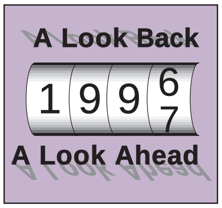
First Media Processors Reach the Market

Programmable Solutions from Chromatic, Philips Gain Momentum



by Peter N. Glaskowsky

Despite limited availability in 1996, media processors became a significant factor in the PC market. Several new architectures were introduced in 1996. There are now three major architectures for the PC market, and designers of consumer electronics have several to choose from.

Most of the activity was behind the scenes: building strategic relationships between hardware and software vendors and attempting to influence the development of 3D and multimedia architectures at Microsoft. These efforts will guide the formation of the market over the next few years.

This year will be much busier than last, as the plans of several vendors finally reach fruition and customers get their first look at the new technology. Products based on Chromatic's Mpact will hit the streets this month or next, with the Philips TriMedia only three months behind. Samsung's more ambitious MSP should arrive late in the year, finally allowing direct comparisons among the three chips based on real applications instead of raw clock rates.

While these three vendors are hoping to gain design wins in both PCs and consumer products, other vendors are more narrowly focused on consumer devices. By eliminating some of the overhead required by PCs, such as floating-point support and a PCI interface, these embedded chips aim to reach the lower price points required for consumer products. Fujitsu and Mitsubishi have announced such devices, with DVD players as the primary target; Oak and C-Cube are expected to follow suit this year.

Rendition is in a class by itself. With its programmable core, the Vérité chip looks much like other media processors, but the company has positioned the device solely as a 3D accelerator for PCs. Vérité competes mainly against hardwired 3D graphics chips.

Combining Capabilities Can Cause Confusion

Flexibility, the greatest advantage of media processors, may also be their biggest problem. In some ways, media processors are a middle-of-the-road technology. In theory, they combine the cost/performance advantages of hardwired solutions with the flexibility of software implementations. This opens them to competition from several directions, however. Makers of hardwired graphics and audio chips, along with software-only vendors, can target specific aspects of PC multimedia and sometimes offer better point solutions.

The media-processor solution does not satisfy all PC OEMs. Some system vendors believe that the classic approach, with separate subsystems for graphics and audio, provides a more useful form of flexibility. By offering a selection of graphics solutions—a low-end 2D/3D chip on the motherboard, or a few different PCI cards—as well as hardware and software alternatives for audio, vendors can create a well-differentiated product line. Media-processor boards can be difficult to fit into this strategy. Even though media processors can provide high-performance graphics along with high-quality audio, they potentially eliminate several configurations from a system vendor's product line.

This problem is really the result of the checklist mentality that prevails at many PC vendors. Product differentiation is achieved by checking off a different set of items—3D acceleration, MPEG playback, wavetable audio, etc. Media processors are just too good at this game: they allow the vendor to check off every box, as long as the media processor has the right software available.

The narrow checklist view makes media processors look so good that vendors have a hard time explaining why the user should want any other system configuration. The solution to this quandary is to offer media-processor solutions at several performance levels. Low-end and midrange systems can be differentiated solely by the software components sold with the system, while high-end systems can be equipped with faster hardware and even more software.

Chromatic to Take Early Lead

The first full-featured media processor to ship will come from Chromatic Research. Chromatic's two original partners, Toshiba and LG Semicon, shipped the first production units of the Mpact/3000 media processor to OEMs in September of last year. In November, SGS-Thomson became the third (and final, according to Chromatic) source for Mpact. SGS-Thomson is likely to begin shipping product in late 1997.

The key strengths of first-generation Mpact parts are in the areas of 2D graphics, audio, and MPEG-2 playback. Mpact's 3D performance will improve dramatically with the arrival of floating-point hardware and a rendering pipeline on Mpact 2, but Mpact/3000 is at least competitive with low-end 3D chips like the S3 Virge and ATI Rage.

No Mpact-based products have yet appeared in retail sales channels, and only LG Electronics has even announced a board-level Mpact product. Even so, Chromatic anticipates strong sales this year, primarily in motherboard applications. The Mpact R/3000 and R/3600 are expected to ship in volume in 1Q97, adding an internal RAMDAC and a faster speed grade, with the Mpact 2/6000 shipping in 3Q97. This lineup will give Chromatic customers four parts to choose from, providing much-needed product-line differentiation.

