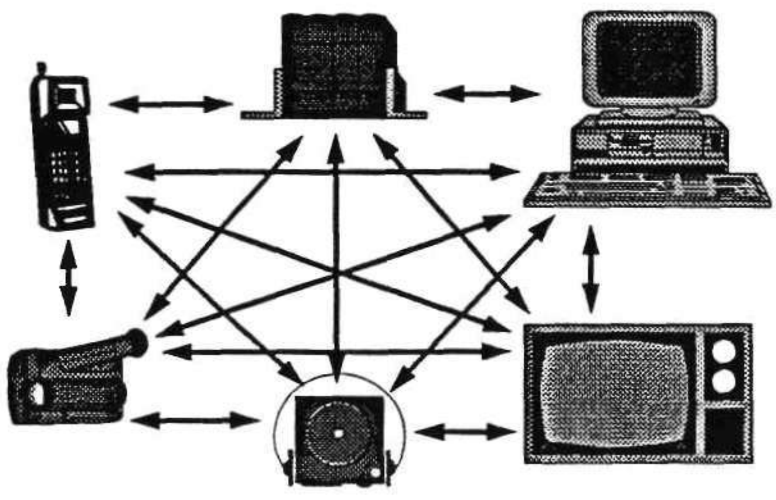


Notes:

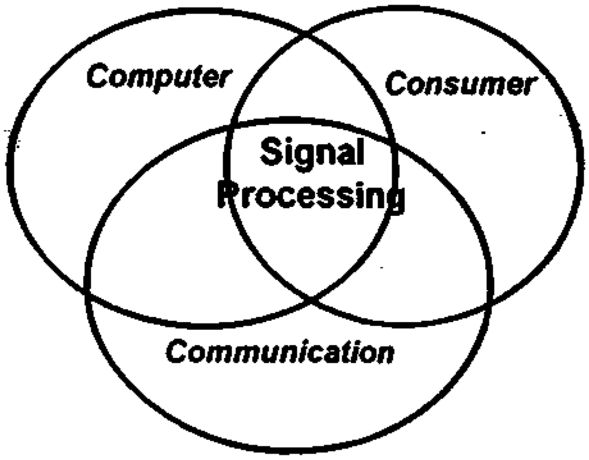
THE POWER OF MULTIMEDIA *IS NOT* CREATING A PRODUCT THAT DOES EVERYTHING



THE POWER OF MULTIMEDIA *IS* SEAMLESS INFORMATION EXCHANGE BETWEEN DIVERSE PRODUCTS

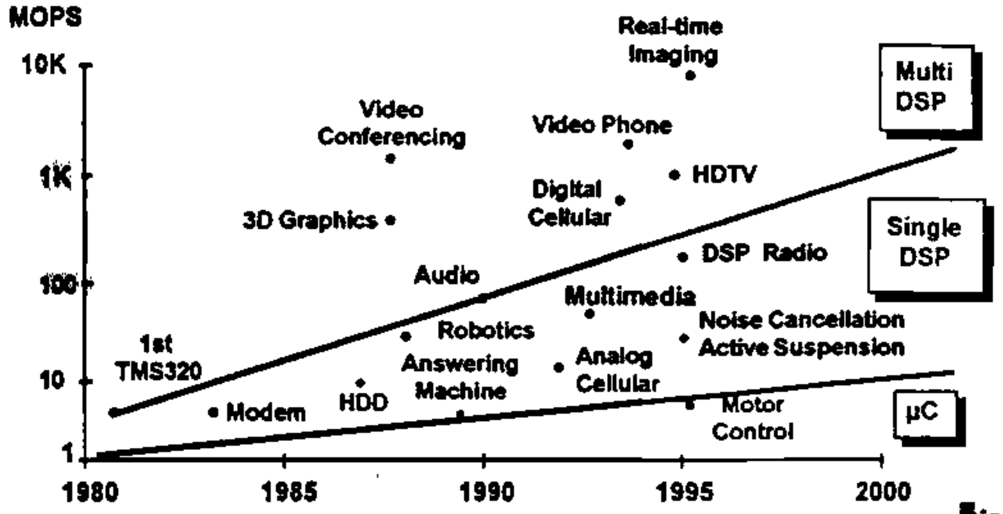


THE DRIVING TECHNOLOGY FOR CONVERGING MARKETS IS SIGNAL PROCESSING



Notes:

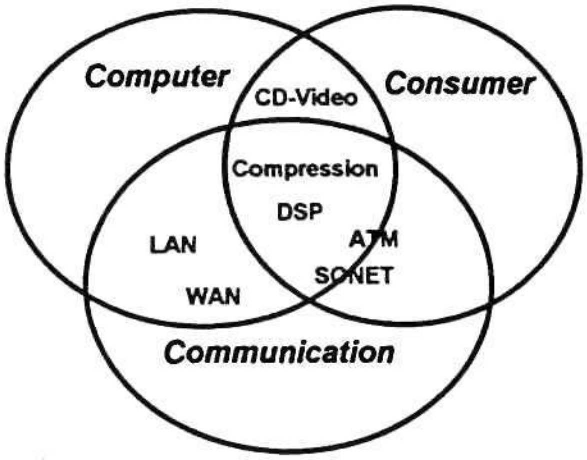
SEMICONDUCTOR MARKET DRIVER OF THE 1990s - DSP



SILICON SOLUTIONS NEEDED FOR MULTIMEDIA

- High performance, cost effective compression products
- High-speed voice, data, and video "Multimedia Transport"
- Cost-effective integration of processor, system logic, memory, analog and power maintenance functions
- Digital signal processing is required for:
  - Wireless telecommunication
  - Speech and handwriting recognition

MARKET CONVERGENCE INCREASES TECHNOLOGY COMMONALITY



Notes:

MARKET DYNAMICS REQUIRE A DIFFERENT SEMICONDUCTOR COMPANY

1970s	Logic-level Integration	SSI/MSI
1980s	Function-level Integration	Microprocessors
1990s	System-level Integration	Single-chip Systems

- Design Environments
  - CAD Tools
  - ASIC Libraries
  - Global Applications Support
- Submicron CMOS / BiCMOS
  - Memory
  - Logic
  - Analog
- Core Functions
  - Memory Compilers
  - Microprocessors (DSP, 80x86, SPARC™, etc.)
- Capacity for Sole-Source Products
  - Global Deployment
  - Flexibility
  - Future Growth Plan

ALIGNING TI STRATEGY WITH MARKET NEEDS

1980s	Today
Commodity Products	Differentiated Value-added Products
Self-funded Capital Investment	Shared Third-party Capital Investments
Traditional Supplier / Customer Relationships	Virtual Integration with Customers

MODELS OF COOPERATION

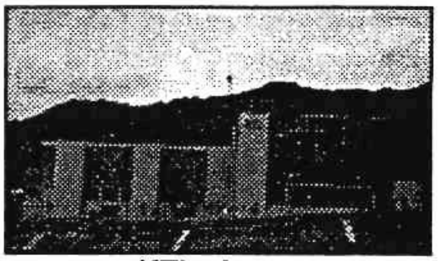
- Lower Cost of Capital
- Risk Reduction
- Access to Assets
  - Customer Base
  - Technology / Patents
  - Copyrighted Information
- Virtual Integration

Notes:

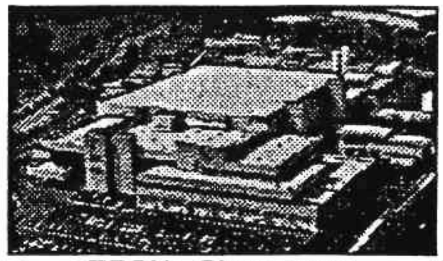
SHARED INVESTMENT WAFER FABS

Avezzano - Italy

TI-ACER - Taiwan



KTI - Japan



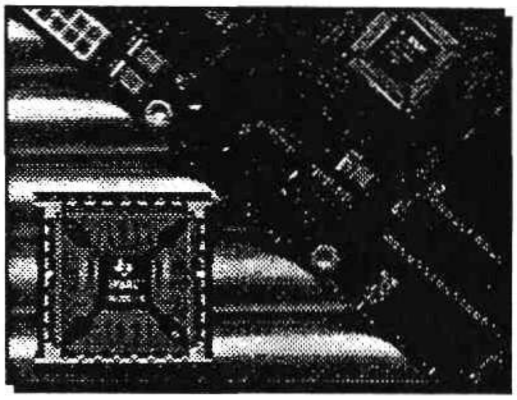
TECH - Singapore

COOPERATION TO REDUCE RISK

- Hitachi and TI
  - R&D cooperation with a competitor
  - Also a good customer
- Joint wafer fabs
  - Shared investment and risk
  - Guaranteed source and price

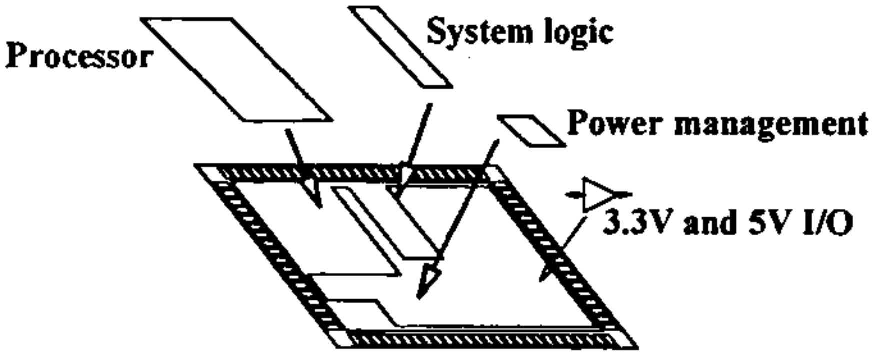
ACCESS TO ASSETS

- TI and Sun
  - SPARC™ RISC architecture
- TI and Cyrix
  - x86 CISC architecture
- TI and ARM™
  - Low cost microprocessor architecture



Notes:

MIXED SIGNAL INTEGRATION USING ASIC TECHNOLOGY

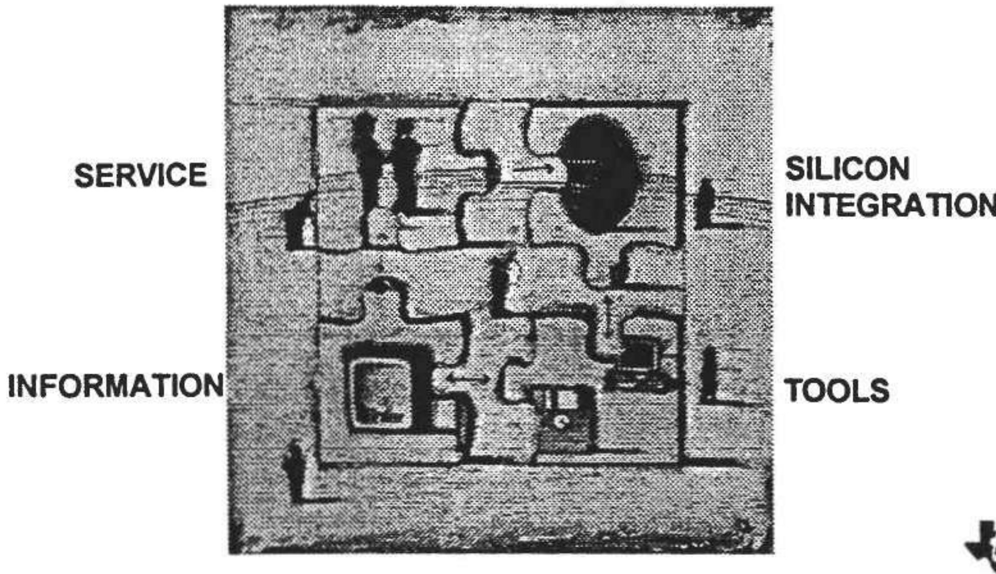


Customer chooses processor as well as custom features

VIRTUAL INTEGRATION MAXIMIZES THE VALUE OF CORE COMPETENCIES

- Integration with customers
  - Reduces total time to market
  - Increases ability to focus silicon solutions on real-world problems
- Integration with suppliers
  - Improves reliability and functionality of tools
  - Raises quality of end product

TOTAL INTEGRATION



Notes:

SUMMARY

- Multimedia is more than microprocessors
  - Signal Processing ➡ digital data compression
  - Telecommunication ➡ multimedia transport
  - Mixed-signal integration ➡ required for man-machine interface
- Cooperation is vital to success
  - Expands access to markets, technologies and customers
  - Virtual Integration serves as the model

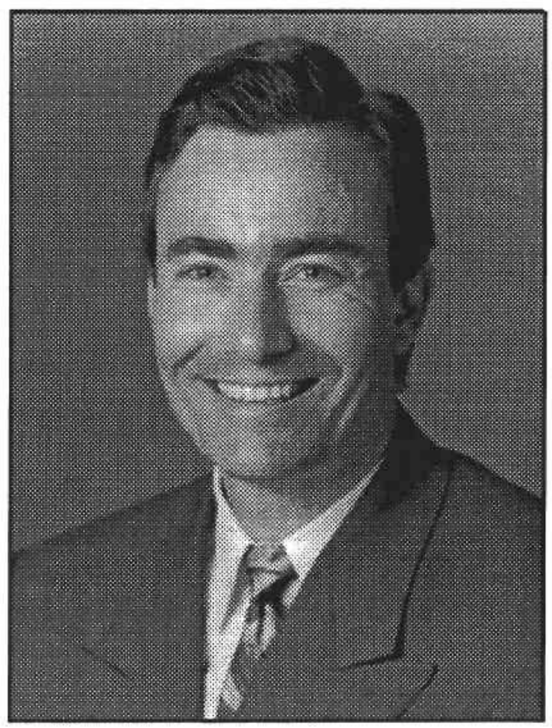
Notes:

Notes:

The Multimedia Decade

Trip Hawkins
President and
Chief Executive Officer
The 3DO Company

Mr. Hawkins is President and Chief Executive Officer of The 3DO Company, a pioneering multimedia venture that is establishing a new standard for interactive multimedia in consumer electronics. 3DO was formed in October 1991 and has forged strategic partnerships with a variety of industry leaders including Matsushita, AT&T, Time Warner, MCA, Electronic Arts, and the venture capital firm, Kleiner Perkins Caufield & Byers. Mr. Hawkins is also Chairman of Electronic Arts, which he founded in 1982. Despite entering a tumultuous marketplace with 135 competitors, Electronic Arts rose in only four years to become the largest supplier of computer entertainment software in the world and has achieved a consistency in profits and growth that is unrivaled in the industry. Mr. Hawkins' vision has been the driving force behind the company's successful growth strategy and unique organization. Prior to starting Electronic Arts, Mr. Hawkins was one of the early managers at Apple Computer where, over a period of four years, he provided leadership for Apple's successful entry into the business market. Mr. Hawkins holds a degree in strategy and applied game theory from Harvard College and an M.B.A. from Stanford University.



Notes:

No Presentation Available

Notes:

No Presentation Available

Notes:

Notes:

Dataquest®

PANEL DISCUSSION:
"The Future of Computing"

MODERATOR:
Kenneth A. Lowe
Principal Analyst, Semiconductor
Microcomponents Service
Dataquest Incorporated

PANELISTS:
Thomas A. Beaver
Corporate Vice President
and Director, PowerPC Programs
Motorola

Karen Hargrove
Senior General Manager
Digital Office Systems
Microsoft Corporation

J. Gerry Purdy
Vice President and Chief Analyst
Mobile Computing
Computer Systems and
Peripherals Group
Dataquest Incorporated

Brad Smith
Vice President
Worldwide Computer Systems
and Peripherals Group
Dataquest Incorporated

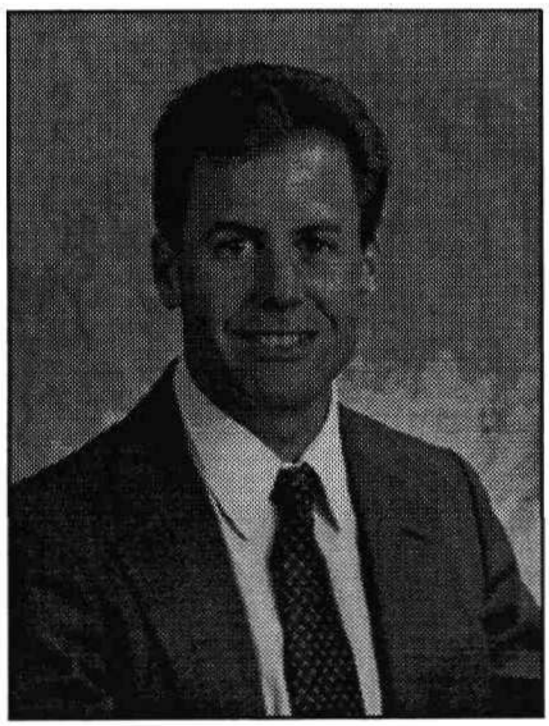
Dr. Lani Spund
Chief Technologist
Enterprise Systems Division
Apple Computer, Inc.

