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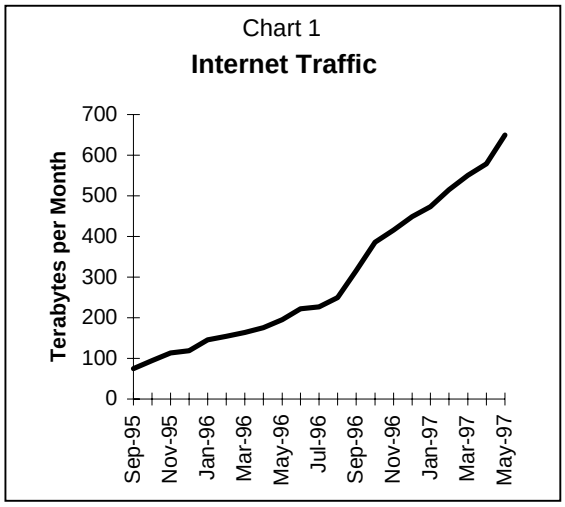
THE STATE OF THE TELECOSM: MID-YEAR UPDATE

In this mid-year issue of the GTR we will review and update a number of developments previously discussed in the pages of the GTR. This month's report includes: our monthly data on the growth of Internet traffic and an update on the explosion in Internet commerce; an update on WDM technology and companies which are opening the bandwidth potential of fiber and allowing the Internet's growth; recent news regarding **Terayon**'s breakthrough S-CDMA technology for bringing high bandwidth into the home across unimproved coax; an update on **TCI** (TCOMA), **Cox** (COX) and **Comcast**'s (CMCSK) ventures in cable Internet access (**@Home**) and wireless CDMA (**Sprint PCS**); those **NextWave** folks; developments in GaAs and SiGe radio frequency chips making advanced fiber and wireless possible; our continuing optimism over PC sales; endorsement of **Compaq**'s (CPQ) recent moves; comment on Bill Gates' recent Java move; and final notes on the somewhat exaggerated death of Wintel.

"Today communications technologies are unleashing the Internet as the definitive force of a new industrial era, rendering the CPU peripheral, and the net central . . .The net will capture as much as one half of all the world's burgeoning commerce." *GTR July 1996*

Since its inception the GTR has published monthly the only publicly available statistics monitoring the growth of Internet traffic (see Chart 1). GTG's monthly Internet traffic statistics only begin to gauge the extent of Internet expansion (perhaps capturing only 20% or less of total traffic). Yet through our limited data we are able to document the continuing explosive rise of this new medium. Today, total Internet traffic probably exceeds 3 petabytes (10 to the 15th) a month, or a some 200 fold rise since the privatization of the US's NFS Net in April 1995.



The Internet's sustained growth has disarmed its harshest critics. According to Computer Intelligence, the number of people using the Internet in the US has increased 108% to 31 million in early 1997 from 15 million the previous year. Internationally, Internet users in Japan increased 194% in a year to reach 5.3 million.

Some skeptics still question the commercial viability of the medium. Meet Michael Dell of **Dell Computers** (DELL) and John Chambers of **Cisco Systems** (CSCO). On June 17, Dell announced that his company's Internet based sales are about $2 million a day, for a run rate of $500 million dollars, up from $1 million a few months ago. On June 30, Chambers declared that Cisco would garner some $2 billion in business on its Web site this year. From start ups such as **Amazon.com** (AMZN) selling books, to **WalMart** (WMT) offering its full catalogue of products, retailers are converging on the Net in search of customers. Computer Science Corporation's 7th annual Retail Technology Study found nearly 20% of respondents say they currently offer online shopping programs and another 39% plan to offer online stores by 1999 (see Chart 2).

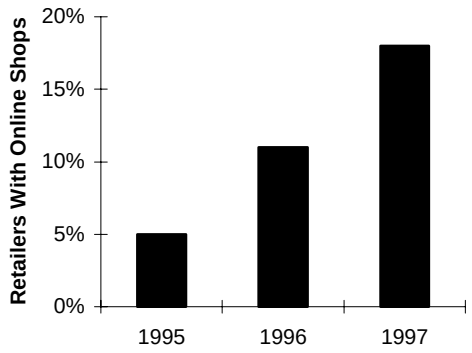
According to the Ernst & Young 6th Annual Report on Technology in Banking and Financial Services, 89% of US financial firms expect to have Internet transactions by 1999. But Myers Internet Services–a web hosting, design and marketing firm working with over 300 mortgage companies, banks and credit unions–confirms Fannie Mae estimates that roughly 1%, or

some $7 billion, of total mortgage originations would come from the Internet in 1997.

The US Labor Department's online job board, America's Job Bank, lists more than 500,000 positions at about 200,000 companies. The number of job postings on the Internet has risen from tens of thousands to millions.

A survey by Computer Intelligence reports that although use of online services such as **AOL** (AOL) and the Microsoft Network has increased 25%, direct Internet access through an ISP has skyrocketed 223%. As a consequence, more users now access the Internet directly (17.6 million) than through an online service (16 million), and a declining number of users are satisfied with the offerings on online services alone without venturing onto the Net (see Chart 3).