	Chromatic Mpact R/3000	Chromatic Mpact 2/6000	Philips TM-1	Philips TM-PC	Samsung MSP-1	Samsung MSP-1G
2D acceleration	Yes	Yes	No	Yes	No	Yes
3D geometry (polys/s)	n/a	1M	750K	750K	750K	750K
3D setup (polys/s)	n/a	1.2M	1M	1M	750K	750K
3D fill rate (pixels/s)	5M	42M	n/a	n/a	n/a	n/a
MPEG-1 decode	Yes (SW)	Yes (SW)	Yes (SW)	Yes (SW)	Yes (SW)	Yes (SW)
MPEG-2 decode	Yes (SW)	Yes (SW)	Yes (SW)	Yes (SW)	Yes (SW)	Yes (SW)
MPEG-1 encode	Yes (HW)	Yes (HW)	Yes (SW)	Yes (SW)	Yes (SW)	Yes (SW)
Videoconferencing	Yes	Yes	Yes (SW)	Yes (SW)	Yes (SW)	Yes (SW)
Video in	Yes	Yes	Yes	Yes	Yes	Yes
Video out	Yes	Yes	Yes	Yes	Yes	Yes
Audio support	Yes	Yes	Yes	Yes	Yes	Yes
Telephony support	Yes	Yes	Yes	Yes	Yes	Yes
Clock rate	62.5 MHz	125 MHz (est.)	100 MHz	100 MHz	100 MHz	160 MHz
Integer ops/cycle	48	48	38	38	64	64
Peak integer perf	3.0 GOPS	6.0 GOPS	3.8 GOPS	3.8 GOPS	6.4 GOPS	10.2 GOPS
Int width at peak perf	8 or 9 bits	8 or 9 bits	8 bits	8 bits	8 bits	8 bits
Peak FP performance	n/a	0.5 GFLOPS	0.5 GFLOPS	0.5 GFLOPS	1.6 GFLOPS	2.5 GFLOPS
Local RAM bandwidth	500 Mbyte/s	1200 Mbyte/s	400 Mbyte/s	400 Mbyte/s	800 Mbyte/s	1280 Mbyte/s
Open SW dev env	No	No	Yes	Yes	Yes	Yes
Price for chip	$50	n/d	$50	$53	n/d	n/d
Production date	Now	n/d	Now	8/97	3Q97	n/d

Table 1. Samsung's MSP-1 shows a clear advantage in both integer and floating-point performance compared to other PC media-processor architectures, while Chromatic's Mpact includes the broadest range of features. n/a=not applicable, n/d=not disclosed (Source: vendors)

Introducing second-generation Mpact technology even before first-generation parts had reached the hands of end users was a gutsy but correct decision. Chromatic is a small company, and Mpact 2 should reassure potential customers that Chromatic is determined to become a significant force in the PC market.

Software, Business Models Evolve

High-performance media processors mean nothing to end users without software to implement the necessary multimedia algorithms. Chromatic refers to this code generically as Mediaware, and derives most of its revenue from Mediaware licensing. Licensing fees for chip designs are calculated to cover the cost of chip development, not to generate profit.

Chromatic has released version 1.0 of its Mediaware library, which supports basic 2D, 3D, audio, telephony, and digital-video functions. The company has already described some of its plans for the next release in 1H97, adding DVD support, videophone operation, and more advanced audio and telephony features. This next release will also take advantage of MMX extensions, if present, to reduce host-processor overhead. All of this work is being done by Chromatic's 100+ software engineers, certainly a challenging task.

Chromatic does not make it possible for its semiconductor partners, or anyone else, to develop software for Mpact, although the company remains open to the possibility if a compelling case is offered for some specialty function. Aside from business issues, developing for a complex VLIW (very long instruction word) SIMD (single-instruction multiple-data) architecture is inherently difficult. If Chromatic were to allow third-party software development, it would have to expend considerable effort on tools, training, and technical support for the independent developer.

