PS/2 Wizard Adapter

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PS/2 Wizard is a bus master card that incorporates the Intel i860 chip. In combination with Micro Channel architecture, it is a high-speed attached processor for numeric-intensive applications.

One of the most exciting new technologies announced this year will soon be available as a bus master for PS/2 Micro Channel computers. When Intel's i860 microprocessor was announced in February 1989, its high-performance capabilities were demonstrated on a prototype adapter in a PS/2 Model 80. This adapter, PS/2 Wizard, provides an application accelerator for numeric-intensive applications.

The design of the Micro Channel computers paved the way for this PS/2 numeric-intensive solution to be implemented quickly and efficiently. The combination of Micro Channel architecture and the Intel i860 microprocessor expands the PS/2 opportunity in new and existing areas. The benefits derived from this combination translate into performance improvements for existing PS/2-based applications and a new platform for technical workstation applications.

The PS/2 Wizard adapter, jointly developed by IBM and Intel, will be marketed exclusively by IBM. When Intel first approached IBM with the i860, its value as a high-performance numeric processor was immediately recognized. What remained was deciding how to provide the i860 microprocessor in a PS/2 computer. After weighing the factors, the decision was made to bring the i860 to the PS/2 as an attached processor that would take advantage of Micro Channel architecture. This solution required minimal operating system changes, and allowed focus on those applications that would benefit most from the performance of the i860 while never losing compatibility with the broad scope of PS/2 applications available today.

Once the implementation mechanism was determined, development efforts went into full swing immediately. Intel designed and developed the adapter, while IBM focused on the functions required to provide the bus master capabilities. This coordination of efforts by groups from both companies forged the path for the i860 Micro Channel bus master.

The adapter (Figure 1) consists of three IBM-designed bus master interface chips, Intel's i860 microprocessor, 2 MB of memory, and support logic. The i860 microprocessor is the key component of the PS/2 Wizard adapter. With its one million transistors, this single VLSI component specializes in integer, floating-point and graphics calculations. The chip also has an internal 8 KB data and 4 KB instruction cache. Often referred to as a "supercomputer on a chip," it performs approximately twice as fast as other reduced instruction set computer (RISC) chips running the Dhrystone benchmark (see Note).

The bus master chips give the card the capability of moving data into and out of system memory and accessing the entire system memory map and I/O address space. The private memory on the card provides 85-nanosecond access with 45-nanosecond static column feature. Two megabytes reside on the card, and a top card connector allows a daughter card to be attached with six additional megabytes. The powerful capabilities offered by the i860 microprocessor, together with the bus master capabilities of the adapter itself, merge into the attached processor that is an application accelerator for PS/2 computers.

An application accelerator, while much like a coprocessor, lets the application decide what to process where. In the case of the PS/2 Wizard adapter, sections of application code requiring extensive floating-point or integer operations or needing graphics assists will be directed to the i860 for execution. I/O requests should be limited in these code segments in order to allow the i860 to perform at its best.

The operating system support (Figure 2) required to handle this structure is implemented as a device driver. At the application's request, secondary pieces of the application that are to be executed by the i860 are moved across the Micro Channel by the device driver running on the 386™ or 486™ to the device driver running on the i860. A small kernel of code on the i860 then executes the code segment and returns the results through the device driver mechanism across the Micro Channel bus to the primary application on the 386 or 486. These secondary segments of code may be a small or large portion of the application, but execution must be initiated on the 386 or 486 processor. In addition, the 386 or 486 processor can be executing other applications. In OS/2, the i860 application can be just another application running in a Presentation Manager window. If real-time graphics updates are required, it is best to use a dual-screen configuration and use the bus master capabilities of the PS/2 Wizard adapter to write directly to the display adapter (Figure 3).

As an application accelerator, the PS/2 Wizard adapter fits best into what is commonly called the numeric-intensive computing (NIC) application area. Typical applications include molecular modeling, bond trading, seismic analysis, CAD/CAM, and medical imaging. These types of applications generally have a core section of code that handles the numeric manipulation and will show significant performance gains when processed by a high-speed processor like the i860. Application porting, in this case, requires a small amount of rework and a recompilation in order to take advantage of the i860. The two major criteria in selecting application candidates to port to the PS/2 Wizard adapter are those that have identifiable segments of numeric-intensive code and do not require a significant amount of I/O within the segment. When the applications have been recompiled, they will execute with PS/2 Wizard in PS/2 32-bit Micro Channel machines.

Micro Channel architecture, in general, is much more suited to the capabilities of the PS/2 Wizard

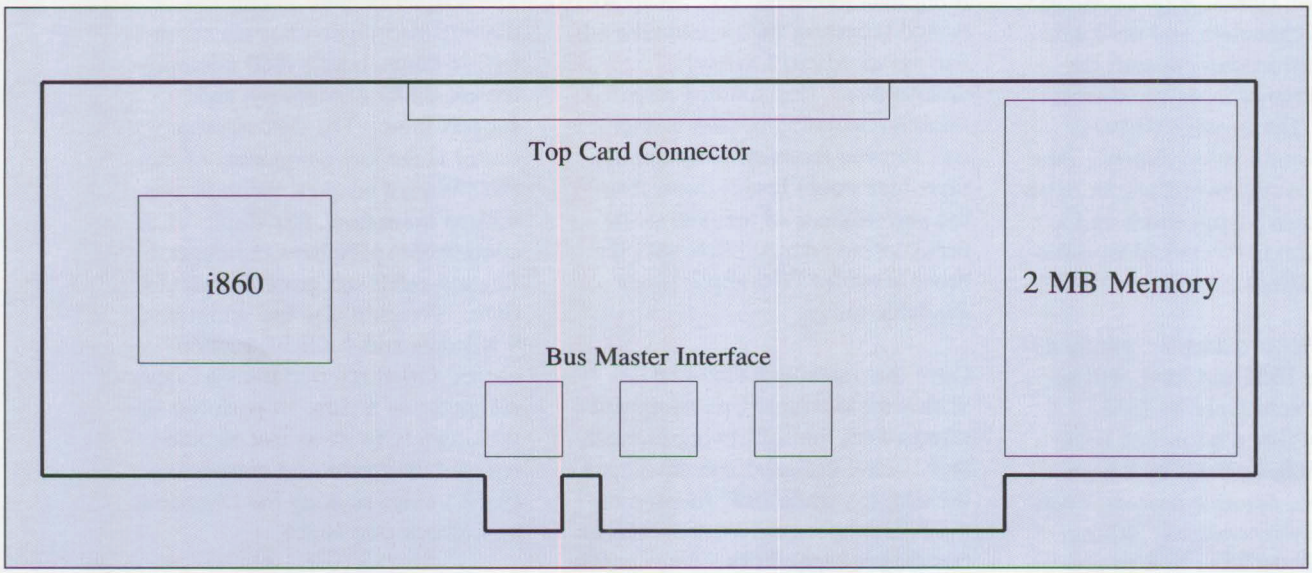

Figure 1. PS/2 Wizard Adapter

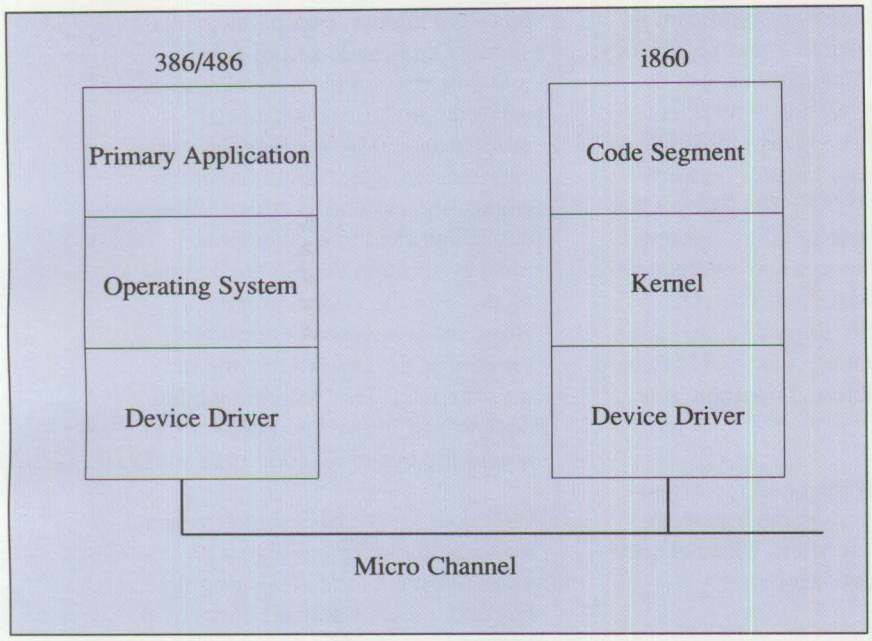

Figure 2. Operating System Support

adapter than is the AT bus structure. More specifically, two key factors brought about the decision to design PS/2 Wizard as a Micro Channel adapter:

- The 32-bit Micro Channel bus provides double the data transfer rate in the same cycle time as the AT bus and is, therefore, a much more efficient mechanism for passing the i860 the large amounts of data it is capable of processing.

- The ability of multiple bus masters to share the bus efficiently (that is, Wizard and a display adapter) increases the overall performance of the application. A key example is the performance improvements seen in applications requiring real-time updates to the screen.

The PS/2 Wizard adapter uses the power of Micro Channel architecture to bring the i860 microprocessor to the PS/2 line of products. In doing so, it extends the capability of personal computers into the workstation environment while continuing to maintain the platform for existing personal computer applications.

Note: Additional information about the i860 microprocessor and the performance of the chip may be requested from Intel Corporation.

ABOUT THE AUTHOR

Tina DeAngelis joined IBM in 1979 as a programmer working with the EDX and RPS operating systems for Series/1. Next she moved into the PC software area of the business, working in PC Productivity Applications. She became manager of an operating system development group responsible for a vendored graphics software package, then she worked on a team that provided the OS/2 and PS/2 technical seminars for application developers. Tina is currently an advisory planner with operating system and application responsibility for the PS/2 Wizard adapter.

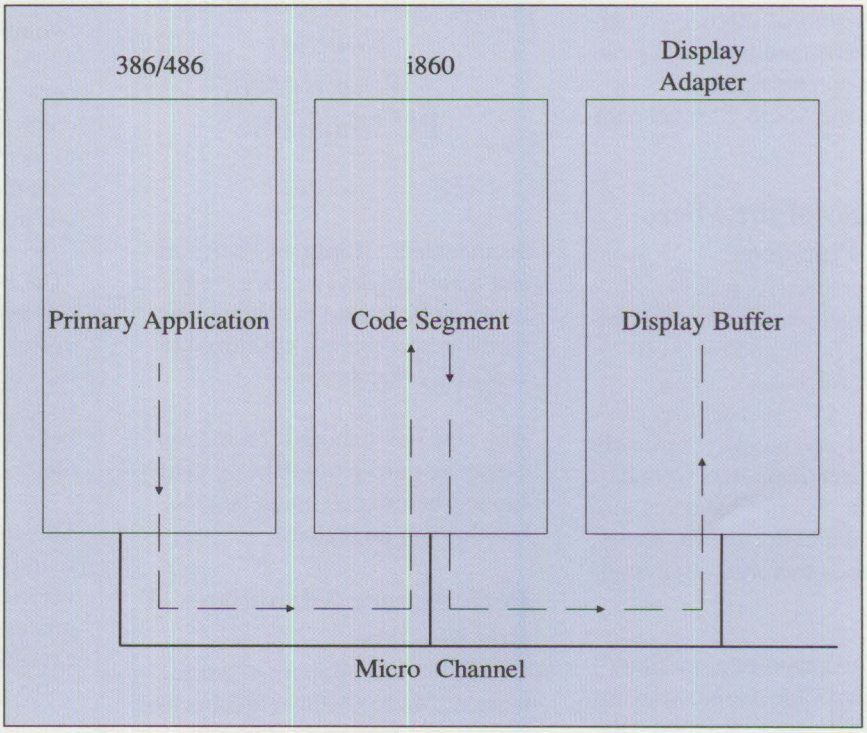

Figure 3. Writing Directly to the Display Adapter