Chart 2
Retailers Offering Online Shopping



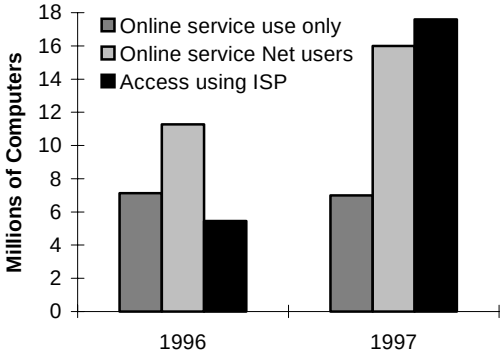
Source: Retail Info Systems

The largest online service, AOL, is quickly becoming another ISP. While the number of ISPs registered with "The List," has roughly doubled in the last year, to 5,300, some consolidation of the industry has begun. On June 11, 1997, **MindSpring Enterprises, Inc**. (MSPG), an ISP based in Atlanta, acquired the subscriber accounts of two smaller ISPs. MindSpring has now made 13 subscriber account acquisitions since the beginning of the year.

Overcoming the advantage of the online services in national access, ISPs are forming alliances to offer national and global roaming.

Yet the Net, like any fast growing adolescent, remains flawed; Bob Metcalfe is still the first to tell us how. Nourished by the on stage consumption of his December 1995 column predicting an Internet collapse in 1996–he literally ate the fiber-rich newsprint before an April audience of 1000 Web enthusiasts–the Ethernet inventor returned to the fray on June 26. In a hilarious and hard-hitting survey of the Internet delivered at his cherished MIT, he pointed out: "The Internet's routers and circuits, like the Golden Gate Bridge, are simply overrun during rush hours. And the trouble with that analogy is that during rush hour they don't throw the extra cars into the San Francisco Bay." He also called dial-up modems an "abomination": "They layer digital data packet-switching on top of the analog voice circuit-switching it was supposed to replace. Modems are the worst of both worlds. And modems know this. Just listen to the horrible hissing and screeching every time we force them to do it."

Chart 3
US Internet and Online Access



Source: Computer Intelligence

Metcalfe concluded with a call to arms which GTR heartily endorses: "I do now urge that we all take up a class action and sue somebody, perhaps the telopolies, perhaps the FCC, anybody! Demanding what I'm calling a Coppertone decision. Remember the FCC's Carterphone decision in 1968, which said, after much telco fear mongering, that competitors could connect equipment, like modems, up to telephone wiring on the customer side. The Coppertone decision I'm looking for would open up the other end of that wiring to competition….Internet access does not need monopolized central office switching. The Internet needs competitive multimegabit packet switching directly among ISPs, small businesses, schools, libraries, video arcades, and homes." Hear, hear.

"About to go public in the most important IPO since Netscape, Ciena is the industry leader in open standard WDM gear." *GTR February 1997*

By following the laws of the telecosm, wasting bandwidth and stinting on power, Wavelength Division Multiplexing (WDM) allows the simultaneous transmission of scores of optical signals on a single fiber, but it reduces power to combat nonlinearity.

The entrepreneurial leader in this technology is **Ciena Corporation** (CIEN) of Linthicum, Maryland. Initially offered to the public at $23 a share, this volatile stock is near its all time high of $54 despite its $4.85 billion market cap and a proposed further public offering, which will triple the current float.

The Ciena MultiWave 1600 has gained broad acceptance. Already there is speculation of a 40 channel Ciena product. On June 5, 1997, Ciena announced it has signed a trial agreement with AT&T. On June 10, 1997, the company won a contract with **Cable & Wireless** (CWP) for a 100 wavelength back-haul link for the new transatlantic cable system, GEMINI, a joint venture between Cable & Wireless and **WorldCom** (WCOM), to whom Ciena is now the exclusive supplier of WDM.

Leading competitors are **Lucent** (LU), **Alcatel** (ALA), and the originator, **Pirelli** (PIREX) of Italy. The dominant company in the overall market, Lucent revealed that researchers at their Bell Laboratories have tested a single-laser WDM system that can transmit an unprecedented 206 independent data streams down a single fiber thread.

Other companies that have gained a foothold in the rapidly expanding WDM arena include **Uniphase** (UNPH) and **SDL, Inc**. (SDLI). Uniphase supplies Ciena and Alcatel with WDM modulators that wiggle a signal onto a carrier beam. In March 1997, SDL also received a contract from Lucent to supply laser pump modules for use in the all-optical amplifiers used in WDM. On June 9, 1997 the company announced the introduction of the FA 30, an optical amplifier system with 30 dBm of gain, claimed by SDL to be double the power of rival products made in the US.

