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INTEL UPDATES PLATFORM PLANS

Timna, USB 2, InfiniBand, Bluetooth to Figure in Future Systems

By Peter N. Glaskowsky {9/25/00-03}

The latest Intel Developer Forum (IDF) had few major announcements relevant to mainstream PC systems, but Intel did use the show to update the industry on its plans for future CPUs, chip sets, and peripheral interfaces. In addition to describing the ongoing development of the AGP 8X standard (see *MPR 9/4/00-02*, "Intel Announces Graphics Port Initiative), Intel presented new information on Timna, USB 2.0, and InfiniBand.

Taken together, these updates show a company making uncertain progress in its most crucial market. Some of the IDF announcements reflect products that will be of clear value to Intel's customers. The value of others is much less clear.

Intel Offers Quick Look at Timna

Intel's forthcoming integrated-graphics processor, code-named Timna, is nearing release. The new chip should appear in 1Q01 for desktop systems, with a mobile version just months behind. Intel says Timna's die size is "similar" to that of the current Celeron chip; both are manufactured in Intel's 0.18-micron process.

Timna will use the same 370-pin PGA package and socket now used for Celeron, but its external pinout is very different. For example, Timna has no external P6-bus interface. To simplify the task of integrating multiple functions on the chip, Intel included an on-chip bus much like the P6 bus, but there are minor functional differences, and the lack of external connections allows this local interconnect to run at speeds up to 200MHz. The on-chip bus connects the Katmai-derived CPU core to a memory controller and the chip's graphics subsystem. The CPU core has been hand-optimized in certain areas to reduce its die size, in addition to the space savings permitted by the shrink to the 0.18-micron process.

The main-memory subsystem is clearly the weak point of the Timna design. Timna was originally designed to support the same memory options originally found on the 820 chip set. A direct connection was to be offered for one channel of RDRAM, and an optional external converter would translate this connection to a PC100 SDRAM array for applications that were more cost-sensitive.

Intel ran into two problems with this approach. First, RDRAM has not been as widely used as the company expected, so prices have remained high and supplies are limited. Second, the memory translator hub (MTH) chip designed for the 820, and slated for use with Timna, proved faulty.

Because of the first problem, Timna with RDRAM makes no sense. Because of the second, Timna with SDRAM could not be released on the original schedule. Intel is now developing a new SDRAM translator it will use only with Timna. This chip, now called a memory protocol translator (MPT), to avoid associations with the failed MTH, includes changes to both the logic and packaging of its predecessor. It will support up to 512M of PC100 SDRAM on two modules.

This is enough memory for entry-level PCs, but the high latency and low bandwidth of this solution will surely fail to meet the needs of most users. The MPT architecture will give Timna-based systems even lower memory performance than machines based on Intel's 810 chip set.

Timna has 128K of L2 cache, which is not involved with memory accesses from the graphics subsystem. This design avoids cache thrashing caused by display refresh and

other transfers. Although there are small on-chip caches for color, Z-coordinate, and texture data, Timna lacks the 810's optional display cache—a separate 4M DRAM array that boosts performance in 3D rendering. Timna will thus offer 3D graphics performance comparable with that of the base-level 810—a level already unacceptable for current 3D games.

The 3D core in Timna includes a few quality improvements over the cores in the 810 and 815 chip sets. Timna adds support for true trilinear texture filtering, colored specular reflections (highlights), and exponential fogging calculations—features long since available in mainstream 3D chips.

Timna has a 230MHz on-chip RAMDAC to drive RGB displays directly. TV and LCD displays require an external chip, which Intel says will be available from third-party vendors. This external chip connects to Timna via a 12-bit, 112MHz double-pumped data bus.

External peripherals are connected to the ICH2 south-bridge chip, also used in current 800-series chip sets (see *MPR 6/19/00-04*, "Intel Improves Integrated Chip Set"). The ICH2 connects to Timna via the same proprietary point-to-point link used in these chip sets.

Timna and its associated silicon will be cheaper for Intel to manufacture than current Celeron-based chip sets, but we believe Timna's performance will force Intel to price the chip well below the combination of a Celeron processor of the same clock speed and an 815 chip set. This situation makes Timna a sort of "loss-leader" solution—the basis of machines that may be widely advertised but not wildly popular. Intel has yet to see a profit from its involvement in graphics chips, either the discrete or integrated varieties, and it seems unlikely that Timna will change the company's luck in this demanding market.

USB 2.0 Progress Detailed

In an interview with *Microprocessor Report,* Intel representatives described recent progress on version 2.0 of the USB standard. The company recently opened a test lab at its Hillsboro, Oregon, facility where vendors can develop and test USB hardware and software. The lab is open to all members of the USB Implementers Forum (USB-IF), including Intel competitors like Apple and VIA. The lab is equipped with software-development systems, testing tools, and sample USB devices. All the software, tools, and equipment used in the lab are also available for purchase so that companies can do the same work at their own facilities.