TriMedia Provides First Competitor to Mpact

The Philips TriMedia TM-1 is close on the heels of Mpact. Entering production only three months later than the Chromatic design, the TM-1 offers potentially better performance at a higher cost. As Table 1 shows, the chip's processor core is more directly comparable to the Mpact 2's, since it includes floating-point support. Both use VLIW and SIMD techniques to achieve high performance on multimedia algorithms.

Philips, however, chose not to include hardware support for 2D/3D graphics or MPEG encoding in the TM-1. While the TM-1 is nominally capable of acting as an SVGA-compatible display controller with the appropriate firmware, performance is likely to be unacceptably slow in this mode, and Philips does not emphasize this capability. Later TriMedia parts will remedy this omission.

In fact, Philips's roadmap refers to no fewer than seven TriMedia derivatives, as Figure 1 shows. By the end of 1997, Philips may be shipping the TM-1 (itself a shrink of previous internal versions), a TM-1c with further feature shrinks, a TM-PC for Microsoft's Talisman, and a TM-CE version for consumer-electronics applications. In 1998, Philips expects to have a TM-2 with 4× the performance of the TM-1 and additional (but unspecified) features. TM-2 will beget TM-TV, a version for interactive televisions from the Philips consumer-electronics division. An even faster part, described only as TM-3, may arrive in 1999.

In other respects, the TM-1's level of integration is similar to that of Mpact 2, with digital audio and video I/O. The

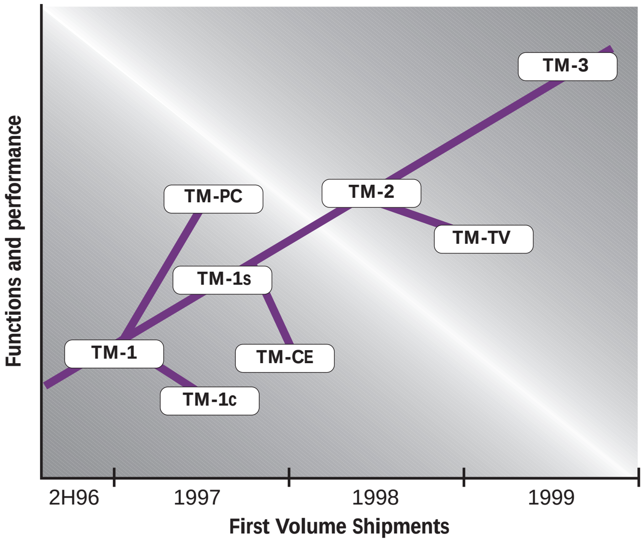


Figure 1. Philips's Trimedia roadmap shows a plethora of parts, including the mainline of TM-1, TM-2, and TM-3 as well as several derivatives aimed at specific markets. (Source: Philips)

Philips TM-1 reference design emphasizes these features, providing video digitizing and playback plus sound and telephony features. Most TM-1 products will follow the same pattern, leaving 2D/3D graphics on the motherboard or a separate expansion card.

Apple's recent adoption of TriMedia fits well with the part's current capabilities. This plan is similar to Apple's earlier use of a DSP for QuickTime acceleration. The coprocessor approach was dropped when Apple moved from the 68K to PowerPC, but now it's back. TriMedia thus becomes Apple's response to Intel's MMX. IBM, Motorola, and Apple have not developed multimedia extensions for the PowerPC processor family, so Apple was forced to find another way to provide multimedia acceleration for its platform.

Samsung Promises Best Performance

The most ambitious media-processor design yet described is Samsung's MSP. Although the first 100-MHz MSP is not scheduled to ship until 3Q97, Samsung has already described a 166-MHz follow-on that will exceed 10 BOPS on 8-bit data. Even the 100-MHz part matches the integer performance of Mpact 2 in the same time frame.

MSP shines in floating-point throughput. Its 256-bit-wide SIMD engine—four times wider than Mpact's—supports a 32-bit IEEE-compliant floating-point representation in addition to the 8-, 16-, and 32-bit integer formats common to most media processors. The result is a peak execution rate of 1.6 GFLOPS on multiply-accumulate operations at 100 MHz, far exceeding the FP capabilities of all other announced parts, as Table 1 shows. Floating-point performance translates directly to 3D geometry performance, giving MSP a significant advantage over host-based geometry processing and other media processors on complex 3D scenes with many small triangles.