David L. House
Senior Vice President
Intel Corporation

PANEL DISCUSSION:
The Future of Computing

Kenneth A. Lowe
Principal Analyst
Semiconductor
Microcomponents Service
Dataquest Incorporated

Mr. Lowe is Principal Analyst for Dataquest's Microcomponents service in the Semiconductors group. He is responsible for research, analysis, and forecasting of microprocessors and microperipherals, including controllers for graphics, networks, and storage. Previously, he was Dataquest's Senior Industry Analyst for graphics processors. Prior to joining Dataquest, Mr. Lowe was President of Performix Technology, a start-up company that developed and marketed Windows graphics accelerator boards for PCs. Mr. Lowe has more than 12 years of experience in the electronics industry, having served in marketing management positions at Sigma Designs Inc., Wyse Technology Inc., Personal CAD Systems Inc., and the Design & Test Systems Division of Gould Inc. He also served as a hardware design engineer for microcomputer-based test systems at Watkins-Johnson Company. Mr. Lowe received a B.S. degree in Electronic Engineering from California Polytechnic State University.



Notes:

PANEL DISCUSSION: The Future of Computing

Thomas A. Beaver
Corporate Vice President
and Director, PowerPC Programs
Motorola

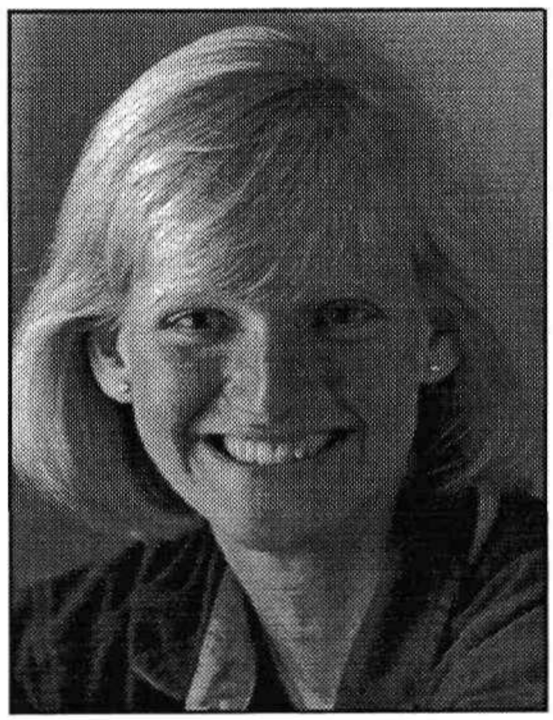
Mr. Beaver is Corporate Vice President and Director of the PowerPC programs of the Semiconductor Products Sector of Motorola. He is responsible for marketing and sales of Motorola's Computer/Workstation segment. Mr. Beaver began his 27-year career with Motorola as an engineering intern while attending Marquette University. Upon graduation, he officially joined the corporation and has continued to play a key role in a variety of positions including General Manager of the Computer Group; Materials Manager of the Semiconductor Products Division; Manager of Industrial Marketing; Manager of Automotive, Intra-Company, and Canadian Sales; Manager of Systems Sales and Engineering; and Vice President and Director of Systems Sales and Engineering. Mr. Beaver received his B.S.E.E. and B.S.B.A. degrees from Marquette University and holds an M.B.A. degree from the University of Minnesota.

Notes:

PANEL DISCUSSION: The Future of Computing

Karen Hargrove
Senior General Manager
Digital Office Systems
Microsoft Corporation

Ms. Hargrove is Senior General Manager of the Digital Office Systems Group at Microsoft Corporation, responsible for all systems software found in workplace products including telephones, FAX machines, copiers, hand-held systems, and printers; and for connecting these systems to personal computers running Microsoft Windows. The charter of the Digital Office Systems Group is to integrate all of the devices and systems in the workplace with each other, with the personal computer, and with networks to make communication easier for end users. Work in this area was first started in the Advanced Technology and Development Group, where Ms. Hargrove has been since she first joined Microsoft. Prior to joining Microsoft, Ms. Hargrove was a member of the Digital Equipment Corporation West (DEC West) Engineering team, which focused on advanced hardware design and software platforms.

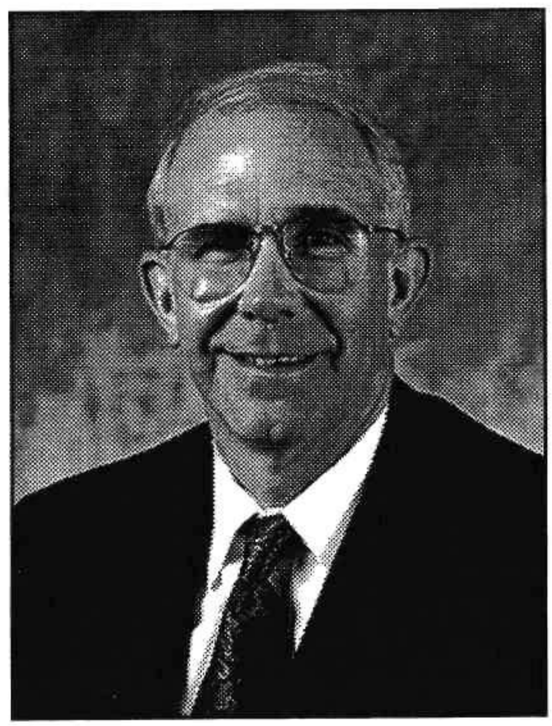


Notes:

PANEL DISCUSSION: The Future of Computing

J. Gerry Purdy
Vice President and Chief Analyst
Mobile Computing
Computer Systems and
Peripherals Group
Dataquest Incorporated

Dr. Purdy is Vice President and Chief Analyst of Mobile Computing in the Computer Systems and Peripherals group at Dataquest. He is responsible for in-depth analysis, evaluation, forecasting, and research of mobile computing hardware and software products and peripherals. Mobile computing is the intersection of portable computing with landline and wireless data communications, information-oriented consumer electronics, and storage as they relate to people who are mobile and, yet, need information whether it is local in a portable computer or personal digital assistant (PDA) or remote via e-mail or database inquiry. He is also responsible for consulting that focuses on product strategy for mobile computing systems. Dr. Purdy has more than 25 years of experience in the computer industry, with the last 7 years involved in portable computing. His career includes past positions with Connecting Point (Intelligent Electronics), Compaq Computer Corp., Fujitsu Personal Systems (Poqet), and Phoenix Technologies. He has consulted with many leading manufacturers on the design and development of hardware, software, and storage for portable computing. Dr. Purdy earned a B.S. degree in Engineering Physics from the University of Tennessee, an M.S. degree in Computer Science from UCLA, and a Ph.D. from Stanford University in Computer Science and Exercise Physiology.

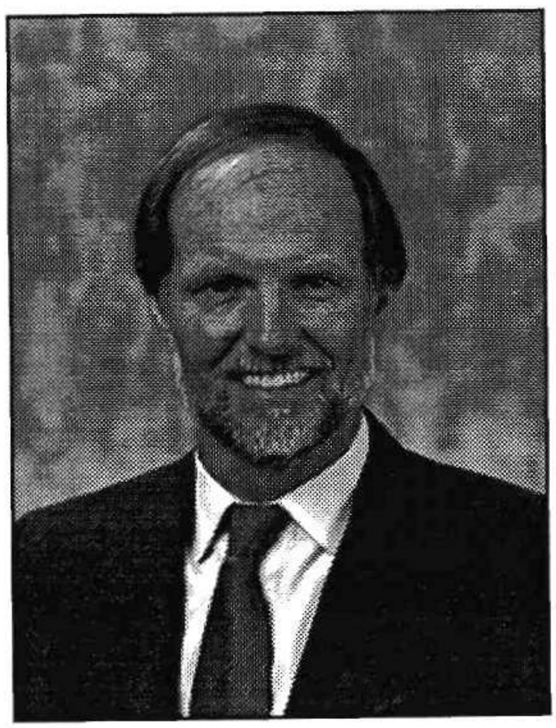


Notes:

PANEL DISCUSSION:
The Future of Computing

Brad Smith
Vice President
Worldwide Computer Systems and Peripherals Group
Dataquest Incorporated

Mr. Smith is Vice President of the Worldwide Computer Systems and Peripherals group at Dataquest. Mr. Smith is responsible for the systems and peripherals product line worldwide. As the Chief Analyst in Personal Computers, Mr. Smith is responsible for in-depth analysis, evaluations, forecasting, and research of personal computer products, markets, applications, and industries. Mr. Smith has 20 years of experience in the computer industry, with the last four years in the PC and microprocessor industry as Director of Product Marketing at NexGen Microsystems, a Silicon Valley start-up company building a Pentium-class PC and microprocessor. Prior to NexGen Microsystems, Mr. Smith spent six years in market research at Dataquest and created the Technical Computer Systems Service and the Technical Workstation Service. His career also includes positions in marketing at Prime Computer and Digital Equipment Corporation. Mr. Smith holds a B.S. degree in Electrical Engineering from the University of Massachusetts.



Notes:

PANEL DISCUSSION: The Future of Computing

Dr. Lani Spund
Chief Technologist
Enterprise Systems Division
Apple Computer, Inc.

Dr. Spund is a Distinguished Engineer, Scientist, and Technologist (DEST) for Apple Computer, Inc. He is currently the Chief Technologist for Apple's Enterprise Systems Division (ESD) and formerly the Chief Technologist and Chief Architect for Apple's Information Systems and Technology (IS&T) Division. Dr. Spund is a seasoned veteran in systems engineering and management. He has 24 years of experience as both a line business manager and systems developer, and as a deployment director in manufacturing/distribution and financial service industries. Since the early 1970s, he has been successfully addressing sensitive multinational situations requiring business reengineering, systems integration, and information sharing. Today, Dr. Spund is recognized as an industry leader in the design of innovative and strategic business systems in client/server environments. Known as "the father of VITAL," Dr. Spund was influential in creating a Virtually Integrated Technical Architecture Lifecycle (VITAL) plan. VITAL is Apple's software engineering blueprint for creating platform independent enterprise systems that are human centered, database enabled using client/server techniques. It is composed of portable, reusable, message-based modules existing in a network of mixed hardware and software platforms. VITAL was created by individuals within Apple's own systems organization, under the leadership of Dr. Spund, to support the dynamic business growth at Apple. It has since been validated and adopted by many of Apple's large system customers. Dr. Spund's prior experience includes both direct business and systems management, including: Senior Vice President and founding member of Citicorp's "Corporate Technology Office"; Principal of a large "ACME" rated financial systems consultancy; MIS Director for Campbell Industries; Director of Manufacturing and Systems for Max Factor's West Coast Operations; and owner of an auto parts inventory software company that helped launch the Honda CIVIC automobile in the late 1960s. Today, he is working to evolve Apple Computer's own business systems and its client/server products into a logically integrated set of information services, which are designed to be available worldwide as an intuitive extension of the familiar Apple desktop interface.

Notes:

PANEL DISCUSSION: The Future of Computing

David L. House
Senior Vice President
Intel Corporation

Mr. House is Senior Vice President of Corporate Strategy for Intel. As a member of Intel's executive staff, he is responsible for Intel's product strategy. Mr. House joined Intel in 1974 as Manager of Applications for Memory Components and since then has held various management positions including Manager of Product Marketing and Applications; Marketing Manager for the Microcomputer Components Division; General Manager of the Microprocessor and Peripheral Operation; General Manager of the Development System Operation; Vice President and General Manager of the Microcomputer Components Group, and was promoted to Senior Vice President in 1987. For 12 years, Mr. House held profit and loss responsibility for Intel x86 microprocessors and related products. In 1991, he headed up the Architecture, Marketing, and Applications Group, prior to assuming his current position this year. Prior to Intel, he was with Microdata as Director of Computer Development. In 1969 he joined Honeywell's Computer Control Division where he managed minicomputer development and received the H.W. Sweatt Engineer Scientist Award for his definition and development of a new computer family. He began his professional career in 1965 at Raytheon where he worked on the design of computers and data acquisition systems. He earned a B.S. degree in Electrical Engineering from Michigan Technological University and an M.S. degree in Electrical Engineering from Northeastern University. Mr. House is a member of the Institute of Electric and Electronic Engineers.

Notes:

Notes:

Home Multimedia

Dataquest®

BREAKOUT SESSION:
The Future of Home Multimedia Communications

MODERATOR:
Gregory L. Sheppard
Director and Principal Analyst
Semiconductor Application Markets Service
Dataquest Incorporated

PANELISTS:
William G. Luehrs
Vice President and General Manager, Video Systems
Scientific-Atlanta, Inc.

Bruce Ryon
Principal Analyst for Multimedia
Software Group
Dataquest Incorporated

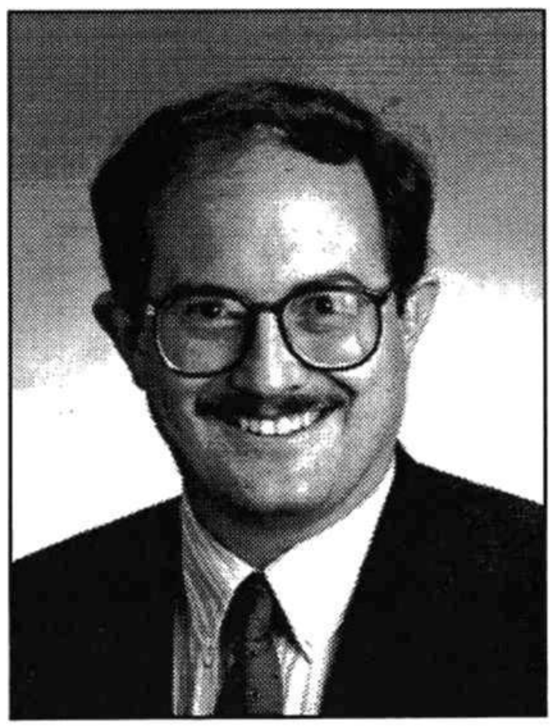
Ed Thompson
Director, New Business Development
Broadcast Products Group
Compression Labs, Incorporated

Simon P. Dolan
Director of Marketing
DSP Division
LSI Logic Corporation

Kevin Seeman
Director of Broadband Services
Pacific Bell Information Systems

BREAKOUT SESSION:
The Future of Home Multimedia Communications

Gregory L. Sheppard
Director and Principal Analyst
Semiconductor Application Markets Service
Dataquest Incorporated



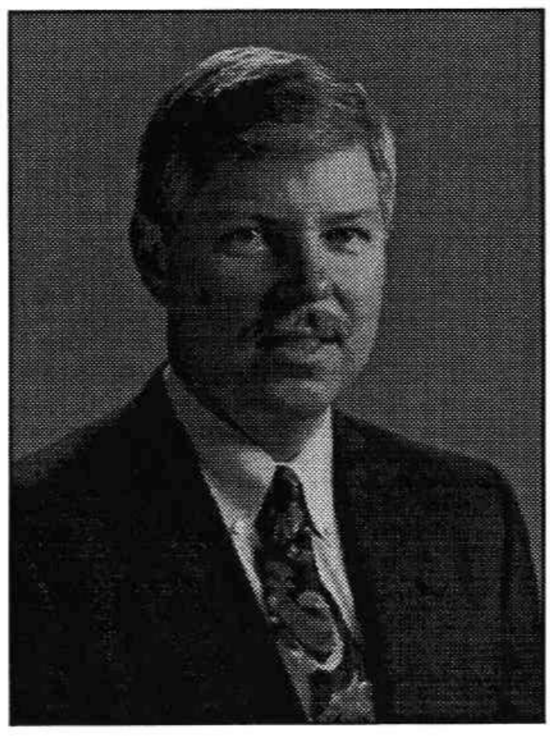
Mr. Sheppard is a Director and Principal Analyst in Dataquest's Semiconductor Application Markets service. He is responsible for coordinating worldwide semiconductor applications research. Besides general applications trends, he specializes in multimedia, communications, and consumer applications. Before joining Dataquest, Mr. Sheppard was on the headquarters marketing staff of Fairchild Semiconductor Corporation as Manager of Business Analysis. In that capacity, he was responsible for the worldwide marketing plan, product market evaluations, and competitive analysis. He was also a board member of Worldwide Semiconductor Trade Statistics Inc. and was Fairchild's liaison to the American Electronics Association. Earlier, Mr. Sheppard was a Hardware Design Manager and a Systems Engineer at GTE Government Systems. While there, he specialized in the design of C31 systems, man-machine interfaces, and the decision aid systems. Mr. Sheppard received a B.S.E.E./C.S. degree from the University of Colorado and an M.S. degree in System Management from the University of Southern California.