"In one technological coup, Terayon increased the number of homes eligible for fast Internet cable service from some 10 million to over 60 million." *GTR January 1997*

On June 4, 1997, privately held Terayon Corporation announced the initial results of Japanese field tests of its TeraComm 14 megabit per second two-way S-CDMA (Synchronous-Code Division Multiple Access) cable modem. While competing cable modems require costly system upgrades to reduce impulse noise and interference, Terayon uses spread spectrum CDMA to enable robust data performance on unimproved cable plant. Terayon and **Sumitomo Corporation** conducted the trials over a large all-coaxial system serving over 62,000 homes passed in Urawa, Japan. With better-than 98% error-free up time under the most demanding conditions, the results confirmed earlier smaller scale tests of the system's reliability and performance.

Just two weeks later, on June 19, Terayon announced that under an agreement valued at over $100 million, Israel's **ECI Telecom Ltd**. (ECILF) will provide equipment based on Terayon's S-CDMA technology to **Telenet Flanders** in Belgium, which is the world's most thoroughly cabled country. Terayon's S-CDMA technology enables the country to provide a broad range of services, such as telephony, data, video conferencing, wireless backhaul and other two-way wideband communications through the existing CATV infrastructure.

"The cable companies who joined with Sprint in its PCS venture–TCI, Cox Communications and Comcast–can benefit both from wireless CDMA and Terayon's cable break-through." *GTR January 1997*

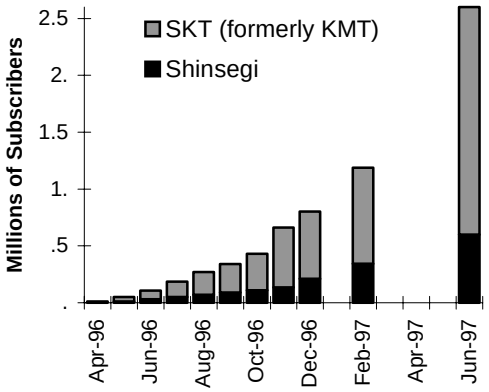
On May 28, 1997, Sprint PCS announced the launch of its CDMA Personal Communications Service (PCS) in 12 additional cities, increasing current coverage to 42 cities across the country. Nearly 90% of customers with previous cellular experience said that the call clarity of Sprint PCS is better.

The CDMA Development Group estimates some 500 thousand CDMA subscribers in the US over the last six months. This compares favorably with the May 15 announcement by GSM North American that US and Canadian GSM customers numbered 400,000 after a year and a half of service.

Now totaling 3.25 million, worldwide CDMA subscriptions promise far to exceed the forecast of 4.5 million for 1997. In addition to a half million in the US, 120,000 in Hong Kong, South Korean CDMA subscribers have reached some 2.6 million, as users increasingly trade in their analog cell phones for digital CDMA (see Chart 4). By contrast, in the US, Sprint PCS says nearly half of their subscribers are new to wireless.

Chart 4

Korean CDMA Subscribers

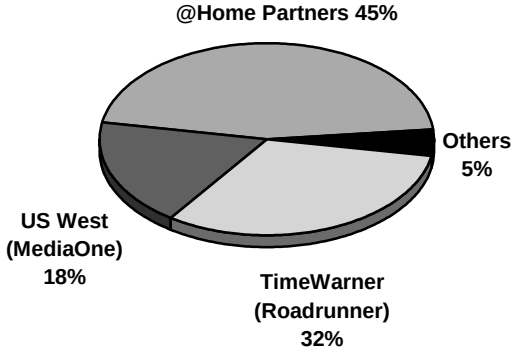


Nearly overshadowing developments in the TCI, Cox, Comcast CDMA partnership with **Sprint** (FON), was news from the three cable companies' other venture @Home. The @Home cable Internet access service, which uses Sprint for national switched ATM backbone services, announced May 19 that it had filed with the SEC for an IPO. The stock offering will be underwritten by Morgan Stanley and Merrill Lynch.

In the @Home network, popular sites are duplicated on servers near to end users and traffic will flow across a private nationwide backbone. On April 10, 1997, the Canadian cable operators **Rogers** Cablesystems (ROG) and **Shaw Communications** announced an agreement to use the @Home infrastructure to improve the speed of service to some 5,000 subscribers. As of June 18, TCI@Home and Comcast@Home were each said to have 2,000 subscribers, with 1,000 for Cox. The @Home partners' total of some 10,000 compares to 7,000 for **Time Warner**'s (TWX) Roadrunner service, 4,000 for **US West**'s (USW) MediaOne and a few hundred each for **Adelphia** (ADLAC), **Jones** (JOIN) and **Cablevision** (CVC) (see Chart 5).

Chart 5

Cable Internet Access Subscribers



On June 9, **Microsoft** (MSFT) announced that it will make a $1 billion dollar cash investment in Comcast. As if to show the investment was already paying off, Comcast announced on June 24 the expansion of its Comcast@Home Internet access service to Orange County, Detroit and Philadelphia. These deployments, Cox@Home expansion in Phoenix and San Diego, US West MediaOne service expansion in Florida, and incremental service in cities already online increase the availability of cable Internet access in the US and Canada to over 3.5 million homes passed (see Chart 6). Together the seven cable systems agreeing to distribute the @Home service to its subscribers pass approximately 44 million homes in North America.