Samsung sidestepped another problem faced by other media-processor vendors: the inefficiency of scalar tasks like communications and scheduling on vector processors. Instead, MSP includes an independent ARM7 processor core to handle system-level tasks like scheduling and host communication without interfering with the vector processor.

Talisman Offers Opportunity for TriMedia, MSP

Although Philips and Samsung plan to add limited 2D and 3D support to future versions of their media processors, the best opportunity for market-leading 3D performance for both architectures will come from Microsoft's Talisman initiative. Talisman defines a radically new 3D rendering architecture with chunk-based rendering and dynamic image-layer compositing. Aimed at the entertainment-software market, Talisman's enhancements should yield dramatically higher 3D throughput.

Microsoft's Talisman reference design will use TM-PC to accelerate 3D geometry calculations as well as audio and video operations, creating a comprehensive single-board multimedia solution that places very little demand on the host CPU except for scene definition and data-structure maintenance.

Samsung's MSP is also part of the Talisman program, but MSP's schedule is far enough behind the TM-1's that Microsoft has settled on TM-1 for the first reference design. Samsung will produce its own reference design once MSP is ready, giving software vendors two Talisman platforms to choose between.

Talisman is unlikely to have much effect on the market in 1997; we estimate fewer than 100,000 Talisman cards will be sold this year at an average price of at least $600, mostly to software developers and forward-looking end users. Throughout the year and into 1998, however, Talisman will be a powerful influence on the development of 3D software as well as competing 3D hardware. Chromatic, for example, has emphasized that Mpact 2 will support some Talisman features.

TriMedia, MSP Rely on Third-Party Developers

Philips and Samsung are also doing most of their own software development, but both depend on outside vendors for key software components. Philips provides TriMedia's real-time kernel and what Philips describes as a "smart" C/C++ compiler that understands the complex static scheduling rules in TM-1. This compiler, part of a software-development environment that Philips offers for $15,000, has been under development for seven years, and Philips believes it represents a significant edge over its competitors. The compiler comes with code libraries for many common multimedia algorithms, but Philips expects its OEM partners to differentiate their offerings by developing custom software.

Most of Samsung's software tools were developed under contract by Metaware. That company, mostly known as a tools developer for embedded development, provided a

Microsoft's Direct3D Delayed—ISVs Eye OpenGL

Amid rumblings of dissatisfaction—and a few open defections—developers of 3D games are trying to deal with delayed and canceled releases of Microsoft's critical Direct3D API.

Direct3D, part of Microsoft's DirectX APIs, provides a software interface between application programs and 3D accelerators. It includes a hardware abstraction layer (HAL) that translates the commands and data structures into the proper format for the 3D hardware. Direct3D also includes a hardware emulation layer that takes over some functions for 3D accelerator chips that provide only partial acceleration.

Microsoft had planned to release version 3.0 of DirectX in August, but it did not ship until November. A Microsoft developers conference in November was postponed until April. DirectX 4.0 has been canceled entirely, and DirectX 5.0 is not expected until midyear.

Direct3D's immediate mode is the focus of most of the trouble. Application software sends commands to Direct3D in execute buffers that are difficult to manage. Direct3D also suffers from hardware implementation problems. Microsoft has no program in place to test or enforce the compliance of 3D hardware with Direct3D. Some boards claim to implement certain features but actually don't, causing trouble for software developers that try to make use of those features. Direct3D provides capability bits to describe which features are supported, but it's difficult to develop applications that support all possible combinations.

At least one game developer has chosen not to support Direct3D until these problems are fixed. John Carmack, cofounder of Id software and lead programmer for Quake, the company's popular 3D shoot-'em-up, has been vocal in his criticisms (*finger johnc@idsoftware.com*). Describing his effort to port Quake to Direct3D, he writes, "Direct3D Immediate Mode is a horribly broken API." Id canceled its Direct3D effort and now plans to release an OpenGL-based version of Quake.

OpenGL is similar to Direct3D's immediate mode and is said to have a number of advantages, including greater ease of use. Instead of execute buffers, applications simply provide a sequence of subroutine calls, each describing one vertex of a triangle. OpenGL products must pass a set of compliance tests, making performance more predictable. This increases the cost of OpenGL hardware but eliminates the need for Direct3D's capability bits and piecemeal approach to emulation.