Notes:

BREAKOUT SESSION:
The Future of Home Multimedia Communications

William G. Luehrs
Vice President
and General Manager
Video Systems
Scientific-Atlanta, Inc.

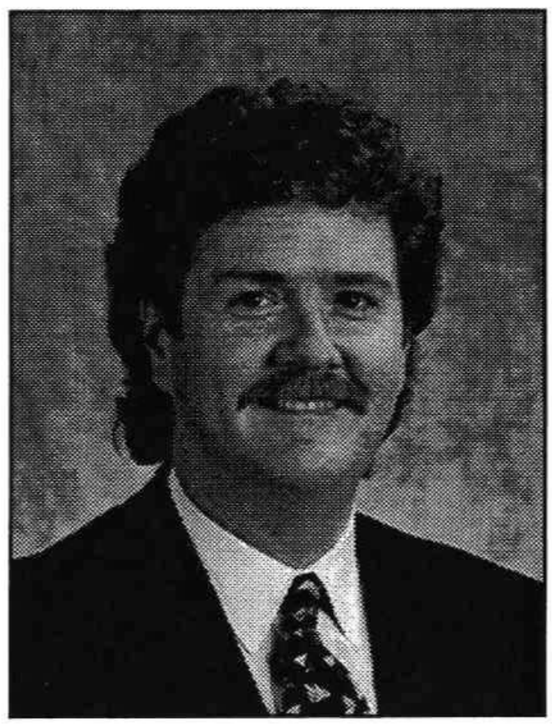
As Vice President and General Manager of Video Systems, Mr. Luehrs has worldwide responsibility for advanced home communications terminals, including the Models 8600 and 8600x_ terminals, and development of subscriber digital video products such as the digital terminal for the Time Warner's Full Service Network. Nearly 2 million of the easy-to-use 8600 terminals with on-screen graphics have been sold or are on order around the world. The digital-ready 8600x includes all the subscriber-friendly features of the 8600 plus electronic program guide, near-movie-on-demand capability, downloadable software, digital compression adaptability, and several other new features. The first digital terminals will be delivered to Time Warner early next year. Previously, Mr. Luehrs was in charge of Digital Audio Systems and the development and marketing of cable, commercial, direct-to-home, and international digital audio products. Earlier, he was Director of Strategic Program Development in the Broadband Communications Group. Prior to joining Scientific-Atlanta in 1988, Mr. Luehrs was with the General Electric Company for 17 years in general management, marketing, and strategic planning positions in power systems and drive systems businesses. He is a member of the Institute of Electrical and Electronics Engineers (IEEE) and is currently on the Board of Directors of the National Telesystems Conference (NTC) of the Aerospace and Electronics Systems Society. Mr. Luehrs was the General Chairman of the NTC '91 conference in Atlanta. Mr. Luehrs received his B.S. degree in Electrical Engineering from Marquette University in 1967. He also earned an M.S. degree in Business Administration from Gannon University in 1976.



Notes:

BREAKOUT SESSION:
The Future of Home Multimedia Communications

Bruce Ryon
Principal Analyst for Multimedia Software Group
Dataquest Incorporated



Mr. Ryon is the Principal Analyst for the Multimedia service of Dataquest's Software group. He is responsible for responding to all inquiries from clients concerning multimedia. Before joining Dataquest, Mr. Ryon was the Business Development Manager for Home Entertainment in the U.S. Consumer Division of Apple Computer, Inc. He was responsible for the marketing of home multimedia and entertainment-related products, as well as channel strategy for CD-ROM hardware, diskette, and CD-ROM based software. Mr. Ryon has a combined 17 years of experience in film production, multimedia production, graphic design, CATV, and voice processing marketing, in addition to computer marketing, sales, and systems integration. Prior to Apple Computer, Mr. Ryon had his own business for four years, which provided print and multimedia design and systems consulting services to San Francisco's leading advertising and graphic design firms. Mr. Ryon worked for eight years in various marketing management positions before opening his own business, mostly high technology, in both creative and strategic capacities. His career began in the film business as a production coordinator for two years with Warner Bros. Pictures. Mr. Ryon received a B.A. degree in Film from the University of California at Berkeley; an M.B.A. degree from San Jose State University; and has taken 30 semester units in Computer Science Engineering.

Notes:

BREAKOUT SESSION:
The Future of Home Multimedia Communications

Ed Thompson
Director, New Business Development
Broadcast Products Group
Compression Labs, Incorporated

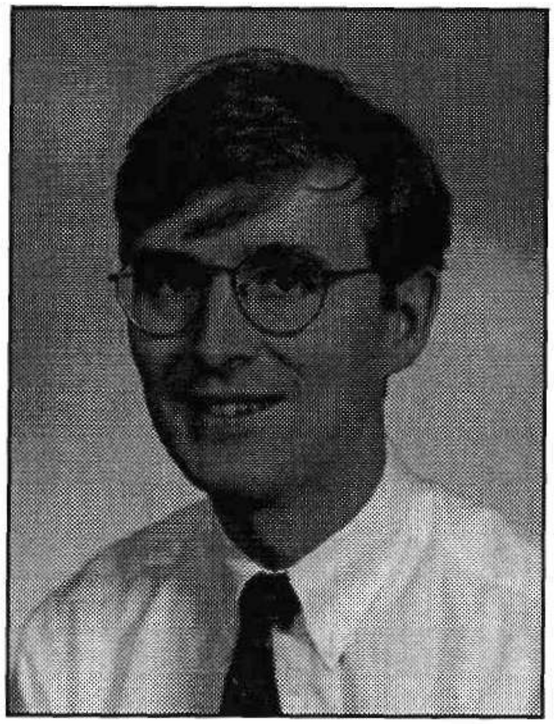
Mr. Thompson is the Director of New Business Development for the Broadcast Products Group at Compression Labs, Incorporated. He is responsible for finding new applications for compressed digital video in the emerging broadcast and cable communication markets for CLI. Prior to joining CLI in 1990, Mr. Thomson was Vice President of Technology Licensing for "dbx," a California-based audio company. Before that he spent eight years as Product Manager for the Color Television Group at RCA. Mr. Thompson received a B.A. degree in Speech/Communications from the California State University, Hayward, and an M.B.A. degree from Indiana Wesleyan University.

Notes:

BREAKOUT SESSION:
The Future of Home Multimedia Communications

Simon P. Dolan
Director of Marketing
DSP Division
LSI Logic Corporation

Mr. Dolan is the Director of Marketing for the DSP division of LSI Logic responsible for strategy and product marketing of LSI Logic's digital video products. Before joining LSI Logic in 1988, Mr. Dolan worked at Inmos Corporation as a product marketing engineer with responsibility for microprocessor, board-level, and DSP products. Prior to holding that position, he was a design engineer at Inmos Ltd., in the United Kingdom. Mr. Dolan received his undergraduate degree in Mathematics and Philosophy from the University of Oxford in 1981 and received his M.S. degree in Information Technology from the University College in London in 1984.



Notes:

BREAKOUT SESSION: The Future of Home Multimedia Communications

Kevin Seeman
Director of Broadband Services
Pacific Bell Information Systems

Mr. Seeman is the Director of Broadband Services for Pacific Bell Information Services (PBIS), a wholly owned subsidiary of Pacific Bell. He is responsible for choosing the services platforms for PBIS' trial and deployment of broadband interactive residential services and is the producer of some of the key services to be offered on the platform. Prior to his present assignment, Mr. Seeman has been employed by Pacific Bell in various marketing, engineering, and project management responsibilities. He has also worked in land-use consulting and banking. Mr. Seeman has a B.S. degree in Economics from the University of California, San Diego, and completed master's coursework in Social Sciences and Economics at the University of Chicago.

Notes:

Dataquest®

BREAKOUT SESSION:
The Future of Flash Memory

MODERATOR:
Nicolas C. Samaras
Director and Principal Analyst
Semiconductor Application
Markets Service
Dataquest Incorporated

PANELISTS:
Bruno Beverina
Vice President, Memory Group
General Manager,
Flash Division
SGS-Thomson

Walid Maghribi
Vice President
Non-Volatile Memory Division
Advanced Micro Devices, Inc.

Toshiaki Masuhara
General Manager
Technology Operations
Semiconductor and IC Division
Hitachi Ltd.

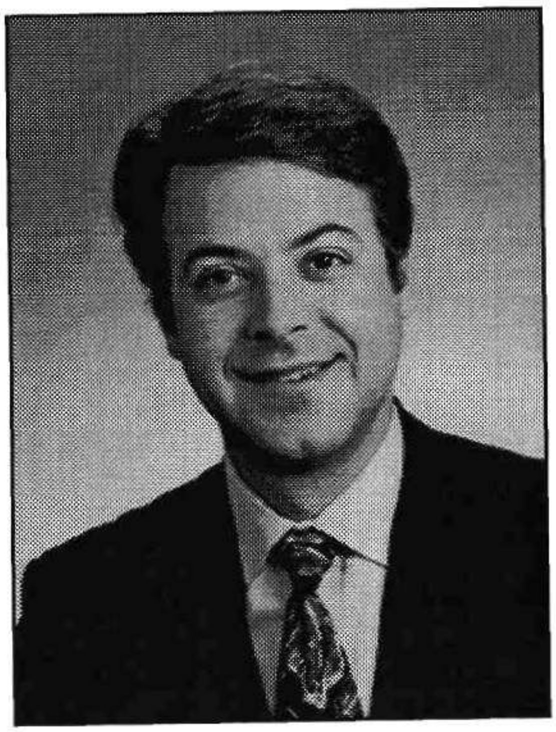
Richard D. Pashley
Vice President
Semiconductor Products Group
Intel Corporation

Osamu Ozawa Ph.D.
Technology Executive
Toshiba Corporation

BREAKOUT SESSION: The Future of Flash Memory

Nicolas C. Samaras
Director and Principal Analyst
Semiconductor Application
Markets Service
Dataquest Incorporated

Mr. Samaras is a Director and Principal Analyst in Dataquest's Semiconductor Application Markets service. He is responsible for analyzing semiconductor consumption in data processing applications and tracking of trends in nonvolatile memory products and markets. Previously, Mr. Samaras founded Telamon, a marketing and research firm specializing in the emerging Smart Card/Memory Card technology. Prior to that, he was Director of the Microcomputer Division of Catalyst Semiconductor Inc. During his tenure at Catalyst, he was the principal developer of a new serial EEPROM architecture (CAT35C704), which was named best of 1988 and 1989 by Electronic Design magazine. Prior to Catalyst, Mr. Samaras spent nine years at National Semiconductor Corporation in a variety of engineering and marketing positions. Mr. Samaras received a B.S.E.E. degree from McGill University in Montreal, Canada. He is currently pursuing his M.B.A. at the University of Phoenix.

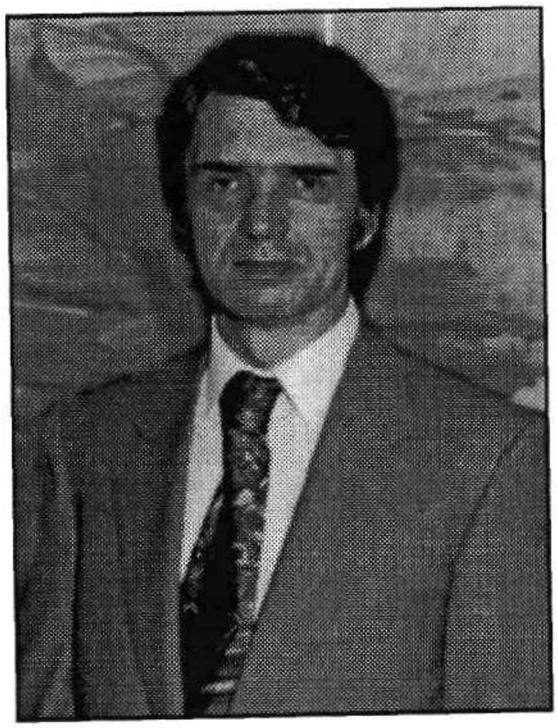


Notes:

BREAKOUT SESSION:
The Future of Flash Memory

Bruno Beverina
Vice President, Memory Group
General Manager, Flash Division
SGS-Thomson

Mr. Beverina is currently the Vice President of the Memory group and General Manager of the Flash division of SGS-Thomson. Previously he was General Manager of the EPROM group. Mr. Beverina has been involved in the semiconductor industry since 1961 and some of his previous positions have been: process engineer, R&D engineer, quality and reliability engineer, international inventory control manager, material planning manager, budget manager, and strategic planning manager. Mr. Beverina has degrees in Electronics and Business Administration.

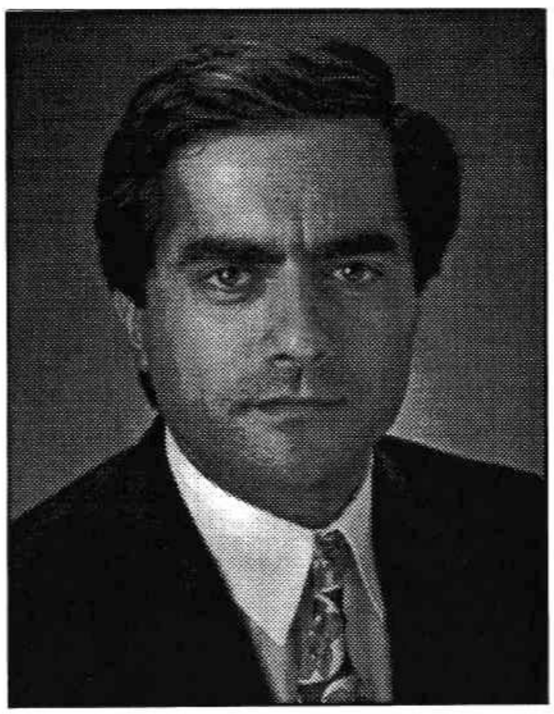


Notes:

BREAKOUT SESSION:
The Future of Flash Memory

Walid Maghribi
Vice President
Non-Volatile Memory Division
Advanced Micro Devices, Inc.

Mr. Maghribi was appointed Vice President of the Non-Volatile Memory Division at AMD in 1991. He joined AMD in 1986 as a Product Line Manager and was promoted in 1989 to Product Line Director. Previously, he was Director of Operations at Seeq Technology for four years and a Senior Engineering Manager at National Semiconductor for seven years. Prior to this he was an engineer at Intel Corporation. Mr. Maghribi has a B.S. degree in Electrical Engineering from San Jose State University and an M.S. degree in Computer Science from Santa Clara University.