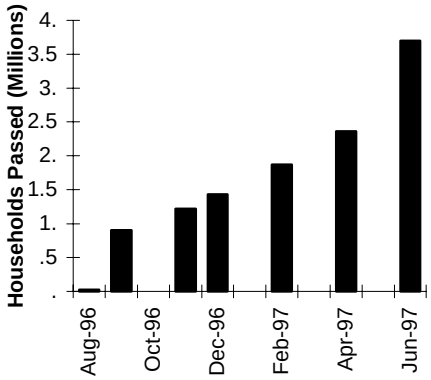
It is unclear how Microsoft's investment in Comcast, which owns a 13.3% share of @Home, will influence the cable Internet

service. As a result of a private placement in April **Netscape Communications** (NSCP) and James Barksdale received shares in @Home and Barksdale took a seat on the @Home board. The existing agreements for @Home deployment of Netscape browsers and servers may be tested by these developments. In the meantime, through Comcast and @Home, Microsoft and Netscape have entered into an awkward partnership.

An April private placement also solidified a partnership between @Home and cable modem makers **Motorola** (MOT) and **Bay Networks** (BAY). Motorola and Bay are now both @Home investors and suppliers. These new financial ties dampen hopes for any early @Home adoption of S-CDMA technology from Terayon, which is 20 percent owned by Cisco.

Chart 6

Cable Modem Service Availability

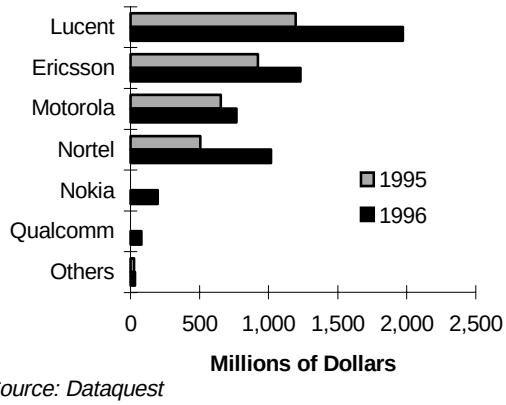


"The CDMA era will favor a new array of companies. The obvious wireless spearheads will be Qualcomm, Primeco, Nortel, Lucent, Motorola, and Sprint, with NextWave emerging as the boldest pure play." *GTR January 1997*

The US cellular and PCS wireless infrastructure market (not including handsets) grew 63% last year, to $5.3 billion, from $3.3 billion in 1995. CDMA developer Qualcomm entered the market with a 1.5% market share, while **Northern Telecom** (NT) rode CDMA orders to 104.8% growth. GSM proponent **Ericsson** (ERICY) lost market share, from 28% down to 23.2% (see Chart 7).

Chart 7

US Wireless Infrastructure Market



Source: Dataquest

On March 31, 1997 the Federal Communications Commission (FCC) suspended interest payments of licenses in the C and F block auctions. This was in part the result of the default on interest payment by **Pocket Communications**, a participant in the same auction block as NextWave. A GSM company whose shareholders include Ericsson, **Siemens Stromberg-Carlson** and Northern Telecom, Pocket is currently in Chapter 11 bankruptcy proceedings.

After solicitation of comments, the FCC held a Public Forum (June 30, 1997) to entertain opinions from representatives and financiers of the industry. The FCC will review all comments over the summer and issue its decision on a new debt structure sometime in the fall.

NextWave, which remains in registration for debt and equity IPOs, awaits a final decision by the FCC on how the debt will be restructured. To date, NextWave has paid its scheduled $504 million on the $4.8 billion in license debt. After receiving a favorable ruling on May 16, 1997 on foreign investment, NextWave has secured additional private capital overseas. Continuing its network buildout, the company will begin to offer service in 14 major markets later this year. Through May 1997, the cumulative investment in the network exceeds $60 million and current vendor financing commitments amount to more than $1.4 billion.

A developer and manufacturer of wireless communications test equipment, **Wireless Telecom Group** (WTT) has introduced an automated CDMA test station. With business from **Qualcomm** (QCOM), Nortel, Lucent, Motorola, and **Samsung**, WTT gets close to one third of its revenues from CDMA test equipment. On May 29, 1997 the company announced an initial order exceeding $1.5 million for satellite test systems. The company has provided test equipment for Motorola's troubled Iridium project and is a leading supplier in the rapidly growing market for satellite testing gear.

"The current ride of gallium arsenide (GaAs) innovators is likely to continue. But watch out for IBM's new silicon germanium." *GTR March 1997*

Strong growth in the wireless and satellite communications industries has raised the fortunes of producers of gallium arsenide (GaAs) radio frequency and digital semiconductors. According to Strategies Unlimited's *GaAs IC and FET Market Review and Forecast 1996-2000*, 1996 sales of GaAs devices were $1.3 billion, with wireless phone and data and satellite communications applications accounting for 68% (see Chart 8). North American companies led GaAs device production in 1996, accounting for 47% of shipment revenues, followed by Japan's 44% share.