The Direct3D controversy may also affect Microsoft's Talisman. The company's original plan was to add extensions to Direct3D to control new Talisman features such as image layers, texture compression, and anisotropic filtering. These extensions are due by the end of 1997, but any substantial changes to the baseline Direct3D API would likely delay these new features and push most Talisman applications into late 1998. Microsoft has also announced plans to add Talisman support to its implementation of OpenGL, covering its bases in the event that more game developers reject Direct3D.

The delays in DirectX releases from Microsoft may signal major changes in Direct3D. Microsoft has often released hastily prepared software just to get a foothold in a new market (probably starting with MS-DOS 1.0) and later followed up with significantly improved code. We hope that will be the case here.

C compiler for MSP's ARM and vector processors, as well as an assembler, linker, and debugger. Samsung added simulator, profiler, and decompiler tools. The tools are available for Windows 95 PCs or SPARC workstations. The lack of C++ support, as in the TriMedia development environment, is not disabling; most driver and codec development will take place at the lower C and assembly-language levels.

No matter who provides the software, all vendors of media processors remain at Microsoft's mercy for the APIs needed to use their processors under Windows. Many uncertainties remain in these software interfaces. For example, a system with an MMX processor and a media processor could perform some multimedia tasks on either chip. Chromatic is developing an x86-based resource manager that could assign a task to the least busy device, but it will be difficult to do this in a Windows-compatible way without Microsoft's help.

Microsoft's Direct3D API is coming under fire from software vendors (see sidebar). Changes in the API would force media-processor vendors to change their software—and possibly their hardware as well, since Direct3D determines the features that 3D accelerators must support.

Product Positioning Open to Debate

These three vendors claim their media processors bring high-end features to the PC market. Chromatic emphasizes Mpact 2's 1M-polygon/s 3D throughput in support of this positioning, for example. By the time Mpact 2 arrives, however, 1M polygons/s will be merely midrange performance; dedicated 3D chips such as the Vsis 3DPro already exceed this mark. Since media processors must be priced at about $50 to meet OEM budgets, it is unrealistic for any of the media-processor vendors to expect to surpass the performance of more expensive 3D-only hardware.

At the same time, the three vendors claim their media processors are also suitable for low-end embedded products. Philips's plans include TM-CE, a TriMedia derivative for

	C-Cube VRP CL-4020	Fujitsu MMA	Mitsubishi D30V	Oak (un-announced)	Rendition Vérité
2D acceleration	n/a	n/a	n/a	n/a	Yes (HW)
3D setup (polys/s)	n/a	n/a	n/a	n/a	150K
3D fill rate (pixels/s)	n/a	n/a	n/a	n/a	25M
MPEG-1 decode	Yes (HW)	Yes (SW)	Yes (SW)	Yes (HW)	No
MPEG-2 decode	No	Yes (SW)	Yes (SW)	Yes (HW)	No
MPEG-1 encode	Yes (HW)	No	No	Yes (HW)	No
Video in	Yes	No	No	No	No
Video out	Yes	No	No	Yes	No
Audio support	No	Yes	Yes	Yes	No
Clock rate	80 MHz	180 MHz	250 MHz	67.5 MHz	50 MHz
Integer ops/cycle	4	6	4	1	2
Peak integer perf	0.32 GOPS	1.08 GOPS	1.0 GOPS	0.07 GOPS	0.1 GOPS
Int width at peak perf	8 bits	16 bits	16 bits	32 bits	32 bits
Local RAM bandwidth	160 Mbyte/s	720 Mbyte/s	n/d	67.5 Mbyte/s	400 Mbyte/s
Price for chip	n/d	n/d	n/d	n/d	$40
Production date	Now	n/d	n/d	n/d	Now

Table 2. Among special-purpose media processors, MMA and D30V offer the highest integer performance, while VRP supports MPEG encoding and Vérité speeds 3D rendering. n/a=not applicable, n/d=not disclosed (Source: vendors)

consumer electronics. Samsung proposes MSP as a good part for video games and set-top boxes, and Chromatic has even suggested using Mpact for multimedia acceleration under Windows CE.