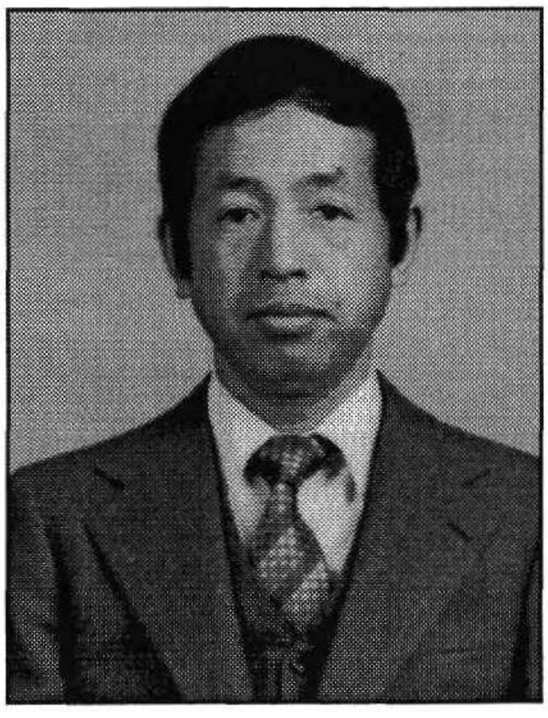


Notes:

BREAKOUT SESSION:
The Future of Flash Memory

Toshiaki Masuhara
General Manager
Technology Operations
Semiconductor and IC Division
Hitachi Ltd.

Dr. Masuhara was appointed General Manager of the Technology Development Operation of the Semiconductor and IC Division of Hitachi this year and is responsible for the development of process, packaging, and CAD/DA for LSI. From 1991 to 1993 he has been in the Telecommunications Division of Hitachi where he was responsible for the design of VLSIs, components, and printed circuit boards. After graduating, Dr. Matsuhara joined Hitachi in 1969 and was a member of the technical staff in the Integrated Circuit Department at Hitachi's Central Research Laboratory in Kokubunji, Tokyo, where he initially worked on depletion-load NMOS integrated circuits and later on modeling and analysis of MOS transistors until 1974. For the following year, he was a special student in the Electrical Engineering and Computer Science Department of the University of California at Berkeley. There he worked on double-diffused MOS transistors and a new CMOS process. In 1975, he returned to Hitachi Central Research Laboratory and initiated a project to develop new high-speed CMOS static memories with NMOS cells. He also supervised groups working on area image sensors and liquid-nitrogen cooled CMOS. In 1987, he became Department Manager of ULSI Research Center of Hitachi Central Research Laboratory and was responsible for the design of microprocessors, DSPs, memories, high-speed bipolar LSIs, linear integrated circuits, and advanced devices. He became the Department Manager of the First Department in 1990, where he supervised research groups working on high-speed GaAs and bipolar integrated circuits, solar cells, imager tubes, quantum devices, and research on materials. Dr. Masuhara is a member of the Institute of Electrical, Information, and Communication Engineers of Japan. He was the Program Chairman of the 1993 Symposium on VLSI Circuits and Cochairman of the 1992 Symposium on VLSI Circuits. He received 1990 IEEE Solid-State Circuits Award on his contributions to NMOS depletion-load circuits and the development of high-speed CMOS memories. During 1984 through 1992 he received four Significant Invention Awards in Tokyo, Japan. Dr. Masuhara earned B.S. and M.S. degrees in Electrical Engineering in 1967 and 1969 and a Ph.D. degree in Electrical Engineering in 1977 from the University of Kyoto, Japan.

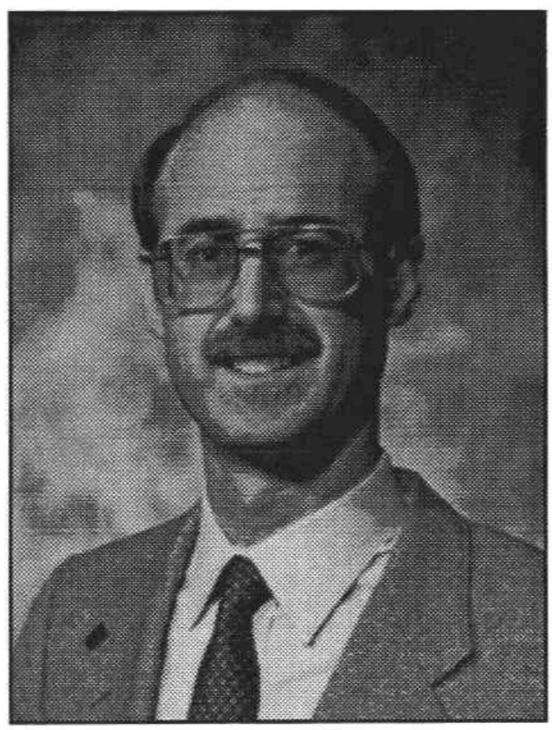


Notes:

BREAKOUT SESSION:
The Future of Flash Memory

Richard D. Pashley
Vice President
Semiconductor Products Group
Intel Corporation

Dr. Pashley is Vice President of the Semiconductor Products Group at Intel Corporation. Previously he was General Manager of Intel's Folsom, California-based Memory Components division and will continue to oversee all aspects of Intel's flash memory business including technology development, design, manufacturing, assembly, testing, marketing, and customer support. A 20-year veteran of Intel, Dr. Pashley holds eight patents and has more than 20 publications to his credit. In 1976, he developed Intel's high-performance metal-oxide semiconductor (HMOS) process technology that has since been used in hundreds of different Intel products, including semiconductor memories, microprocessors, and microcontrollers. Dr. Pashley holds a Ph.D. degree in Electrical Engineering from the California Institute of Technology.

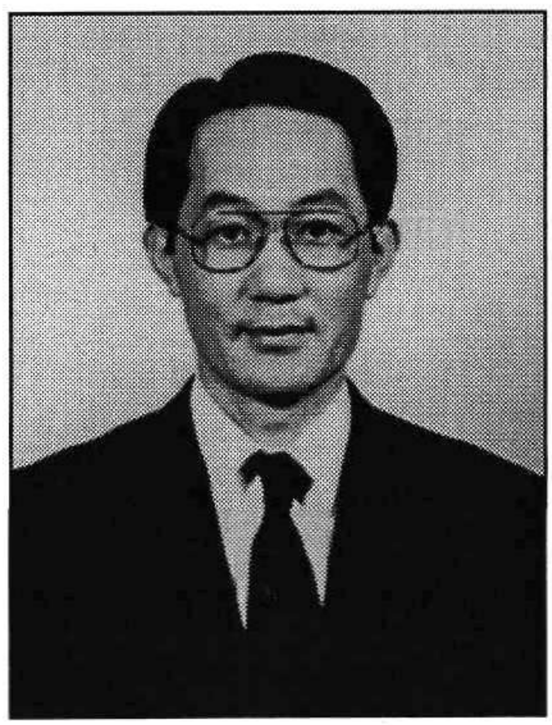


Notes:

BREAKOUT SESSION: The Future of Flash Memory

Osamu Ozawa Ph.D.
Technology Executive
Toshiba Corporation

Dr. Ozawa is the Technology Executive of Memories at Toshiba since April 1993 and is responsible for all new memory development (including NAND and NOR EEPROM) and reliability of memories. After graduating from Nagoya University, Dr. Ozawa entered the research and development center of Toshiba in 1971 where he developed a new device called Static Induction Transistor (SIT) and a new bipolar logic of I^2L with very high packaging density. In 1979, Dr. Ozawa moved to Toshiba's new laboratory named Semiconductor Device Engineering Laboratory (SDEL) where he developed 256K DRAM, 1M DRAM, 4M DRAM, 4M EPROM, and 1M SRAM. Papers were presented at ISSCC on these memories and awards were given for 1M DRAM and 4M DRAM. Since 1989 to 1992 he has worked in the Ohita Works, which is the largest semiconductor fabrication line in Toshiba. During this period, his main achievement is the ramp-up of 4M DRAM production and technology transfer of 16M DRAM from SDEL to Ohita Works.



Notes:

Notes:

Dataquest®

BREAKOUT SESSION:
Procurement Benchmarking

MODERATORS:
Mark Giudici
Director and Principal Analyst
Semiconductor Procurement Service
Dataquest Incorporated

Ronald A. Bohn
Senior Industry Analyst
Semiconductor Procurement Service
Dataquest Incorporated

PANELISTS:
Larry D. Durandette
Benchmarking Program Manager
Hewlett-Packard Company

A. Kenneth Pattin
Vice President, Worldwide Supply and Acquisition Management
IBM Personal Computer Company

P. William Quinn
Vice President, Procurement
SCI Systems, Incorporated

Bill Russell
Purchasing Manager, Electronics Systems and Advanced Technology Division
Texas Instruments, Inc.

BREAKOUT SESSION:
Procurement Benchmarking

Mark Giudici
Director and Principal Analyst
Semiconductor Procurement Service
Dataquest Incorporated

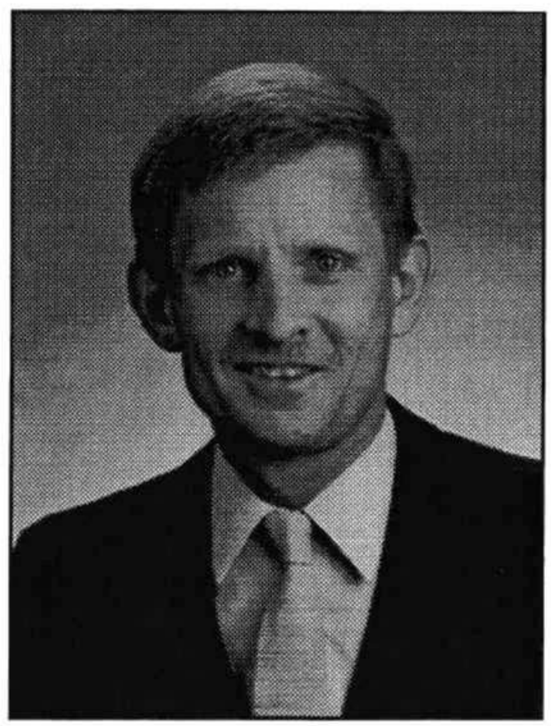
Mr. Giudici is Director and Principal Analyst of Dataquest's Semiconductor Procurement service. He is responsible for tracking and analyzing emerging semiconductor procurement issues and trends. He also covers regional semiconductor prices and cost modeling issues including product/supplier analysis on MPU and ASIC markets. In addition, he has participated in various custom research projects involving procurement needs, contract manufacturing, and regional price differentials. Prior to joining Dataquest, Mr. Giudici spent eight years in both the computer and semiconductor industries, where he held a variety of financial and marketing positions. Most recently, he was a Product Marketing Engineer with Gould-American Microsystems, where he was responsible for cost modeling and marketing semicustom and foundry-custom semiconductor components. Mr. Giudici received his B.S. degree in Business Administration from the California State University, Chico, and his M.B.A. in Business Management from the University of Oregon.

Notes:

BREAKOUT SESSION:
Procurement Benchmarking

Ronald A. Bohn
Senior Industry Analyst
Semiconductor Procurement Service
Dataquest Incorporated

Ronald Bohn is a Senior Industry Analyst for Dataquest's Semiconductor Procurement service. He is responsible for research and analysis in semiconductor pricing trends and procurement benchmarking. He assesses semiconductor life cycles and the supplier base from a purchasing and component engineering perspective. He has developed a database listing the top-ranked electronic equipment producers' purchasing locations by application market. This database serves as the survey base for Dataquest's research on procurement benchmarking. Prior to joining Dataquest, Mr. Bohn was with a market research company involved in the analysis of worldwide markets for electronic components and systems. He was International Market Research Manager for the Korea Trade Center in the United States. Mr. Bohn received a B.A. degree from Cornell University, an M.B.A. degree from the University of California at Berkeley, and a J.D. degree from the Hastings College of Law.



Notes:

BREAKOUT SESSION:
Procurement Benchmarking

Larry D. Durandette
Benchmarking Program Manager
Hewlett-Packard Company

Mr. Durandette is the Benchmarking Program Manager for Hewlett-Packard. He is responsible for the development and implementation of a standardized benchmarking process for use in the business entities. As part of that role he provides training, consulting, and facilitation services to teams actively involved in the benchmarking process. In addition, he also screens incoming requests to ensure that the exchange can add value to HP. Prior to joining Corporate Quality, Mr. Durandette served as quality manager in one of HP's Personal Computer Divisions, where he managed teams focused on implementing business process improvement methodologies and warranty management. He has also been a member of both marketing and manufacturing teams during his nine years with HP. While in manufacturing he played a major role in the start-up of a new manufacturing facility in South Queensferry, Scotland. Before joining Hewlett-Packard, he spent three years with Inland Specialty Chemicals as a product development engineer. He is a member of the American Society for Quality Control and sits on the founder's council for the International Benchmarking Clearinghouse.
Mr. Durandette earned a B.S. degree in Chemistry from the California State Polytechnic University, Pomona.

Notes:

BREAKOUT SESSION:
Procurement Benchmarking

A. Kenneth Pattin
Vice President Worldwide Supply and Acquisition Management
IBM Personal Computer Company

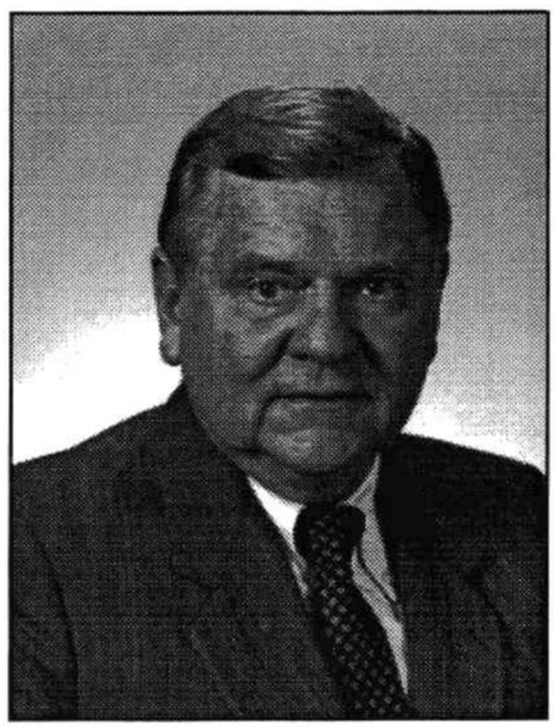
Mr. Pattin is Vice President, Worldwide Supply and Acquisition Management for the IBM Personal Computer Company, responsible for the supply of PCs from IBM's worldwide sources, the management of the supplier network supporting final product assembly, and the business processes to improve the overall responsiveness of the network, as well as worldwide procurement for all technology required by the IBM Personal Computer Company. Prior to this, he was Vice President, Supply, for the Entry Systems Division, responsible for the worldwide supply of PS/2 products and RISC/6000 products. He previously was based in Tokyo as Group Director of Manufacturing and Procurement for the IBM Asia/Pacific organization, responsible for IBM's procurement and manufacturing operations in Asia and Australia. Before going to Tokyo, Mr. Pattin was Director of Operations in Corporate Component Procurement, responsible for worldwide procurement, distribution, quality, and engineering for industry electronic components used in IBM products. Mr. Pattin received a B.S. degree in Electrical Engineering from Newark College of Engineering, an M.S. degree in Electrical Engineering from Syracuse University, and an M.S. degree in Computer Science from the IBM Systems Research Institute. He is a graduate of the Advanced Management School of Duke University.

Notes:

BREAKOUT SESSION:
Procurement Benchmarking

P. William Quinn
Vice President, Procurement
SCI Systems, Incorporated

Mr. Quinn is Vice President of Procurement at SCI Systems and is responsible for worldwide purchasing activities, a position he has held since 1989. Annual purchases of semiconductors and related material under his control currently exceed U.S.$1.5 billion. Before joining SCI, Mr. Quinn was Vice President of Materials Management for Fisher Scientific Group of Pittsburgh. Previously, Mr. Quinn held several management positions at IBM, one of which was Senior Procurement Manager responsible for the IBM Personal Computer programs in Boca Raton. Mr. Quinn is the International Chairman for the National Association of Purchasing Managers (NAPM) District VII. He has been the Chairman of the Board of Wake Opportunities, Incorporated, and has written several articles on purchasing and materials management. Mr. Quinn earned his undergraduate degree in Electrical Engineering from the State University of New York and has done graduate work at Duke and Dartmouth.