Threatening the ambitions of the GaAs specialists, however, are recent advances in silicon germanium (SiGe) semiconductors,

now coming to market in commercial products. On June 19, 1997, Nortel announced an agreement with the dominant SiGe developer, **IBM**, under which Nortel will design fiber optic, cellular, and PCS devices to be manufactured by IBM.

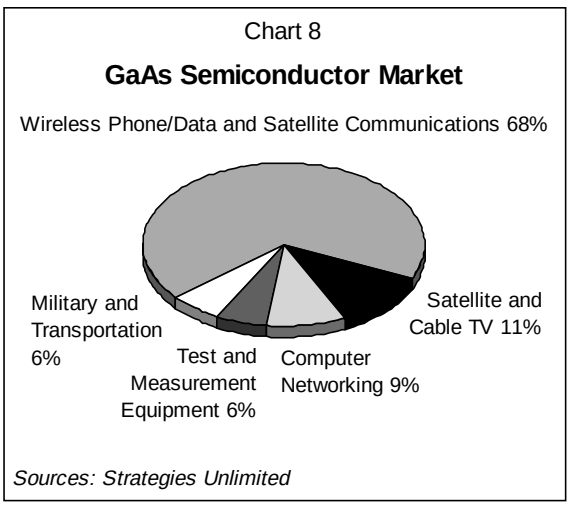
Also providing SiGe products to Nortel is **SiGe Microsystems** of Ontario, Canada. Although the company is only about 8 months old, its principals have some 12 years experience working in SiGe as researchers with the National Research Council of Canada's Institute for Microstructural Sciences. Developing SiGe independently from IBM , SiGe is currently negotiating to license IBM's SiGe patent portfolio. SiGe Microsystems also has relationships with **Leybold** of Germany and **Epigress** of Sweden, the two manufacturers of the unique ultra high vacuum/ chemical vapor deposition (UHV-CVD) equipment that is essential for manufacturing ultra high speed SiGe heterojunction bipolar transistor devices (HBTs).

Privately owned by Canadian investors, SiGe Microsystems recently secured $5.5 million of venture capital. The company currently counts 10 major US and Japanese companies as customers of their SiGe epitaxial and design services, and projects its first year sales of approximately $1 million to grow to $50 million in 3 years. Their first commercial product offering is a Global Positioning System (GPS) module which will ship in Q4 1997.

In addition to their Nortel announcement, IBM indicates that their previously disclosed work with Hughes and other companies will yield a flurry of SiGe announcements and activity in the coming months. After failing to find an adequate market to justify IBM's $2 million annual license fee, however, Analog Devices, an early leader in SiGe designs, has turned to SiGe Microsystems.

Chart 8

GaAs Semiconductor Market

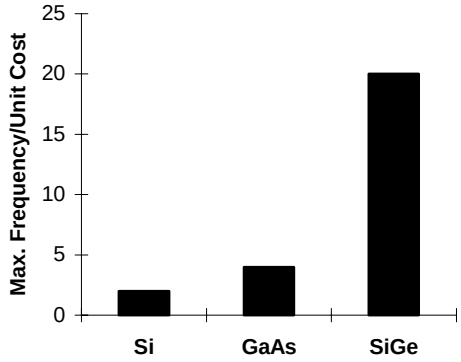


Sources: Strategies Unlimited

In the May issue of Microwave Journal, Hughes describes their success in reaching chip speeds as high as 200Ghz. This would allow SiGe to compete favorably with GaAs in performance across the range of frequencies where GaAs is now dominant. SiGe Microsystems claims SiGe devices with frequencies from the current 2Ghz limit of ordinary silicon up to 20Ghz, a range which encompasses nearly all of the current market for RF chips. Meanwhile, **M/A-COM** has announced breakthroughs in microwave power amplifiers, previously thought to be a gallium arsenide stronghold. With performance comparable to GaAs, SiGe chips cost one third as much to build since they can be manufactured on traditional silicon lines. Testing and packaging costs for GaAs can also run as much as ten times higher.

Chart 9

Price-Performance of Si, SiGe, GaAs



Falling over the cliff of costs (see Chart 9), while maintaining performance, reducing power and increasing environment robustness, SiGe has the potential to seriously compromise the future of the three GaAs companies that we have cited in various Reports, **Vitesse** (VTSS), **Triquint** (TQNT) and **Anadigics** (ANAD). These firms have experienced substantial price appreciation in the stock market, based on estimated earnings per share growth in the 30% to 35% range over the next five years. Vitesse is building a new chip fabrication plant estimated to cost $70 million and operational sometime in 1998. Given the advantages in cost and performance of the SiGe chips, GaAs is now maturing and has been deleted from our Table of ascendant technologies.