These plans also may be unrealistic. Media processors must be powerful and sophisticated to meet the needs of the PC market, but this requirement burdens them with relatively large die sizes made on advanced fab lines. This burden will make them uncompetitive with parts designed for low-cost applications. Instead, media-processor vendors should focus on the mainstream PC market, at least 40 million units a year—certainly an opportunity worth pursuing, and one that will require their full attention.

C-Cube Concentrates on Video Compression

Chromatic, Philips, and Samsung form the “Big Three” of the media-processor business, but other companies plan to use programmable architectures to good advantage in narrower markets. C-Cube, for example, has been a long-time advocate of programmable engines for digital-video compression and decompression.

C-Cube’s VideoRISC processor (VRP) is widely used for MPEG-1 and MPEG-2 encoding by digital satellite TV broadcasters, but VRP derivatives could certainly be adapted to other tasks. The core of VRP is a fairly conventional RISC design. It executes 32-bit integer instructions in a five-stage pipeline and also supports a set of SIMD operations on four byte-size operands in an eight-stage pipe shared with the integer engine.

Like most media processors, VRP includes some fixed-function logic. A variable-length-coding unit offloads the relatively simple data-compression tasks from the CPU, and a motion estimator accelerates MPEG compression by comparing 8×8-pixel blocks against two reference frames at an effective rate of two billion operations per second.

Even with its on-chip caches, DRAM controller, and video and host I/O interfaces, VRP is small enough to allow C-Cube to offer one or two complete VRPs on a single chip. The current implementations run at up to 80 MHz. At this speed, a single device can perform limited MPEG-1 encoding; multiple VRPs in parallel are used for higher quality and for MPEG-2 encoding.

Future VRP derivatives could include more than two VRPs per chip and operate at higher clock rates. Digital video is likely to become a major application segment in the next few years, and with the simple addition of a PCI interface, VRP could become a strong player in that market. Adding support for additional data types, including 2D/3D graphics and audio, could make VRP into a true media processor competitive with Mpact, TriMedia, and MSP. C-Cube’s relationships with OEMs like Diamond, Matrox, and Orchid would provide good sales channels for such products.

Fujitsu, Mitsubishi, Oak Seek DVD Role

Fujitsu’s multimedia assist (MMA) processor is a relatively simple 32-bit, two-way LIW design with limited 16-bit SIMD support. With a peak throughput of 1.08 BOPS at 180 MHz, the part is capable of DVD decoding but requires a separate SparcLite host processor.

MMA includes a graphics controller, audio interfaces, and several built-in peripherals but lacks a PCI interface, floating-point support, and 3D rendering capabilities. Without these capabilities, MMA is not useful for PC multimedia applications. In the DVD application, however, MMA is a good fit. By way of comparison, MMA could replace as many as seven of the devices found in Toshiba’s reference DVD player chip-set design.

Mitsubishi has developed the D30V, a programmable chip intended mainly for consumer devices. At just 37 mm^2, the D30V is the smallest of all announced media processors. At 250 MHz, it is also the fastest, as Table 2 shows. The high clock speed allows the chip to use a simple two-way LIW architecture very similar to MMA’s. Even with its small die, the D30V includes 64K of on-chip memory split between instruction and data storage. The D30V also includes audio and video output circuitry and a variable-length decoder.

Oak Technology is considering its options in the DVD market. While Oak has not yet announced any parts, the company provided a fairly specific description of a RISC-based DVD decoder at the 1996 Microprocessor Forum.

The design includes a 32-bit RISC engine, but hard-wired function units handle most of the work. MPEG-2 and

AC-3 decoders are included, with the RISC core managing the flow of data within the device and its local memory. Such a part strains the definition of a media processor, but the presence of a programmable engine would make it easier to add additional features should Oak develop an interest in other markets.

These vendors may be satisfied with the DVD market—a total of several million units by 1998—but media processors designed for DVD could provide a foundation for future media processors for the PC market.

Rendition Remains Focused on 3D Graphics

Rendition's Vérité V1000 has become one of the more successful 3D accelerators in the PC 3D market. This is due in large part to Rendition's ability to form strategic relationships within the PC industry.