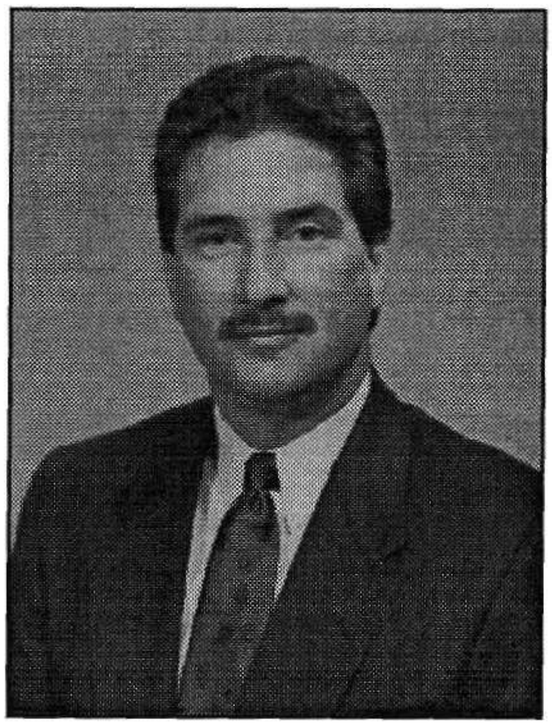


Notes:

BREAKOUT SESSION:
Procurement Benchmarking

Bill Russell
Purchasing Manager,
Electronics Systems and
Advanced Technology Division
Texas Instruments, Inc.

Mr. Russell is Purchasing Manager of the Electronics Systems and Advanced Technology Division at Texas Instruments. Since joining TI in 1980, he has held various positions in Procurement Quality, Purchasing, and Purchasing Management. For the past several years he has managed the Semiconductor Commodity Procurement function for TI's Defense Systems and Electronics Group. He has played a key role in the implementation of cross-functional material teams at TI, which encompasses the Inventory Management Procurement and Engineering functions. Mr. Russell is a Certified Purchasing Manager and holds a B.S. degree in Industrial Technology from the University of Maine and an M.B.A. degree in Industrial Management from the University of Dallas.



Notes:

Worldwide Capacity Issues

Dataquest®

BREAKOUT SESSION:
Worldwide Capacity Issues

MODERATOR:
Joe Grenier
Vice President
Semiconductor Manufacturing
and Applications Service
Dataquest Incorporated

PANELISTS:
Eugene W. Bernosky
President, CEO, and Cofounder
Applied Chemical Solutions

Thomas A. Nelson
Process Manager,
Electronics Commercial
Development Group
Praxair, Inc.

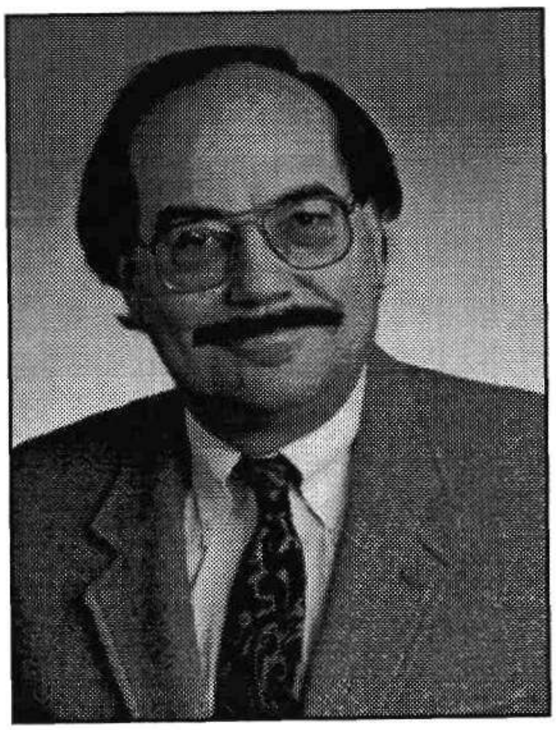
John Osborne
Vice President
Lam Research Corporation

Jack Saltich
Director, Fab 25 Wafer Facility
Advanced Micro Devices

BREAKOUT SESSION:
Worldwide Capacity Issues

Joe Grenier
Vice President
Semiconductor Manufacturing and Applications Service
Dataquest Incorporated

Mr. Grenier is Vice President of Dataquest's Semiconductor Manufacturing and Applications group. He is responsible for managing the research activities of the Semiconductor Equipment, Manufacturing, and Materials service; the Semiconductor Application Markets service; and the Semiconductor Procurement service. In addition, he is responsible for promoting consulting activity and new product ideas for the Worldwide Semiconductor group. Prior to joining Dataquest, Mr. Grenier was Product Marketing Manager at GCA Corporation where he managed marketing activities for the reactive ion etch program. He was also International Marketing Manager at GCA and was responsible for the overseas marketing of wafer-processing equipment. Previously, he worked as a Product Manager at Varian Associates/Instrument Division, as a Systems Engineer at the USAF Satellite Test Center, and as a Test Engineer at General Motors' Noise Vibration Laboratory. Mr. Grenier received a B.S.E.E. degree from the University of Detroit and an M.B.A. degree from the University of Santa Clara.



Notes:

BREAKOUT SESSION:
Worldwide Capacity Issues

Eugene W. Bernosky President,
CEO, and Cofounder
Applied Chemical Solutions

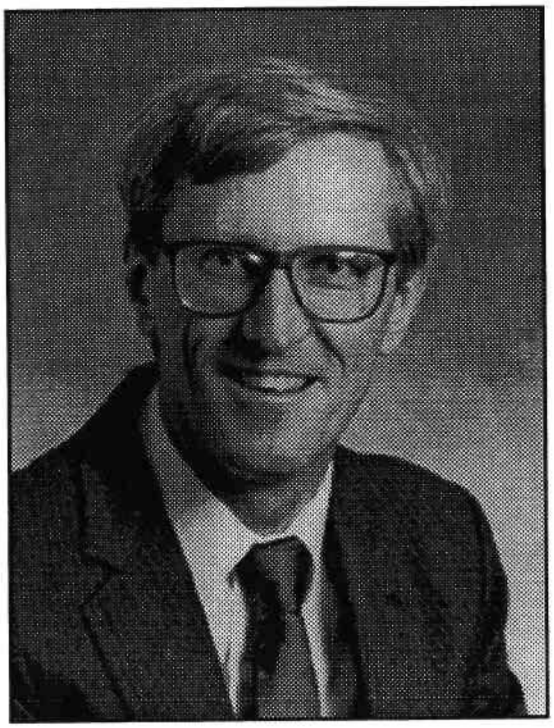
Mr. Bernosky is President, Chief Executive Officer, and Cofounder of Applied Chemical Solutions, a leading supplier of chemical management systems to the semiconductor industry. Previously, he was with Athens Corp., where he held the positions of General Manager (High Purity Chemicals Division), Sales Manager, and Product Marketing Manager. Prior to Athens he was a Product Manager at Applied Materials, where he launched the Precision 5000 Etch product. At Hercules Inc., he held several Product Marketing and Business Development positions, successfully growing the AquamerR line of Dry Film Photoresists for PWB fabrication and commercializing the Nanochem Gas Purification product line. Mr. Bernosky earned a B.S. degree in Mechanical Engineering from the University of Delaware and an M.A. degree in Business Administration from Wilmington College.

Notes:

BREAKOUT SESSION:
Worldwide Capacity Issues

Thomas A. Nelson
Process Manager,
Electronics Commercial
Development Group
Praxair, Inc.

Mr. Nelson is the Process Manager for Electronics in the Commercial Development group at Praxair located in Tarrytown, New York. He is responsible for technical sales support, product/service commercialization, and market research for bulk and specialty gases, supply systems, and services for the semiconductor industry. He began his employment with Praxair, then Union Carbide-Linde, in 1976 as an applications engineer. He has also held positions in marketing, product, and technology planning management. He earned a B.S. degree in Chemistry from the University of Nebraska, a B.S. in Engineering from the Illinois Institute of Technology, and an M.B.A. degree from Western Connecticut State University

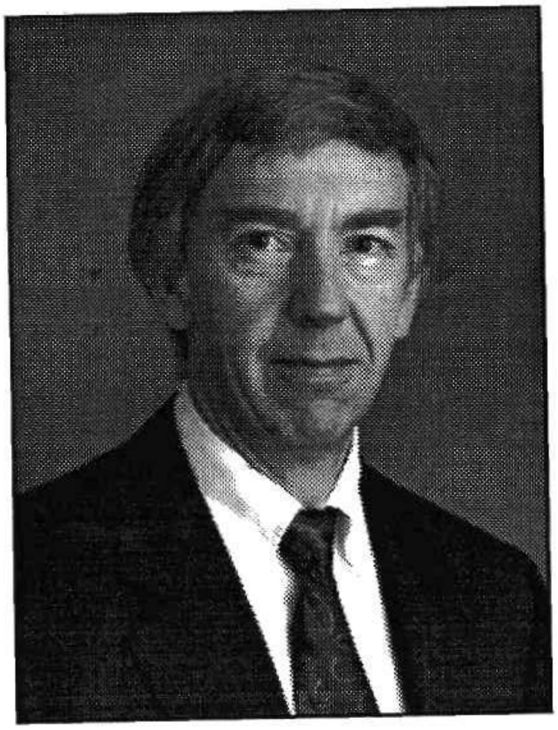


Notes:

BREAKOUT SESSION:
Worldwide Capacity Issues

John Osborne
Vice President
Lam Research Corporation

Mr. Osborne has been Vice President of Lam Research since 1988 and is responsible for corporate quality. His industry experience began with Motorola in 1967 in process development for both bipolar and MOS technologies. In 1974 he joined Signetics where he held various management positions involving product development, fab start-up, and test/assembly operations. He was promoted to Vice President and General Manager of Signetics ASIC division in 1982. He has published 15 publications and holds 7 patents. Mr. Osborne received his undergraduate degree in Metallurgical Engineering from Colorado School of Mines and did his graduate work in Material Science at Northwestern.

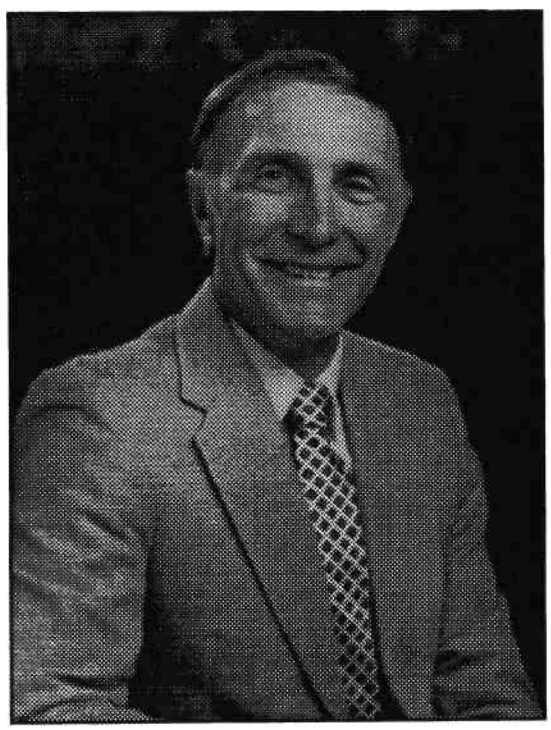


Notes:

BREAKOUT SESSION:
Worldwide Capacity Issues

Jack Saltich
Director, Fab 25 Wafer Facility
Advanced Micro Devices

Mr. Saltich is the Director of the new Fab 25 Wafer Facility at Advanced Micro Devices. His work experience includes 19 years at Motorola in various technology development and wafer manufacturing positions. From 1982 to 1988, Mr. Saltich directed the activities of both the bipolar and CMOS development efforts at Motorola. In June 1988, he joined VLSI Technology, having responsibility for the company's San Antonio wafer manufacturing operation, technology development, memory products business, and technology transfer from its alliance partner, Hitachi Semiconductor. Mr. Saltich received his B.S. and M.S. degrees in Electrical Engineering from the University of Illinois.



Notes:

Notes:

Dataquest®

BREAKOUT SESSION:
Signal Processing Application Trends

SESSION LEADERS:

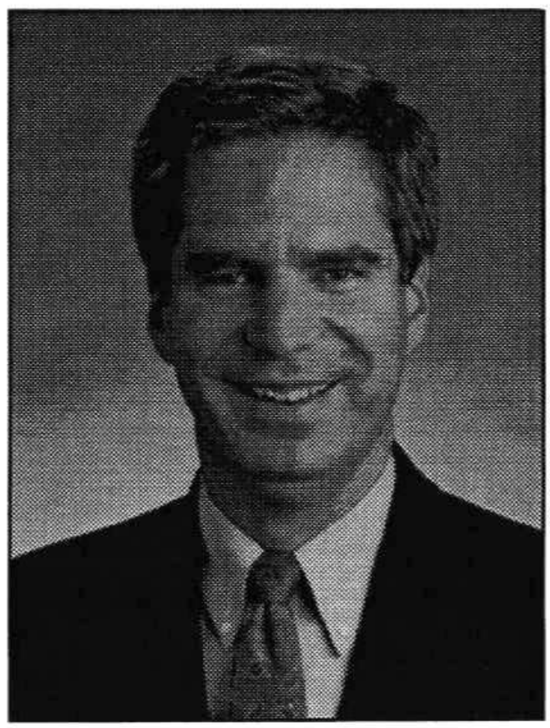
Jerry Banks
Director and Principal Analyst
Semiconductor
Microcomponents Service
Dataquest Incorporated

Gary J. Grandbois
Senior Industry Analyst
Semiconductor Group
Dataquest Incorporated

BREAKOUT SESSION: Signal Processing Application Trends

Jerry Banks
Director and Principal Analyst
Semiconductor
Microcomponents Service
Dataquest Incorporated

Mr. Banks is the Director and Principal Analyst for Dataquest's Microcomponents service, which encompasses microprocessors, microcontrollers, microperipherals, and programmable digital signal processors. Prior to joining Dataquest, Mr. Banks spent 12 years in the electronics industry in various marketing and engineering roles. Most recently, he was Product Marketing Manager for WaferScale Integration Inc. Before joining WaferScale, Mr. Banks held marketing and applications engineering positions at Signetics Corporation and engineering positions at Hewlett-Packard Company and Hughes Aircraft Company. Mr. Banks received a B.S. degree with honors in Electrical and Electronic Engineering from California State University at Sacramento.