"By resuming the ultra-Moore cost-slope, falling DRAM prices will enable more balanced machines. The likely result is a sharp upside surprise in computer sales–and thus in semiconductors–through 1997." *GTR July 1996*

In 1996, US PC sales to homes and businesses topped TV sales and the trend has accelerated in 1997 (see Chart 10). Survey data shows the number of consumers planning to buy a home PC during the next six months has also surpassed TV purchase plans (see Chart 11). This shift has resulted from the growing influence of sub-$1,000 PCs in the retail market, rising to a third of all sales. These lower PC prices are proving the elasticity of demand for PCs. A Wall Street Journal/ NBC News poll in mid-June 1997, confirms the rise in PC penetration into a majority of homes, 51% (see Chart 12). Not only are low income first time buyers raising PC penetration levels, but higher income families are buying additional and replacement PCs.

Further accelerating sales of low-end PCs and opening a market for high-end entertainment PCs is the latest round of **Intel** (INTC)price cuts (see Chart 13). Aimed at Intel rivals **AMD** (AMD) and **Cyrix** (CYRX), this 50% drop brings Pentium prices below comparable AMD products and to about Cyrix's level. With AMD adding a further 25% cut below Intel, the microprocessor price wars will soon benefit makers of the components, software and peripherals that are sold into a booming PC market. This development resembles the gains of one year ago, when in the first issue of GTR we forecast a booming computer market. With DRAM prices also returning to the lows of late last year, the value found in today's PCs will bring computers into more homes.

Packard Bell has regained retail market share through their

low price leadership, but with comparable unit volumes, Compaq has come out on top with revenues some 40% higher than Packard Bell, due to higher ASPs (average selling prices). On June 30, Compaq introduced a Cyrix Media GX 180 PC priced at $799 and a Pentium 200 Mhz PC at $999, deals rivals claim they will be hard pressed to match. The low prices have had the effect of pushing out the traditional low price clone makers. Retail buyers cannot justify stocking unknowns when top-tier Compaq PCs can be sold at comparable pricing. Compaq has also made impressive gains in the laptop market long dominated by Toshiba. Over a short few months Compaq skyrocketed into the number one position in dealer channel sales and the number two slot in retail.

Chart 10
US PCs vs. TVs

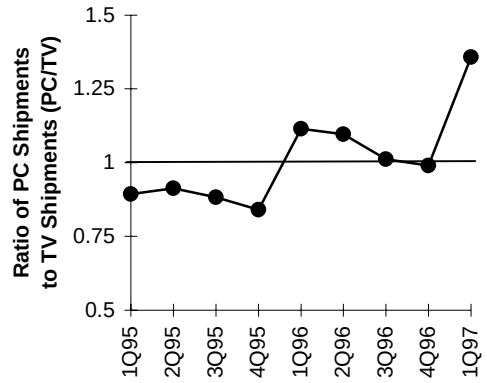
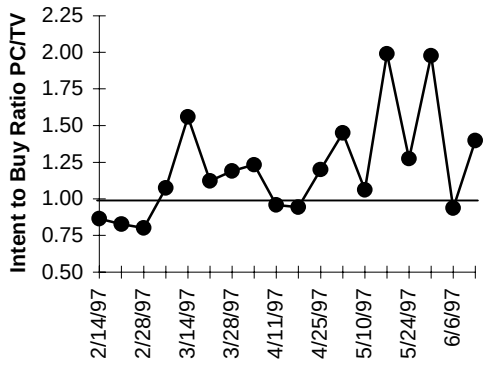


Chart 11
PCs vs. TVs Consumer Purchase Plans



Source: CRW, Verity

Chart 12
US PC Penetration

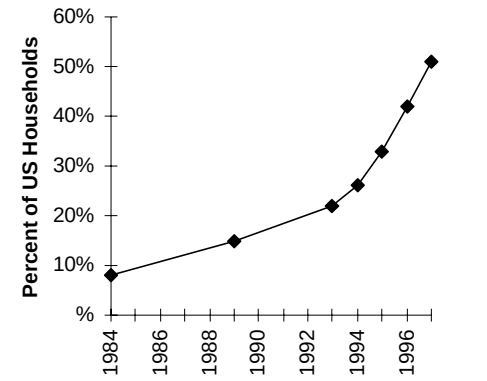
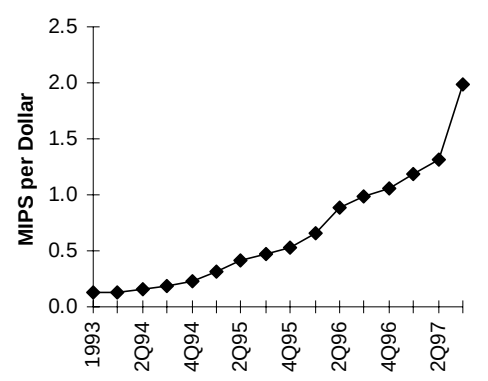


Chart 13
Pentium Price Performance



"A precursor of the new computer architectures is Tandem's ServerNet system. Recently adopted by NEC and four other majors and being tested by IBM, it will be introduced by Compaq in the fall." *GTR July 1996*

Obviously, Compaq was pleased with ServerNet. On June, 23, they announced the purchase of **Tandem** (TDM) for approximately $3 billion, a price nearly 50% above its prior close.