The V1000 is not a multimedia processor and provides only average 3D acceleration, but the part's programmability makes it more flexible than its competitors in the 3D-accelerator market. The core of the V1000 is a 32-bit RISC processor with limited VLIW capabilities. The CPU core handles 3D setup and some 2D acceleration functions. With no floating-point capability of its own, the V1000 depends on host-based geometry processing. Rendition has used this programmability to implement custom antialiasing algorithms and special effects for game titles.

The part is used in graphics adapters from Canopus, Creative Labs, Intergraph, and Number Nine, and at least 19 software vendors have announced support or, in most cases, actual products. The V1000 is currently the only 3D accelerator supported by Quake, a distinction other 3D chip vendors must envy. Rendition has not announced a successor to the V1000, but we expect to see one early this year, offering more competitive performance and reinforcing Rendition's solid position in the market.

Missing in Action: Mfast, MicroUnity, and Nvidia

In spite of impressive specifications, IBM's Mfast project has been canceled. First described at the Microprocessor Forum in 1995, Mfast was designed to yield 10 BOPS of sustained performance on 16-bit operands and was planned to ship in mid-1997. Research continues, but all product plans have been shelved.

MicroUnity's original MediaProcessor, an impressive five-thread 1-GHz BiCMOS design, failed for lack of applications requiring its level of performance (and able to pay its price), but the company continues to develop a single-threaded CMOS MediaProcessor that may find uses in cable modems or other broadband-RF devices.

Nvidia's NV1 became a casualty of mixed messages. While it is an adequate 3D accelerator that offers audio support through an integrated DSP engine, the chip's sales suffered from a mistargeted and misunderstood marketing campaign touting its nonstandard 3D interface. Today, the NV1 is essentially obsolete. The NV3, planned for a 1Q97 debut, will drop audio support and programmability in favor of pure 3D performance for Direct3D. SGS-Thomson manufactured the NV1, and we expect it will also make the NV3 despite the company's involvement with Chromatic.

Multimedia Milestones of 1996

Chromatic *(www.chromatic.com)* began shipments of its Mpact 1 media processor and disclosed the design of its next-generation Mpact 2 device (**1015MSB.PDF**). The company later said SGS-Thomson will join LG Semicon and Toshiba in building and selling Mpact chips (**1016MSB.PDF**).

Fujitsu *(www.fujitsumicro.com)* debuted its MMA design, a media processor intended for DVD players (**101502.PDF**).

MicroUnity *(www.microunity.com)* canceled its BiCMOS media processor, laying off much of its staff (**1010MSB.PDF**). The company is developing a simpler CMOS processor for cable modems (**1014MSB.PDF**).

Mitsubishi *(www.mitsubishi.com)* developed the D30V, a single-chip DVD decoder (**101601.PDF**).

Oak *(www.oaktech.com)* previewed a DVD decoder with a programmable RISC core (**1015MSB.PDF**).

Philips *(www.semiconductors.philips.com)* neared completion of its TM-1 media processor.

Rendition *(www.rendition.com)* rolled out its Vérité chip, a programmable 3D accelerator (**1006MSB.PDF**).

Samsung *(www.ssi.samsung.com)* introduced its media processor, dubbed MSP and expected to ship in 3Q97 (**101101.PDF**).

Intel's **AGP** interface *(www.teleport.com/~agfxport)* is expected to become a standard for high-bandwidth 3D graphics accelerators (**100803.PDF**).

Microsoft announced **Talisman** *(www.microsoft.com/hwdev/devdes/talisman.htm)*, aimed at providing high-performance 3D for future PCs (**1011MSB.PDF**).

Media-Processor Market Maturing Rapidly

Chromatic and Philips have spent years preparing for success in the PC market, and this year they will have their chance. Media processors from these two vendors should appear in many systems during the 1997 holiday buying season. By this time next year, the two vendors will have moved on to second-generation cores while Samsung and others will be firing their first shots in the PC market. Vendors such as Fujitsu and Mitsubishi are saving their ammunition for the consumer market, where they will compete mainly against fixed-function devices.

Two years ago, programmable multimedia engines were virtually unheard of. As recently as last year, the viability of the concept was still in doubt—could programmable devices really compete with hardwired logic? Today, we can answer in the affirmative. M