Research Brief

Intel Unveils Technology Directions

Abstract: At its developers’ forum, Intel highlighted its efforts developing computer, consumer electronics and wireless technology.

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Recommendations

- Semiconductor companies addressing cellular handsets, wireless 802 communications, media, set-top boxes (STBs) and the converged living room should prepare for Intel’s expansion into their markets.

- Technology suppliers serving the computer market and computer manufacturers should align with Intel’s initiatives.
Introduction

The Intel Developers’ Forum (IDF) is an opportunity for the company to showcase its technology and communicate its product strategy. Fall 2003 IDF took place 16 through 18 September. This Perspective offers summaries of several technologies and products that Intel highlighted. Additional information is available in Hardware Platforms Weekly, Issue 38, HWPW-WW-NT-0338, and Semiconductor DQ Monday Report, Issue 37, SCDM-WW-NT-0337.

Vanderpool Technology

Intel introduced its program named Vanderpool to facilitate computer virtualization. Virtualization refers to simulating a computer. The virtual computer is of the same microprocessor architecture as the physical host computer. The physical computer allows the virtual one to perform some functions on the actual hardware, and it emulates other functions in software. (If all functions are implemented in software, the technique usually is referred to as emulation rather than virtualization.) The technical challenge for x86-based systems is that the microprocessor and other hardware were not designed to be virtualized. Consequently, virtual machines-based products that provide virtualization today, such as VMware, require more software emulation and, therefore, run slower than physical machines. Intel’s plan is to enhance its microprocessors and chipsets to facilitate virtualization.

Intel’s demonstration of virtualization showed simultaneous video playback from a video recorder application and running of a video game. In practice, these are the least likely applications to be supported by virtualization. To be fully functional, a video recorder application would need the TV tuner to be virtualized. Because tuners cannot be simultaneously shared and are not standardized, they are unlikely to be virtualized. Video games require maximum performance and, therefore, are also unlikely to be virtualized. A more likely application is server virtualization, for example, to ease server consolidation. On the desktop side, virtualization is used mostly by software developers and Linux and Macintosh users needing occasional access to a Windows machine. However, it could attain wider usage because it enables portability and security of system images. In typical virtualization schemes, images are stored as files, allowing them to be backed up and transported among physical machines. Virtualization also offers the possibility of easing migrating desktop users from one operating system or physical system to another. While virtualization has been used since the 1960s, Intel’s efforts will help expand it from a niche to a mainstream technology. For more information on Vanderpool, see "Intel's New Vanderpool Will 'Virtually' Transform PC Platforms,” FT-21-1014.
Return of the Media Processor

On 10 September, Intel and Xerox jointly announced a family of media processors for use in printers and copiers. Intel and Xerox collaborated to develop the chips. Xerox developed software for them, which it can license to other companies, and provided guidance to Intel about how to optimize the design. Fundamentally, the product is Intel’s because Intel markets the chips. The product is off to a good start. Intel wisely launched the family with a first-tier customer and a base of software. Too many network and media processors in the past were launched with a "build it and they will come" philosophy. Nevertheless, other options remain for developers of imaging systems, and previous attempts at media processors have not been successful. For more information on Intel’s media processors, see "Media Processors Return," SEMC-WW-DP-0341.

Targeting the STB

Intel used IDF to highlight its efforts developing digital technology for consumer electronics. Among them, Intel highlighted a reference design for a motherboard for an STB or digital video recorder (DVR). The motherboard is the same size (170 x 170 mm) as VIA Technologies’ mini-ITX motherboards, and it sports a similar microprocessor as the one that Microsoft uses in its Xbox game console. While Intel’s board is an acknowledgment of VIA Technologies and its success with low-power, low-performance (by PC standards, not by STB or DVR standards) mini-ITX motherboards, it is also a sign of Intel’s interest of using its x86 processors to compete with traditional embedded processor suppliers. Despite being a design that is too costly and overpowered for current STB and DVR configurations than competing integrated offerings, it may lead to more competitive offerings in the future. Furthermore, it indicates the continuing crossover of PC technology into consumer electronics. Additional discussion of the convergence of PC and consumer electronics technology is the topic of a forthcoming document. Such crossover will lead to new types of electronics that will require higher performance than current STBs and DVRs and can bear additional cost.

Securing Entertainment-Centric Home Networks

Intel took advantage of IDF to call attention to the standards effort called Digital Transmission Content Protection over Internet Protocol (DTCP-IP). DTCP-IP is an extension of DTCP being developed by Digital Transmission Licensing Administrator (DTLA), an industry group founded by Intel, Hitachi, Mitsubishi Electric Industrial, Sony and Toshiba that counts Sony Pictures and Warner Brothers as participants. The purpose of DTCP is to protect audiovisual and audio content from unauthorized interception and retransmission. Previously it had been applied to Universal Serial Bus (USB) and Institute of Electrical and Electronics Engineers 1394 (IEEE 1394) connections. DTCP-IP applies to IP-based networks. In addition to the content-protection mechanisms specified by DTCP, DTCP-IP includes mechanisms specific to IP networks.
Extending DTCP to IP networks dovetails with Intel’s efforts to promote entertainment-centric home networking, one of the major conference tracks of IDF. Intel identifies the absence of protection as an inhibitor to the availability of content to be distributed through the home. In such a context, DTCP-IP is a key enabler to developing the home networking market and facilitating convergence — or at least interaction — of PCs and consumer electronics.

**Fuel Cells**

Intel has invested in two fuel cell companies: Neah Power Systems and PolyFuel. Fuel cells remain an emerging technology and have yet to be used in commercially available notebook computers. The limitations in fuel cells will require a hybrid approach in which they are paired with other power sources. Intel suggests fuel cells coupled with batteries and super capacitors (notebooks currently use only lithium-ion battery packs). Intel’s solution anticipates that power consumption will continue to outgrow conventional power supply technologies, despite the company’s power management and conservation efforts. Intel is encouraging methanol-based power technology from multiple vendors to help lower costs, reduce business risk and encourage quick adoption.

**Regulatory Efforts**

Because the computer industry is fairly unregulated, many computer vendors have not given much input to regulatory agencies. With the advent of radios in PCs, including features such as wireless LAN (WLAN) and Bluetooth, the dynamics are changing. They will continue to change as Intel executes its plan to create ubiquitous, low-cost radios. Consequently, Intel is working with several regulatory agencies worldwide to remove roadblocks to its vision. As the largest supplier, Intel is a powerful voice in the industry. Gartner Dataquest recommends that other suppliers collaborate through industry trade associations to form a collective voice speaking on the industry’s behalf to influence outside stakeholders such as regulatory agencies.

**Bulverde for Handheld PCs and Smartphones**

Intel showed the lengths to which it is taking its XScale microprocessor (MPU) architecture to position it as the powerful yet power-thrifty platform for handheld PCs and smartphones, revealing more about the family of products it calls Bulverde. With its origins in the ARM architecture but with extensions unique to Intel, XScale shows high performance with special media capabilities. Borrowing philosophies, techniques and instructions from the much-larger and more expensive Pentium processors, and attaching the word "wireless" to some features, Intel draws strength from its history in the PC space. The visibility and discussion of XScale were lower-keyed than in previous IDF, but Intel is charging headlong into the wireless communications world, especially as it sees a large data component to it.
Conjuring up visions of multimedia devices that resemble today’s cellular phones (with emphasis on the "multi" part of media) and with scarce mention of casual two-way voice conversations, Intel showed the myriad possibilities that these handheld units could evolve into. While most people simply wish the conversations on their cell phones were clearer and consistent, the technologists are jamming the multimedia devices with the following:

- Motion Picture Experts Group (MPEG) Audio Layer 3 (MP3) music
- TV remote controls
- Still and moving picture cameras, including lights and image displays
- Voice recorders and polyphonic synthesized audio
- Internet access and browsing
- Video displays
- Video games comparable to consoles
- PC office suite application software
- Voice inputs and pen inputs
- Financial transaction capabilities
- Access security
- Plenty of expansion memory for downloading more features and applications

Although this is all powered by a little battery, the device can communicate over distances via myriad wireless (and maybe wired, or infrared) media — from the cellular network to any of the 802 protocols to Bluetooth. The business models for the network carriers are still a confusion of wild expectations showing that those minds that brought us the dot-com bombs are still out there, thinking. However, for Intel’s part, if an application processor is needed for the operation, Intel has a series of chips designed with the performance to handle the multimedia.

Intel showed the most advanced of its PXA800 family, often referred to as Manitoba. These are designed for highly capable, data-oriented handsets, what Intel designates "value" and "premium" wireless phones. The highly integrated PXA800F consists of Intel’s ARM5-compatible XScale processor with Intel’s digital signal processor (DSP) and a block of logic to run general packet radio service (GPRS) or Enhanced Data Rates for Global Evolution (EDGE) data networks. The XScale processor runs up to 312MHz with 4MB of flash memory and 512KB of static RAM (SRAM), while the DSP is associated with 512KB of flash and 64KB of SRAM for baseband support. Intel developed this DSP architecture, which is called "Micro Signal Architecture," in partnership with Analog Devices. Assorted peripheral and bus interfaces work with special logic provided on-chip for GPRS (the PXA800F model), or the chip can be upgraded with EDGE-specific software (PXAA800EF).
Bulverde is the code name for the next iteration of XScale processors. Bulverde includes wireless MMX, which are multimedia extensions to the standard ARM instruction set, which is compatible enough with x86 equivalents to ease the porting over from the PC various games and applications that use media. Intel also enhanced its power management circuitry while adding "wireless" to the SpeedStep name borrowed from the Pentium. Refreshingly, Intel added a new technology to the chips that provides a direct interface to a variety of image sensors and the software behind them. This Quick Capture technology should ease the integration of still and video camera functionality to phones and handheld PCs.

Bulverde technology should show up next year in handheld PCs and as application processors in the highest-end smartphones.

**Gartner Dataquest Perspective**

In general, the above initiatives highlight Intel’s two-pronged strategy. One prong is to enhance the utility of computers to maintain momentum for customers to upgrade and to remove barriers to adoption of new computer technology. Examples include Vanderpool Technology, DTCP-IP, fuel cells and regulatory efforts. The other prong is to expand into markets beyond computers and establish a dominant position. Examples include the new media processor, the STB reference design, ubiquitous radios, and handheld PCs and smartphones.

**Key Issue**

What impact will emerging applications and technologies have on the industry?