Semiconductor Industry Conference

The Processing of Signals in the Digital Domain

Jerry Banks

Director/Principal Analyst

Dataquest

G3004477

Digital Signal Processing

- Common applications
  - Echo cancellation
  - Filter
  - Encode/decode
  - Compression/decompression

Dataquest

G3004478

Digital Signal Processing

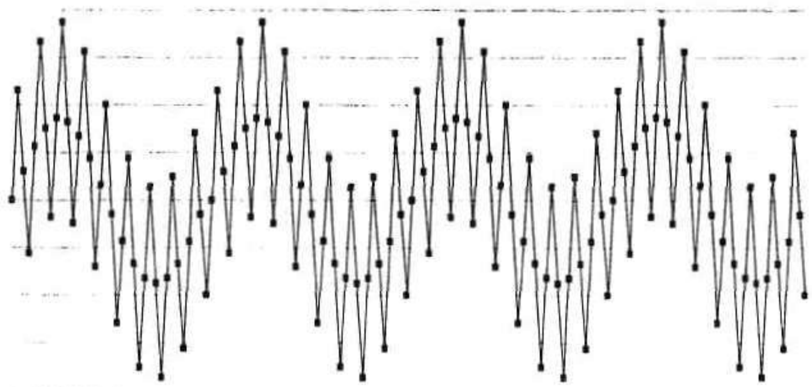
"Digital is simple"

Dataquest

G3004480

Notes:

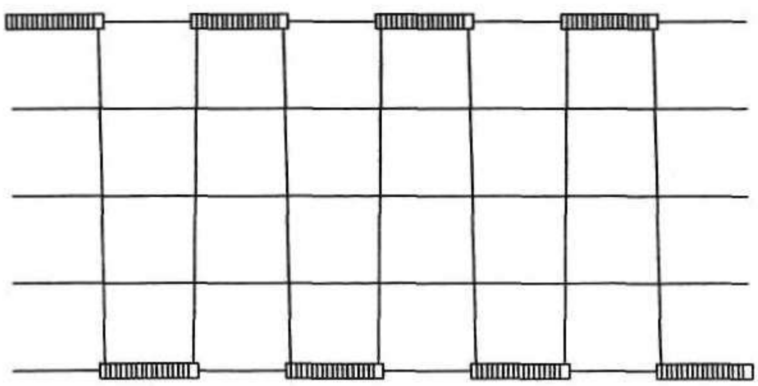
Analog Signal



Source: Dataquest

Dataquest G3005800

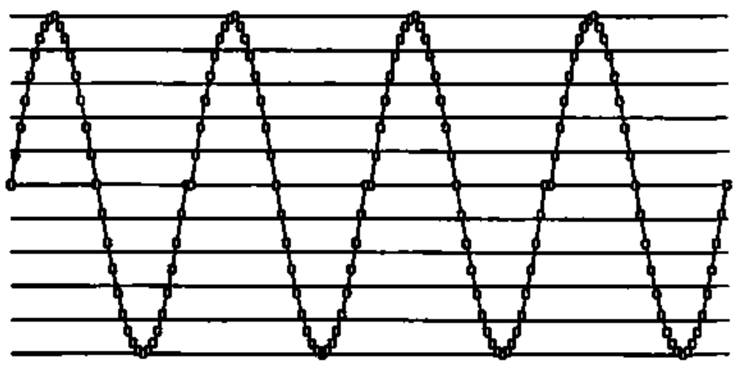
Digital Transmission



Source: Dataquest

Dataquest G3004481

Transmission Line Effect

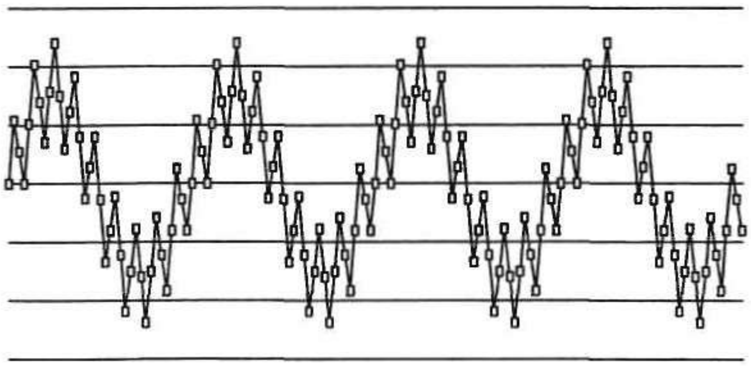


Source: Dataquest

Dataquest

Notes:

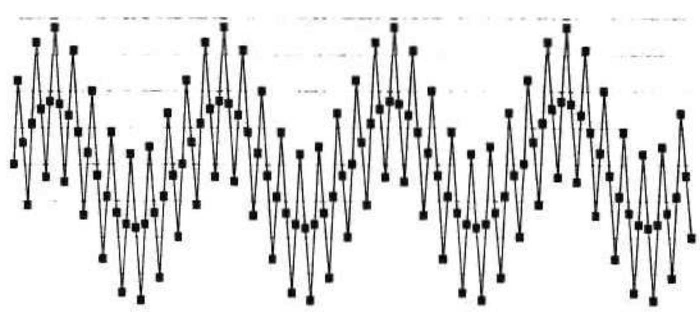
Noise Effects



Source: Dataquest

Dataquest G3004483

Echo Effects



Source: Dataquest

Dataquest G3004484

Digital Signal Processing

Maybe digital is not so simple

Dataquest

G3004465

Notes:

Simplified Block Diagram

Source: Dataquest

Dataquest G3004479

DSP Algorithm Development

Not for the faint of heart

Dataquest G3005801

DSP Support

- Development tools
  - C-Base development languages
  - Software simulators/debuggers
  - Hardware Development tools
- Applications support
  - Vendor supplied
  - Third-party support
- "Canned" algorithms
  - Critical for pDSP proliferation

Dataquest G3004486

Notes:

DSP product types

Dataquest

G3005802

DSP Product Types

- Programmable
  - User-defined program code
- Fixed function
  - Hardwired algorithm

Dataquest

G3004487

Programmable versus Fixed: Advantages

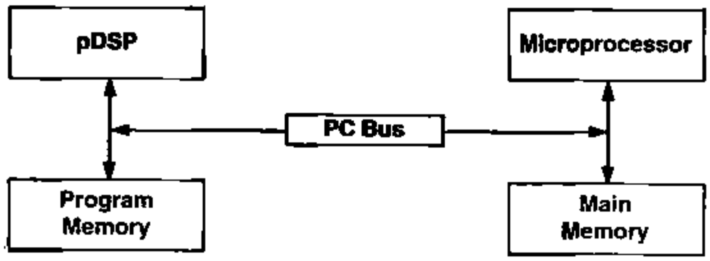
- Programmable
  - Flexible
  - Upgradable
- Fixed
  - Lower cost
  - Higher performance

Dataquest

G3004488

Notes:

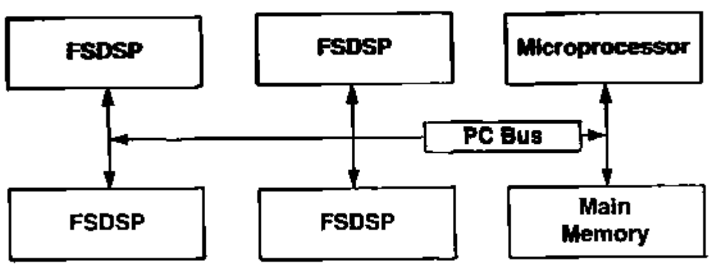
Programmable DSP Solution



Source: Dataquest

Dataquest G3004489

Function-Specific Solution



Source: Dataquest

Dataquest G3004490

Programmable versus Fixed: When to Use (Today's Paradigm)

- Programmable DSP
  - When standards are in flux
  - When standards are complex
  - When differentiation is critical
- Fixed function
  - When standards are in place and accepted
  - When standards are understood
  - When cost is critical

Dataquest G3004491

Notes:

DSP Future Trends

- Multiple-function DSPs
  - Limited space
  - Limited power
  - Limited budget

Dataquest G3004492

Multifunction Applications

- Fax/modem
- Audio
- 3-D graphics

Dataquest G3004493

The pDSP Advantage

- One hardware design
- Reconfigurable
  - Download function-specific algorithm
- Upgradable
  - Algorithm updated/fixed via software revision

Dataquest

G3004494

Notes:

pDSP: When to Use (Tomorrow's Paradigm)

- Programmable DSP
  - When standards are in flux
  - When standards are complex
  - When differentiation is critical
  - In a multifunction environment

Dataquest

G3004495

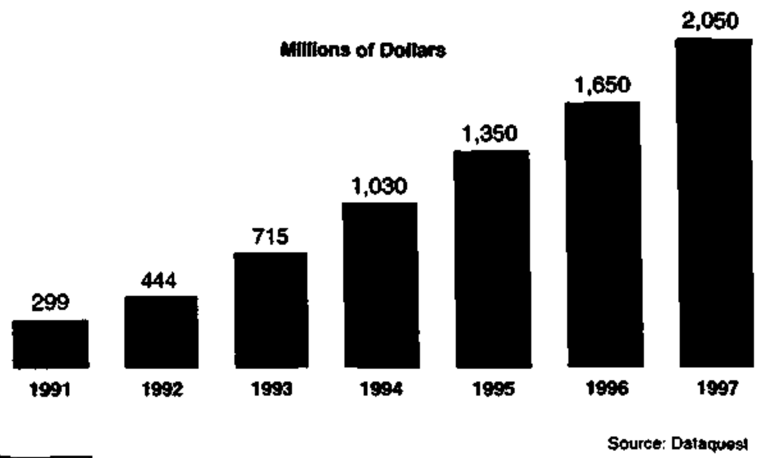
Programmable DSP

A cost-effective solution

Dataquest

G3004498

pDSP Revenue Forecast

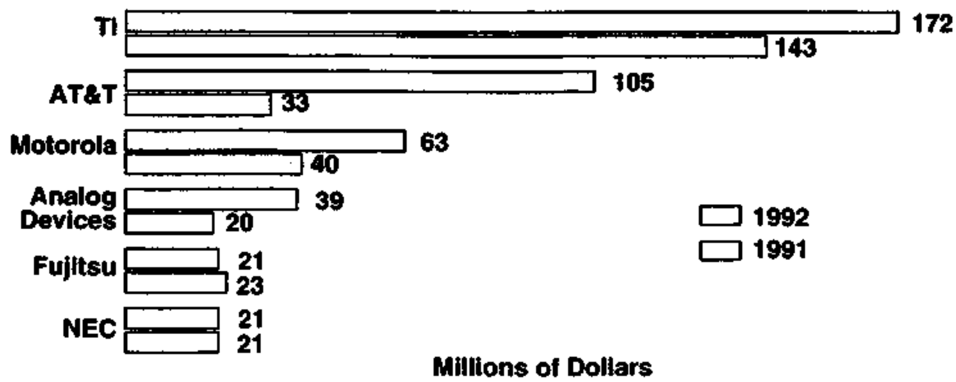


Dataquest

G3004497

Notes:

pDSP Market Leaders (1992 versus 1991)



Source: Dataquest

Dataquest G3004496

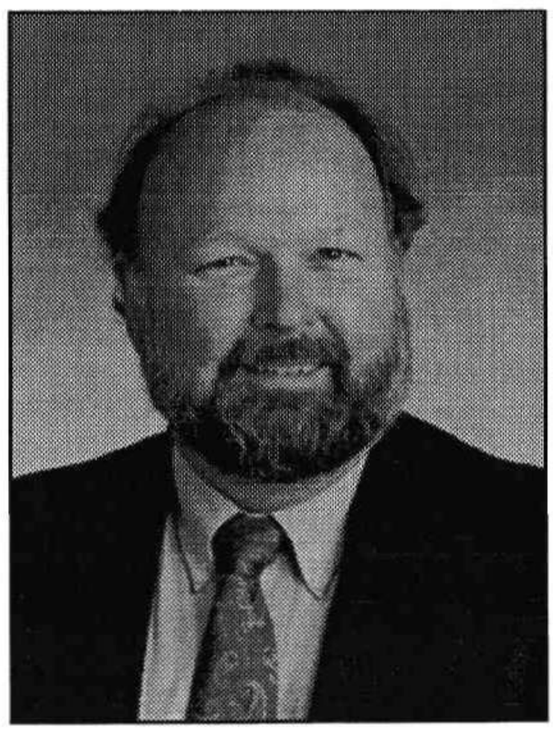
Notes:

Notes:

BREAKOUT SESSION: Signal Processing Application Trends

Gary J. Grandbois
Senior Industry Analyst
Semiconductor Group
Dataquest Incorporated

Mr. Grandbois is a Senior Industry Analyst for Dataquest's Semiconductor group. His responsibilities include market research and product, market, and industry analysis for analog and mixed signal products. Mr. Grandbois has had extensive experience in the semiconductor industry in both the application engineering and marketing areas. He has held positions as Applications Manager at Siliconix Inc., Product Marketing Manager at Precision Monolithics Inc., and Vice President of Marketing/Sales at Teledyne Semiconductor. Mr. Grandbois holds B.S.E.E. and M.S.E.E. degrees from San Jose State University.



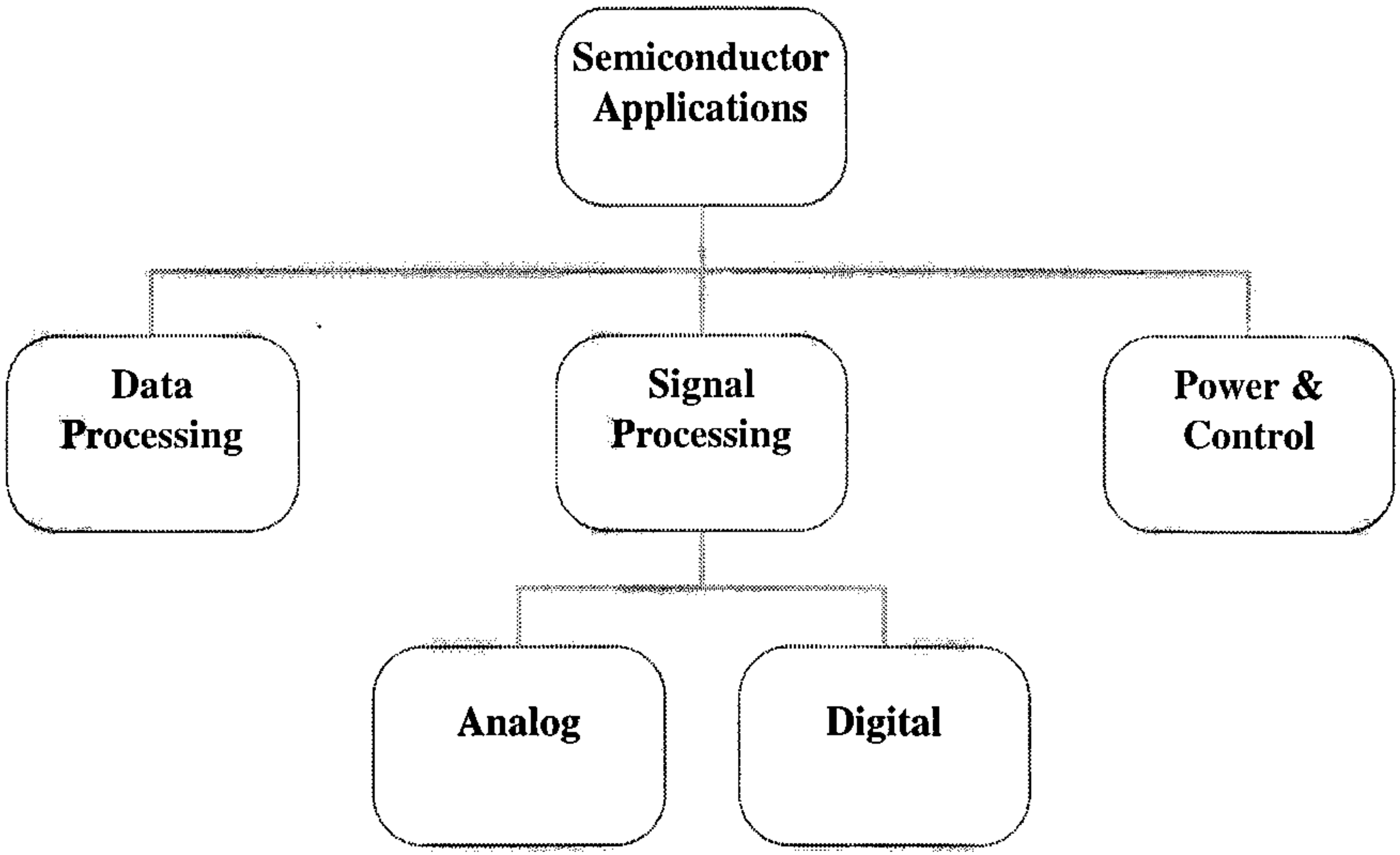
Notes:

Signal Processing

A Market Overview

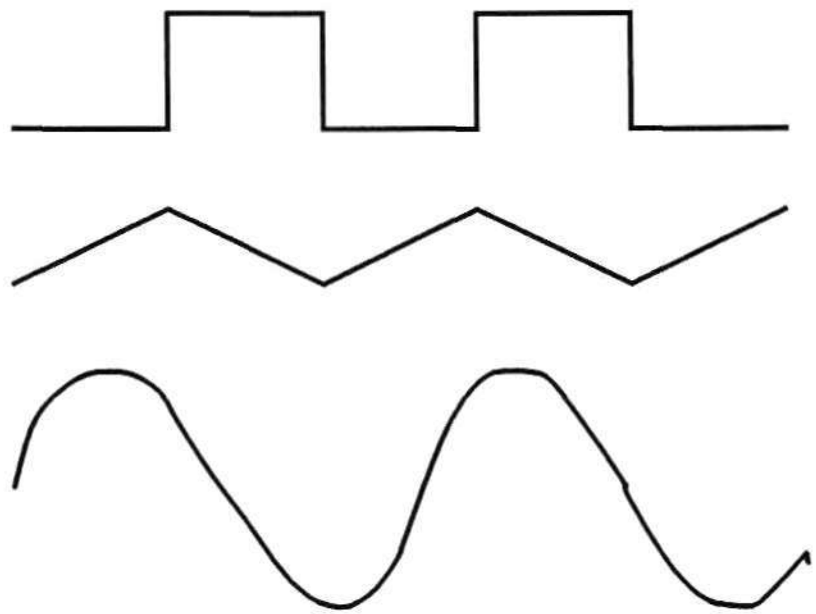
Gary Grandbois

Dataquest



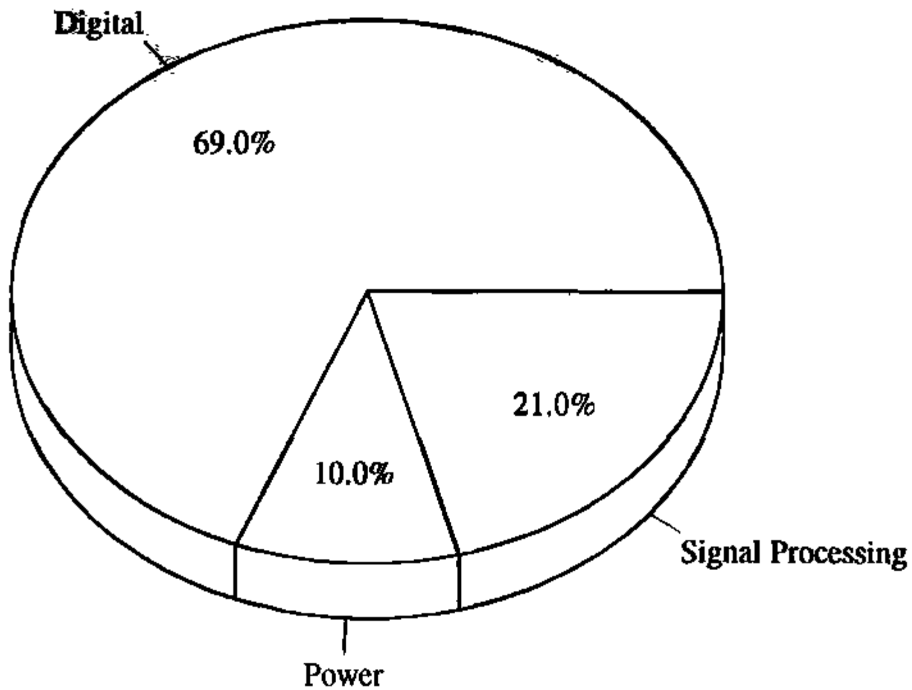
Signal Processing

Signal Processing



Signals are time-varying electrical values

Semiconductor Revenue by Use



1992 = $65.3 Billion

Signal Processing

Dataquest

Signals Are:

- Electrical qualities such as Voltage, Current, Impedance or Frequency
- Electrical Analogs that vary in correspondence to Physical Phenomena
- Capable of taking on infinite range of values
- Real-time

Birth of Electrical Signals

"Watson, come here, I want you"

Alexander Graham Bell

1876

Why Were Signals Preferred in 1876?

- Direct Communication
  - no encoding
  - no middlemen
  - increased privacy
- Quality
  - human vocal uniqueness and emotion retained
- Potential for home use

Historical Highlights

1838 Morse Code Telegraphy
(Digital Communication begins)
1876 Age of Signals Begins
(Bell's Undulatory Currents)
1906 Analog Modulation of Radio
1922 Electronic Recording
1925 TV Experiments
1951 First Univac sold
(digital processing for numbers)
1977 "Digital Audio Processor" IC
Rockwell
1978 TI offers "Speak and Spell"
1982 TI offers first programmable DSP
1984 Compact Disc Audio arrives

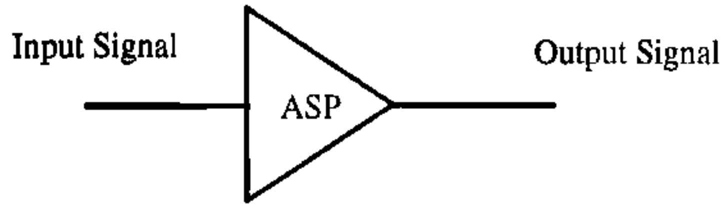
DSP

Emerging from Labs in 1970s

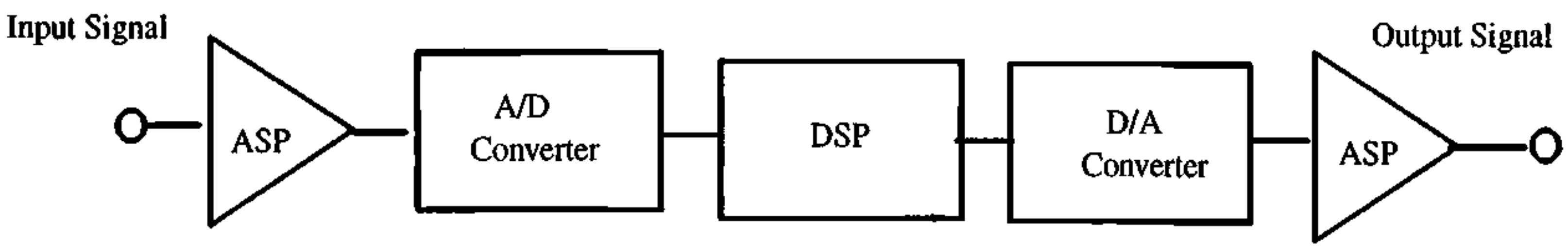
- Ended the Century of Analog Signal Processing

- Began a revolution in Signal Processing capabilities

Going From Analog Signal Processing



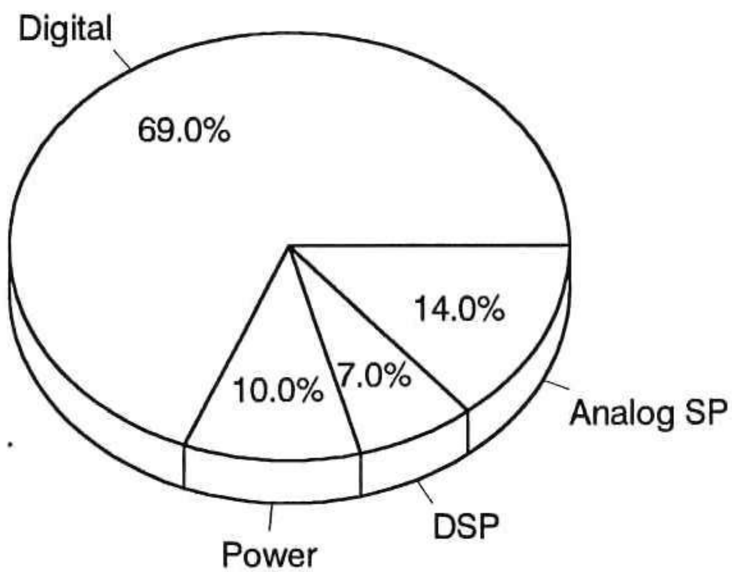
to DSP is functionally complex



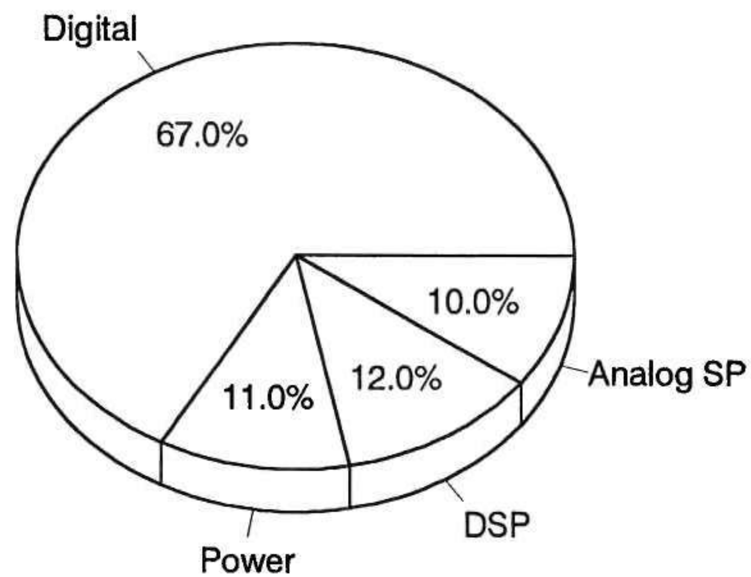
Why DSP?

- Cheat Signal "Entropy" (minimal degradation)
- Faster level of feature integration
- Provide signal storage capability
- Many functions and features more easily done in the digital domain
- Upgradeable in Software/Firmware
- Multi-Tasking Products