The USB-IF (*www.usb.org*) has also adopted a new logo that offers two critical advantages over the old logo. The new logo has an optional mark to indicate USB 2.0 high-speed compatibility, and the logo is also trademarked, so that it may not be used without permission from the USB-IF. This permission will be contingent on the labeled device's passing a new set of compliance tests developed by the USB-IF to ensure proper operation of USB devices. The USB-IF has certified four commercial test labs—one each in the U.S., Europe, Taiwan, and Japan—to perform compliance testing on its behalf.

Compliance-testing tools are currently available only on the Windows platform, but Intel says the USB-IF is working with other OS vendors to port the tools to their platforms. We presume these other platforms include Mac OS and Linux, but Intel would not confirm this speculation.

Intel settled speculation about USB 2.0's software overhead, saying its own USB 2.0 host controller interface (HCI) is more sophisticated than its USB 1.0 HCI and requires little more host processing. Intel is licensing its USB 2.0 HCI to a number of other vendors in hopes of reducing the number of different HCIs to be supported in Windows and other operating systems.

Intel says motherboards with USB 2.0 support should be available in 1H01, along with some peripherals. Devices such as hard disks, CD and DVD recorders, and document scanners will be among the first adapted to the faster bus because of their need for more bandwidth than USB 1.0 can offer. USB 2.0 hubs will also be available at the same time. Intel expects USB 2.0 to eventually be used in non-PC applications where USB 1.0 has had little impact. The company does not expect USB to replace IEEE-1394 (aka FireWire and iLink) in any products, however; instead, it says, we will see more products with both interfaces.

Intel Innovates for InfiniBand

Intel is also making progress on InfiniBand, which is expected to ship in systems by the end of 2001. Intel now offers three different hardware products to address the key elements of an InfiniBand system: a host channel adapter (HCA), an InfiniBand switch, and a target channel adapter. The first host channel adapter will adapt Intel's hub-link architecture to InfiniBand, allowing the company's chip sets to be used with PCI or InfiniBand. The switch element will be offered in chip form to the industry for the creation of InfiniBand switch modules, which are functionally similar to the Ethernet switches commonly used in today's local-area networks.

Intel's first target channel adapter (TCA) will connect an InfiniBand network to a PCI bus. Instead of creating a virtual bridge from the host's own PCI buses to this new PCI bus, which would require the host to manage PCI bus and device enumeration, the TCA must be used with a local intelligent device controller that will manage InfiniBand data transfers. This scheme is similar to the I2O standard (see *MPR 6/1/98-02*, "PLX Drives I2O with PowerPC"), which uses intelligent device controllers to improve bus throughput.

Intel will also offer products to assist other developers of InfiniBand products. The first is a product development kit (PDK), due early next year, that includes a host channel adapter, switch, and supporting software. The HCA in the PDK is a special PCI-X adapter card that allows developers to begin work before Intel ships server motherboards with its hub-link HCA chip. Intel is considering release of the PCI-X HCA as a separate product but has not yet made a

decision. Intel will also license its own InfiniBand cores and related software for the HCA, switch, and TCA to other silicon vendors.

Bluetooth Validation Continues

Perhaps the most unusual presentation of IDF was given by Jeffrey Schiffer of Intel's Mobile Architecture Lab. Schiffer has been conducting extensive tests of the Bluetooth standard in airplanes to ensure that inadvertent airborne operation of Bluetooth-equipped laptops and other devices will not cause safety problems. This testing is important because Bluetooth is meant to operate even while the host system is otherwise unpowered. A sleeping laptop, for example, could be awakened when an email arrives via a nearby Bluetooth-linked cellphone. This feature requires the Bluetooth transceiver to be awake, even when the laptop is not.

The first line of defense against unwanted Bluetooth transmissions is turning off the Bluetooth module. To this end, the Bluetooth standard is being updated to require Bluetooth-equipped systems to provide a way to turn off the Bluetooth module and to indicate that this has been done.

It is inevitable that this step will sometimes be forgotten or ignored. Schiffer quoted a Lufthansa representative's estimate that, on average, at least one cellphone is left powered on during every flight. Intel's testing was designed to prove to Lufthansa, other airlines, and government regulatory authorities that Bluetooth poses even less of a hazard than cellphones.

Because Bluetooth modules usually emit less than 1mW of RF energy on a succession of discrete carrier frequencies across the unlicensed 2.4GHz frequency band, it is inherently difficult to tell if some other device, such as an airplane navigation aid, has picked up a Bluetooth transmission. To make possible interference easier to detect, Intel has built a number of Bluetooth device simulators that radiate much more power—as much as 3W. Some of these devices use the standard Bluetooth frequency-hopping sequence, and some radiate continuously on a single frequency. None of these simulators has caused any detectable interference on any of the airplanes tested to date, even when the transmitter has been placed in close proximity to radio equipment and antennae; these planes range from a Gulfstream V to a 747.

The Bluetooth consortium hopes these tests will convince the airlines and government authorities that they need not impose strict limitations on the use of Bluetooth-equipped devices. Such limitations could impair the ability of travelers to use laptops and other computing devices in flight, even if there is no Bluetooth activity. We believe the testing Schiffer described could even lead to a specific exception to the current blanket prohibition against in-flight transmitting devices, but seeking such an exemption is not part of the current plan. ◇