Across the computer spectrum from super scalable NT server clusters down to handheld PCs, Compaq is aiming to meet every customer's every need. It is cutting parts and development time, improving inventory control, and instigating a new model of Internet based computer sales, in which retailers handle the sale but computers are shipped direct from Compaq–or through a retailer for final configuration. Compaq hopes to realize savings comparable to those achieved by Dell Computer's direct marketing. While Packard-Bell, **HP** (HWP) and other computer sellers move to offer direct sales in competition to their retail partners, Compaq hopes its hybrid model of retailer based build-to-order Internet sales will allow it to compete with the cost structures of the direct sellers, while maintaining its strength in stores where the retailer's support is as significant as low price points. Though squarely entrenched in the Wintel camp and even with the addition of Tandem not yet a core Telecosm company, among PC manufacturers Compaq is clearly well positioned into the future.

"With Bill Gates' amazing intellectual openness and strategic decisiveness, he is moving to make Microsoft the leading Java company. The question is whether he can jettison his proprietary base or whether the proprietary base will corrupt Microsoft's Java products with the usual Redmond gotchas."

GTR October 1996

In Microsoft's vision of the Internet, the links run between Microsoft products, where Office is web enabled, not where the web enables the office. In the view from Redmond, Java programs are written and optimized for Windows and interoperability comes from replacing competing OSs with Windows. On June 18, Microsoft announced J-Direct, their most sweeping move to "embrace" Java. J-Direct opens the full range and legacy of Windows application interfaces (APIs) to Java programmers, simultaneously raising Java's status and functionality to an equal level with Visual Basic and C++ but potentially reducing Java to merely another Windows language. J-Direct is the antithesis of 100% pure Java. While jump starting Java development with new functionality, it replaces "write once run anywhere" with "write once for Windows."

But Microsoft's bold move is double edged. It means that Java has come of age. Java can now be learned and used by programmers without fear that they are producing immature applets rather than real applications. The universe of Java programmers and programs grows in number without any delay awaiting universal Java APIs from **Sun** (SUNW) and others. These early Windows optimized programs will lack Java's promise of true interoperability, but the hundreds of thousands of Java programmers put into business by Microsoft will also be ready when 100% pure Java comes of age. As Java moves beyond PCs and becomes the dominant language for use in everything from smart phones to smart cards and becomes embedded in devices on which no one would dream of ever running Windows, the vision of 100% pure interoperable Java will eclipse Microsoft Java. And thanks to Bill Gates, the programmers will all be up to speed. Checkmate, Java.

Meanwhile, from the world of Java come…

Coastek InfoSys, Inc. (Private) offers a Java administrative interface to simplify access control and monitoring for secure electronic commerce.

VPNet Technologies, Inc. (Private) supplies Virtual Private Networks (VPNs) incorporating Java applications that let network managers define, configure and manage VPNs from any location equipped with a computer hosting a Java-compatible browser.

Applix, Inc.'s (APLX) TM1 Server 7.0 provides the first real-time analytical solution that enables enterprise-wide financial online analytical processing (OLAP). Accessible via Java, it combines with Applix Anyware to customize and deploy Applix's full suite of programs remotely across the Net.

Corel Corporation (COSFF) now ships WordPerfect Suite 8 in Java, including Corel Barista, a Java application that allows users to easily publish content-rich pages to the Web without complicated programming.

Digital Equipment Corp. (DEC) launches Java Development Kit and Digital just-in-time (JIT) Java compiler for Digital Unix.

"Microsoft and Intel are both determined to succeed in the new era. That means they must become fully committed new paradigm firms. History is against them. But both firms have created history before, and defied it."

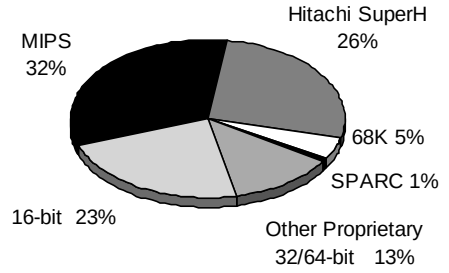
GTR November 1996

Covering all fronts, Microsoft continues its imperial advance, with a 30% share of the installed base of browsers and with browser share among new users perhaps equaling Netscape; a number 2 share of public Internet web servers behind freeware Apache; NT sales challenging Unix on the workstation and small server levels; Windows CE scaling to smaller devices; work with **DirecTV** to bring data to existing satellite services; designs for Windows 98 to include a TV tuner, program guides, DBS, DVD and audio support; and a crushing embrace of Java technology.

Chart 14

MPU/MCU Shipments in Next-Generation Consumer Electronics

1996: 51.5 Million Units



Source: Dataquest

With cash reserves dwarfing the revenues of all the Internet startups, Microsoft has the capability to crush competition through software giveaways (Internet Explorer); revive ailing services (lackluster WebTV has increased subscribers 50%, from 56,000 on April 1, when Microsoft took the helm, to 85,000 on June 17); purchase the technology its lacks (DimensionX, …); invest massively in future bandwidth (Comcast, Teledesic); and buy content (digital photo rights).

Bill Gates has proved capable of swift direction changes while maintaining the overriding goal of keeping his highly profitable Windows monopoly. As long as he remains open to criticism, Microsoft's stock may not soon tumble from its low earth orbit.

Intel chairman Andy Grove was recently seen giving a keynote address at the Netscape developers conference. Speaking to a room of Microsoft bashers, he was touting the virtues of Java and his plans for chips optimized for Java in Intel machines. The new **Oracle** (ORCL)/Netscape Network Computer (NC) uses an Intel processor. Taking a clue from Gates regarding the best means to deal with market

TELECOSM TECHNOLOGIES

ASCENDANT TECHNOLOGY	REPORT(S) Volume: No.	COMPANY (SYMBOL)	Initial Reference Price	Price as of 06/27/97
Erbium Doped Fiber Amplifiers, Telecommunications Infrastructure, Wave Division Multiplexing (WDM)	II: 2, 3, 4	*Alcatel* (ALA)	16 3/4	25 5/8
Analog to Digital Converters (ADC), Digital Signal Processors (DSP), Silicon Germanium	II: 3	*Analog Devices* (ADI)	22 3/8	26 5/8
Java Thin Client Office Suite, Rapid Application Development (RAD)	II: 6	*Applix* (APLX)	4 1/2	7 5/8
Digital Video Codecs	II: 5	*C-Cube* (CUBE)	23	17 1/2
Erbium Doped Fiber Amplifiers, Wave Division Multiplexing (WDM)	II: 2	*Ciena* (CIEN)	23 *	45 1/8
Low Earth Orbit Satellites (LEOS)	I: 2 II: 1, 3, 4	*Globalstar* (GSTRF)	21 3/4	28 7/8
Telecommunications Equipment, Wave Division Multiplexing (WDM)	II: 1, 2	*Lucent Technologies* (LU)	47 1/8	71 13/16
Internet Software	I: 1, 3, 4 II: 1, 4, 6	*Netscape Communications* (NSCP)	53	33 1/2
Code Division Multiple Access (CDMA)	I: 1, 2 II: 1, 3, 4	*Qualcomm* (QCOM)	38 3/4	50 3/4
Java Programming Language, Internet Servers	I: 1, 2, 3, 4 II: 1, 5, 6	*Sun Microsystems* (SUNW)	27 1/2	36 5/8
Servernet System Area Networks (SAN)	I: 1	*Tandem Computers* (TDM) **	9 1/2	19 3/4
Optical Equipment, Smart Radios, Telecommunications Infrastructures	I: 1 II: 1, 2, 3	*Tellabs* (TLAB)	29 1/8	55
Digital Signal Processors (DSP), DRAM	I: 2, 3, 4 II: 5	*Texas Instruments* (TXN)	47 1/2	85 5/8
Wave Division Multiplexing (WDM) Modulators	II: 7	*Uniphase* (UNPH) +	58 3/4	58 3/4
Code Division Multiple Access (CDMA) Testing Gear	II: 1, 2	*Wireless Telecom Group* (WTT)	10 3/8	10 5/8
Field Programmable Logic Chip	I: 3	*Xilinx* (XLNX)	32 7/8	47 7/8

* Initial Public Offering ** To be acquired by Compaq for $3 billion + New Addition Deleted: Vitesse

Note: This table lists technologies in the Gilder Paradigm, and representative companies that possess the ascendant technologies. But by no means are the technologies exclusive to these companies. In keeping with our objective of providing a technology strategy report, companies appear on this list only for these core competencies, without any judgement of market price or timing.

competition, Intel dropped Pentium prices some 50% to hold off AMD and Cyrix. And despite their legacy systems, Intel spearheads the PC industry's crusade to replace TVs as the dominant household appliance.

On a negative note, Intel has been absent from Windows CE handheld PCs–being dominated by **Hitachi** (HIT)–and has been blown away by the competition (MIPS) in the booming video game industry. The market for processors powering "next-generation consumer electronics"–56% are going into advanced video game machines like the **Nintendo** 64–grew 300% last year without Intel participation (see Chart 14). Our warning remains that the all powerful desktop PC, even evolved into the entertainment center PC, will not be the most prevalent computing device in the Telecosm.

Opening up opportunities for upstarts to grab the crowns worn by Gates and Grove, the Telecosm will take us beyond the current Wintel era. But giants have strength to crush the little ones in the grass, if they can see down to the ground. As Intel and Microsoft adjust and adapt to the new world–with the network central and the CPU peripheral–their almost monopolistic positions become vulnerable to new competition. While both companies have not made their way on to our list of ascendant technologies, Intel has risen 103% and Microsoft 118% since the first GTR. That's nearly twice the appreciation of average new paradigm companies. By the millennium, this divergence will close. Like IBM in 1985, on the verge of the Wintel ascension, Microsoft and Intel now are entering a new phase of competition and challenge.

George Gilder and Ken Ehrhart, June 30, 1997

After much consideration, we have decided to allow ForbesASAP exclusive rights to publish an occasional adapted text from the reports some six to eight weeks following receipt by GTR subscribers. In practice this will mean there is a possibility of a second wave of impact after initial publication.

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