Semiconductor by Use

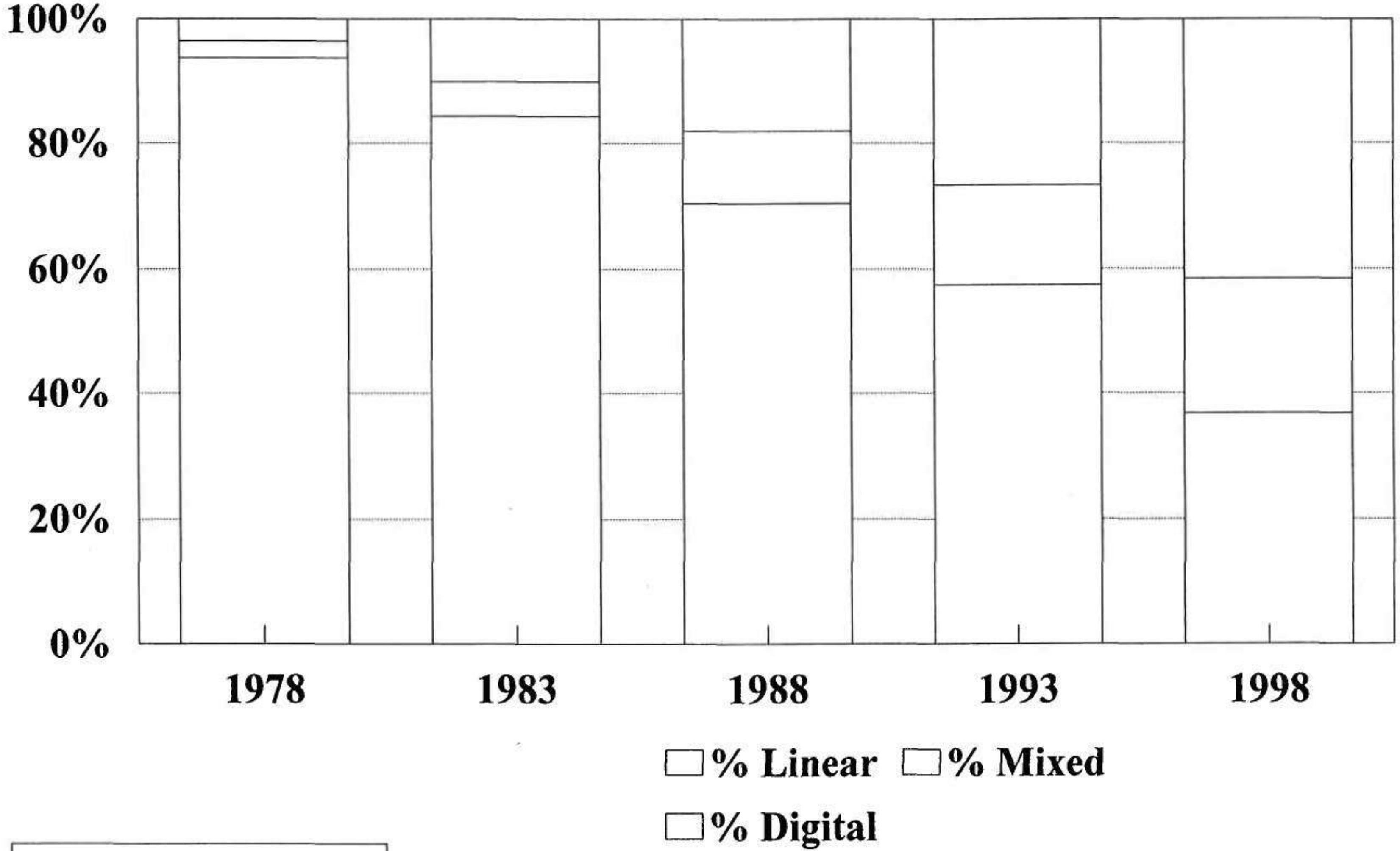


1992 = $65.3 Billion



1997 = $110.2 Billion

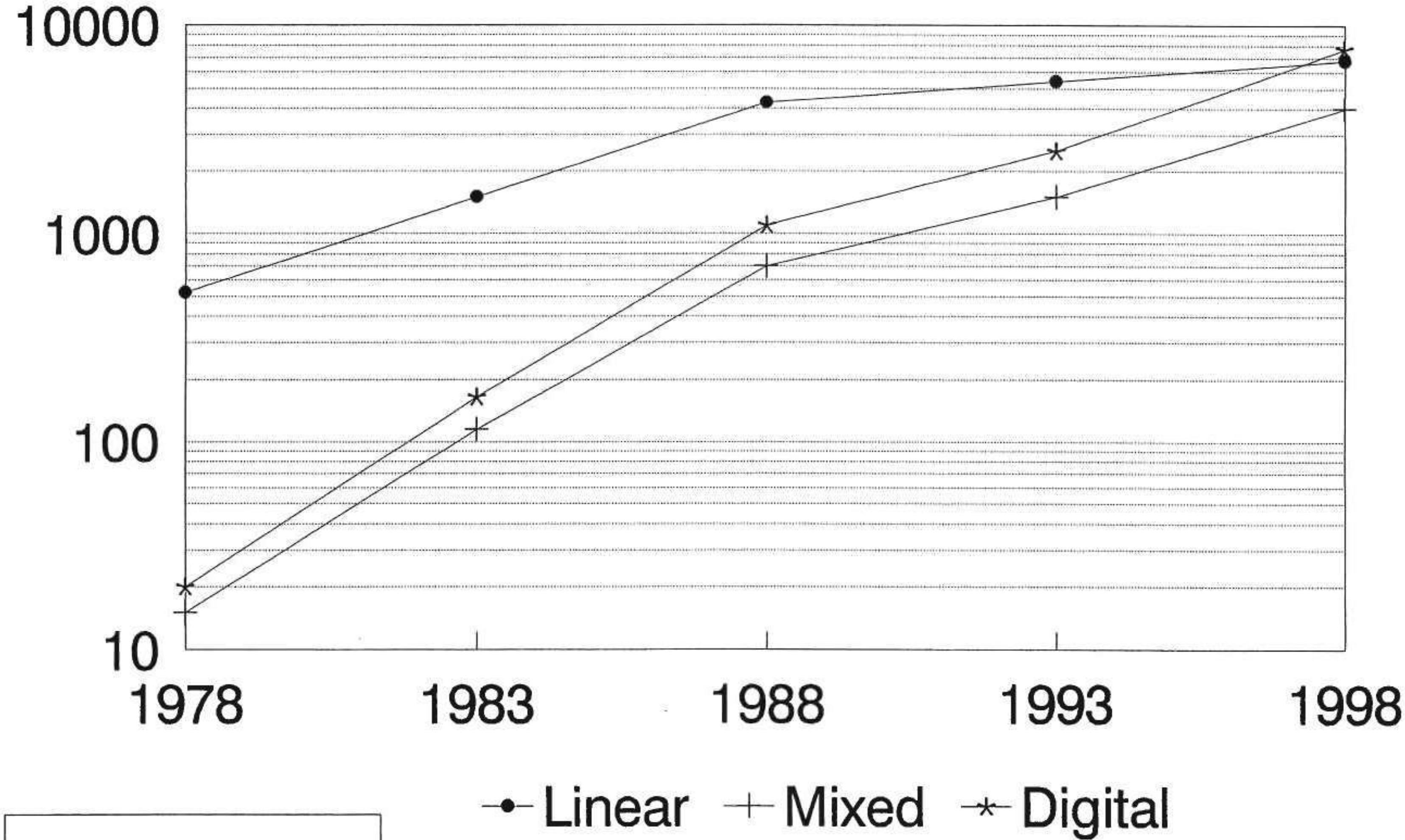
Signal Processing
Semi revenues by type



Signal Processing

Signal Processing

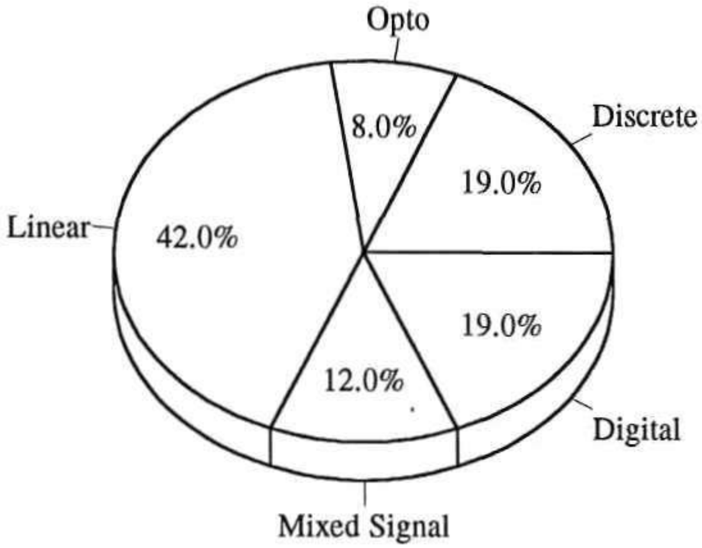
Semi revenues by type



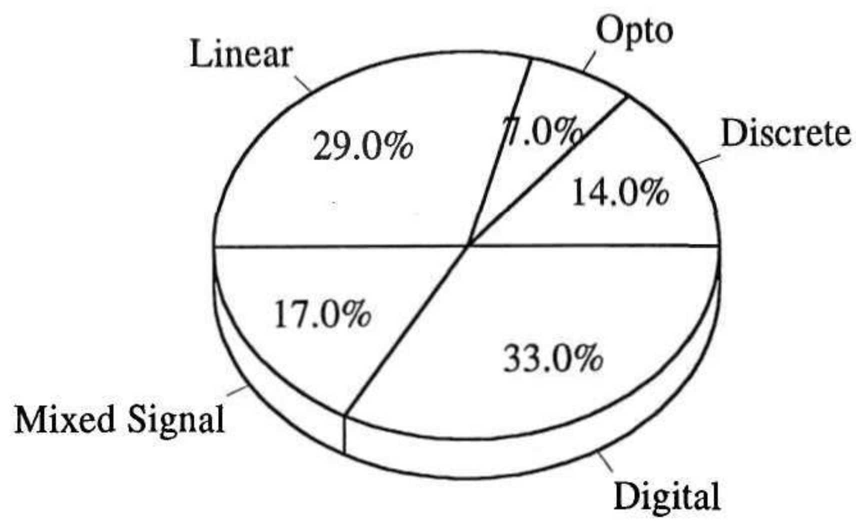
Signal Processing

Dataquest

Signal Processing by Product Type



1993 = $13 Billion

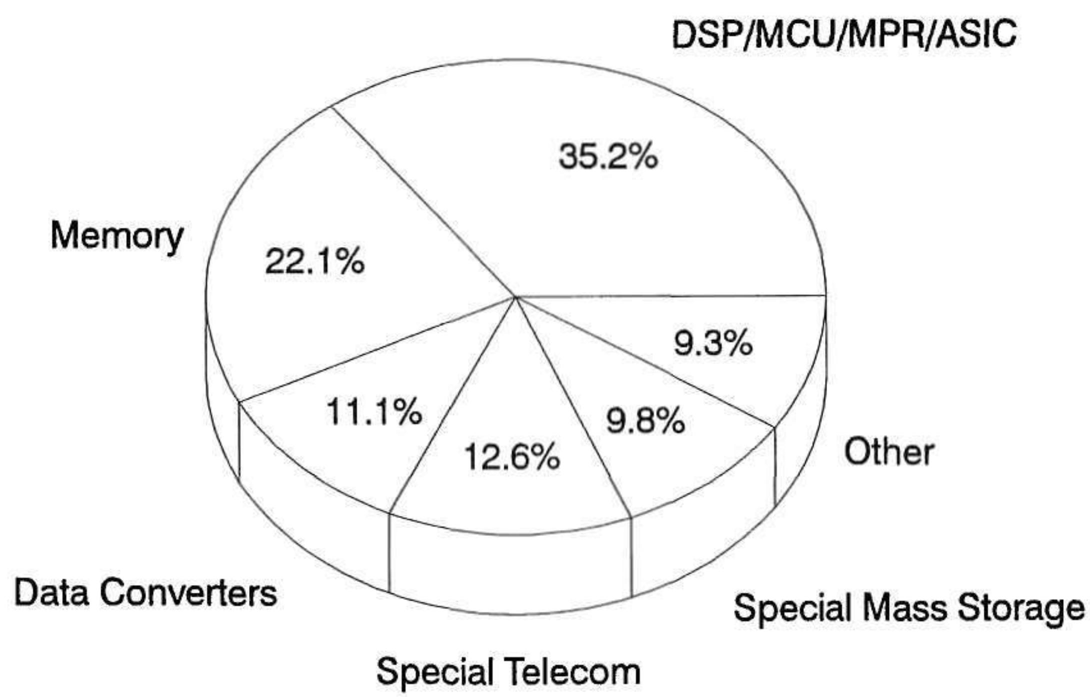


1993 = $24 Billion

Growth in Semiconductors for Signal Processing

Products	93-98 CAGR
Linear ICs	5%
Mixed Signal ICs	22%
Digital ICs	26%
Discrete	6%
Opto	10%
Signal Processing Total	13%
DSP	24%
ASP	2%

IC Types Consumed for DSP



1993 = $4 Billion

Ranking of Suppliers

ASP	DSP
Philips	TI
Toshiba	Motorola
Sanyo	AT&T
Matsushita	ADI
Sony	NEC

Audio Applications for DSP

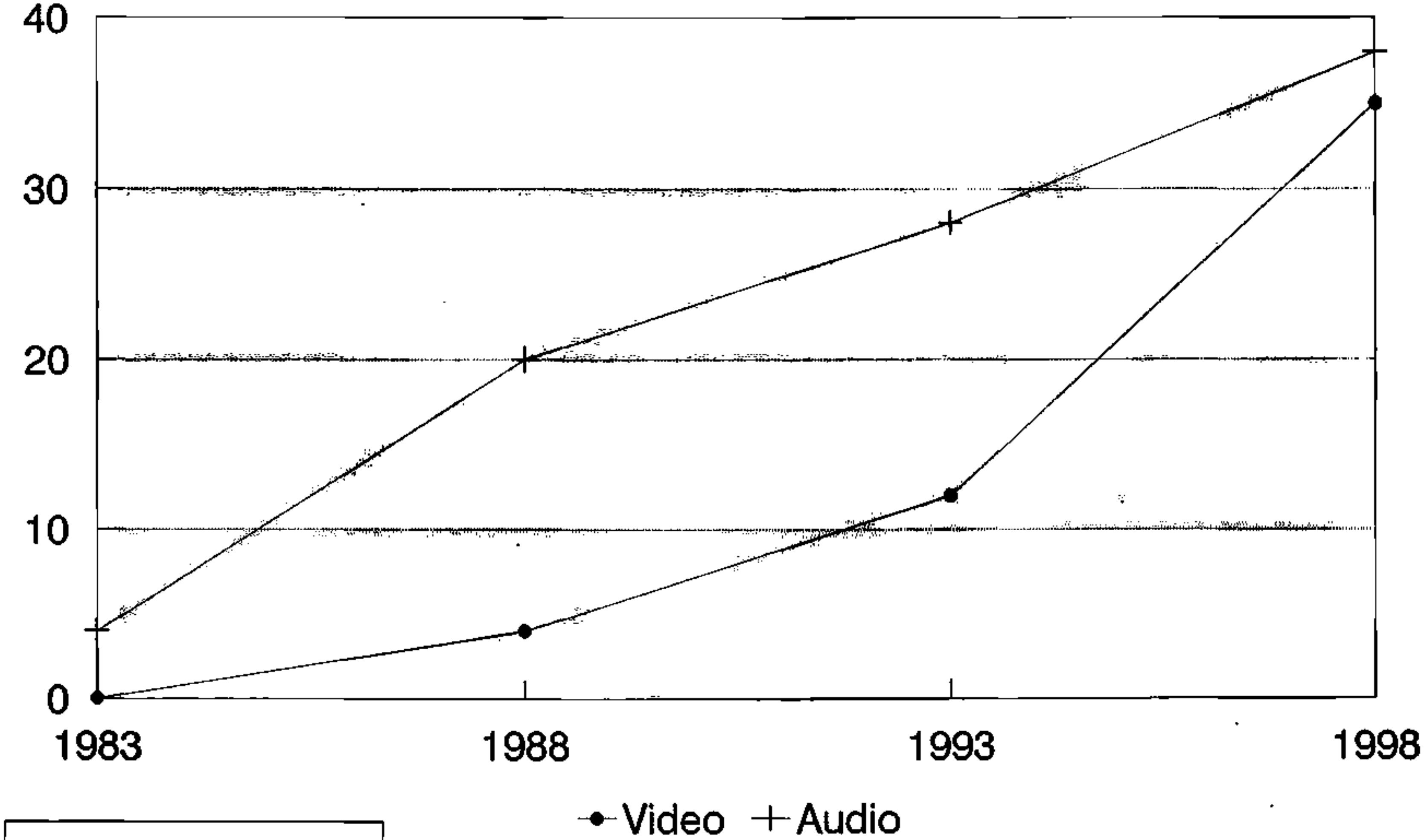
- Recording/Broadcast Audio
  - CD/DAT
  - DCC/Mini-Disc
  - MPEG Audio (HDTV, Movies, etc.)
- Speech Recognition
- Music/Sound Synthesis
  - FM Synthesis
  - Wavetable Look-up
  - Waveguide (Algorithm)
- Telecom
  - Compression/Decompression
  - Equalization/Ghosting
- Noise Cancellation

Video Applications for DSP

- Recording/Broadcast Video
  - JPEG
  - MPEG Video (HDTV, etc.)
  - Video Mixing/Special Effects
- Image Recognition/Machine Vision
- Computer-based Video
- Video Teleconferencing
  - Compression/Decompression
  - Equalization/Ghosting
- Ghost Cancellation

Consumer Electronics

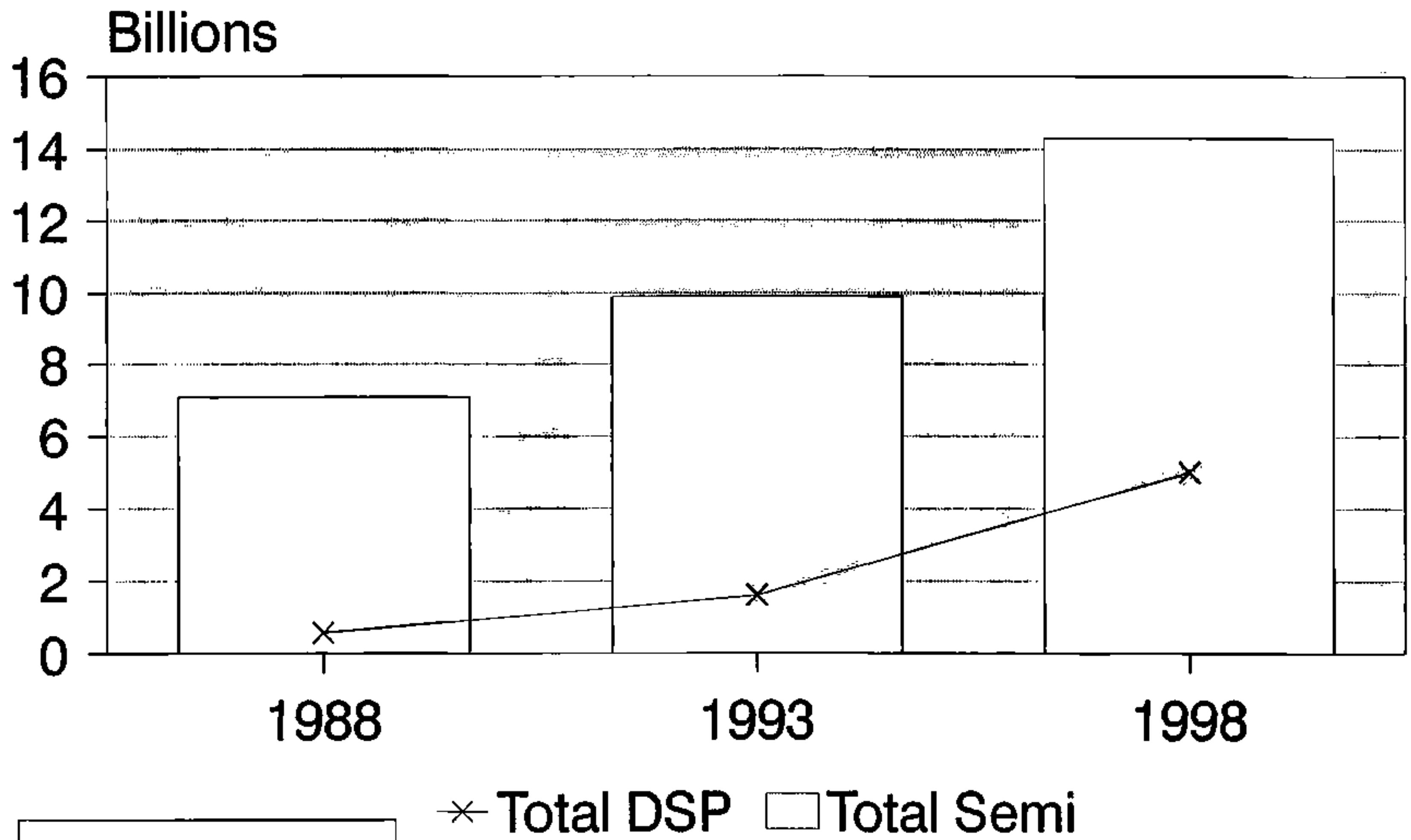
Percentage of Revenues Using DSP



Signal Processing

Dataquest

Consumer Entertainment DSP Revenues



Signal Processing

Dataquest

DSP in Computers

Analog World

Video

Audio

Digital

Mass Storage

CPU & Memory

LAN

Control

Modem

Bridging the Signal and Number Domains

Why Signal Processing in Digital Computers?

9 out of 10 Humans
prefer Signals over Numbers
for their:
Auditory
Visual
Olfactory
and Tactile
Information

Limitations of DSP

- Limited Bandwidth
  - Video, IF & RF are challenges
- Analog components still impose limits
- Digital is an approximation
- Sampling theory limitations
- Quantization and clocking noise
- Many incompatible "standards"
- Compression is often necessary
- Single processor bottleneck
- It cannot do the impossible

Summary

- 100 years of ASP dominance ended
- DSP growing at 24% CAGR
- ASP growing at 2% CAGR
- ASP will be relegated to lowest cost or highest-performance niches
- DSP is a technique not a product
- Programmable DSP vendors are well positioned in the DSP component market

Notes: