IDT®

Using the Tsi310™ to Migrate I/O Adapters from PCI to PCI-X

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1. Using the IDT Tsi310 to Migrate I/O Adapters from PCI to PCI-X

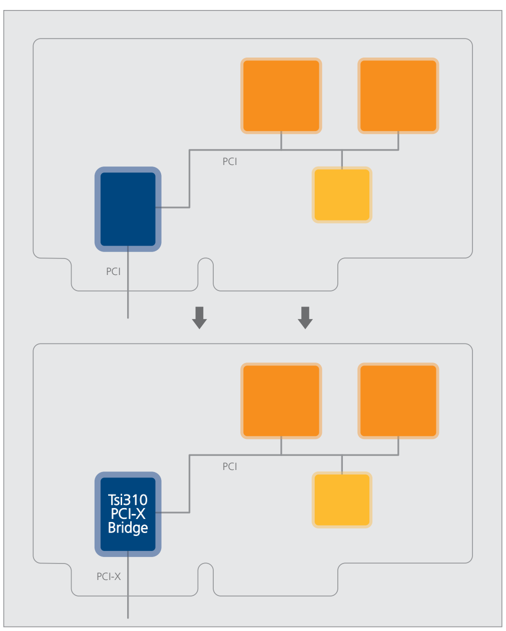
1.1 Advantages of PCI-X vs PCI

PCI-X has a number of improvements over PCI that make migration from PCI to PCI-X highly desirable in a number of applications. PCI-X is fully backward-compatible with PCI, so any PCI-X device is capable of utilizing the PCI-X or PCI protocols. The most notable improvement is bus speed. The highest speed a PCI bus may operate at is 66.66 MHz, while a PCI-X bus may run anywhere from 50 MHz -133 MHz - a top bandwidth of 1.06 GBps - twice that of the best PCI bandwidth and almost ten times that of legacy 32-bit 33 MHz PCI. Other notable improvements include split transactions replace less efficient delayed transactions, block data transfer vs series, and data phase parity error recovery.

1.2 Add the Tsi310 to Obtain PCI-X Capability

The first approach is to place the Tsi310 in front of existing PCI I/O adapter logic to get an adapter with PCI-X capability (see Figure 1). In this configuration, the Tsi310 operates in PCI-X mode on its primary bus and PCI mode on its secondary bus. This approach is the quickest because only a new card and glue logic are required; however, increased latency may be a design issue due to the added intermediate bus. If the existing adapter already uses a transparent PCI-to-PCI bridge, that chip can be replaced by the Tsi310 to resolve the latency problem. In either case, PCI-X bus performance will be limited by the protocol and speed limitations of the secondary bus running in PCI mode. In summary, this approach achieves PCI-X compatibility very quickly but with few performance improvements.

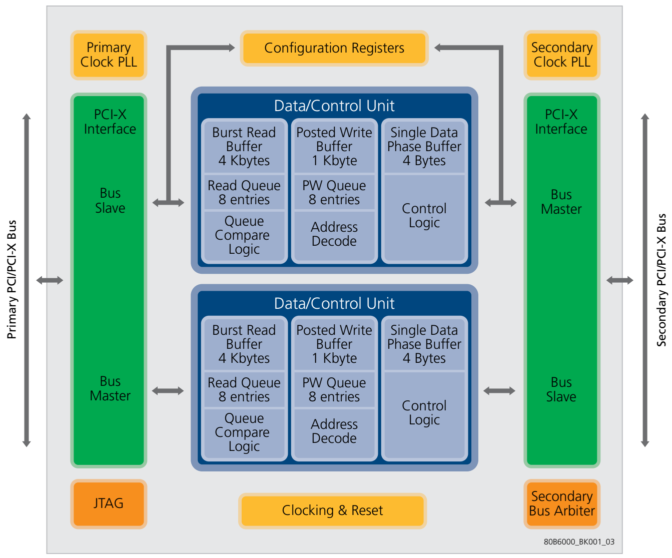
Figure 1: Using the Tsi310 to Create an Adapter with PCI-X Capability



1.3 Combine Multiple Devices with the Tsi310

This approach combines two or more existing PCI adapters into one card. Some savings may be achieved by removing duplicate functions, and performance may increase as multiple threads use the secondary bus more fully and begin to take advantage of Tsi310’s buffer structure (see Figure 2). Some examples of products that may benefit from this design migration are disk controllers with several SCSI interfaces, and networking cards with multiple Ethernet ports.

Figure 2: Tsi310 Block Diagram



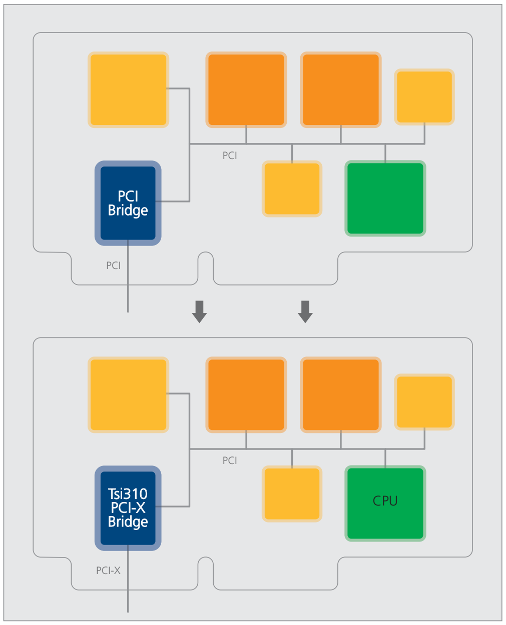
1.4 Add an Embedded Processor to form an Intelligent Adapter

This approach requires adding an embedded processor on the secondary bus to form an intelligent adapter (see Figure 3). With this design, processing previously done by the host can be off-loaded to the embedded processor, which results in better system performance. Furthermore, the processor can optimize data transfers through the PCI-X bridge by combining data into larger data bursts, interpreting DMA instruction streams, performing scatter/gather operations, or using other techniques. In addition, the processing power of the embedded processor may allow new functions to be added to the adapter, such as RAID capability to a SCSI disk controller.

One of Tsi310’s optional features can be especially useful in this system design. For example, the opaque address range feature allows definition of a private area within the PCI/PCI-X address space. This address space can be used by the embedded processor for communicating with the other devices on the secondary bus without interference from the host.

In addition, the private device feature may simplify the adapter’s device driver by allowing the embedded processor to manage the configuration of the secondary bus devices.

Figure 3: Add an Embedded Processor on Secondary Bus to Form an Intelligent Adapter

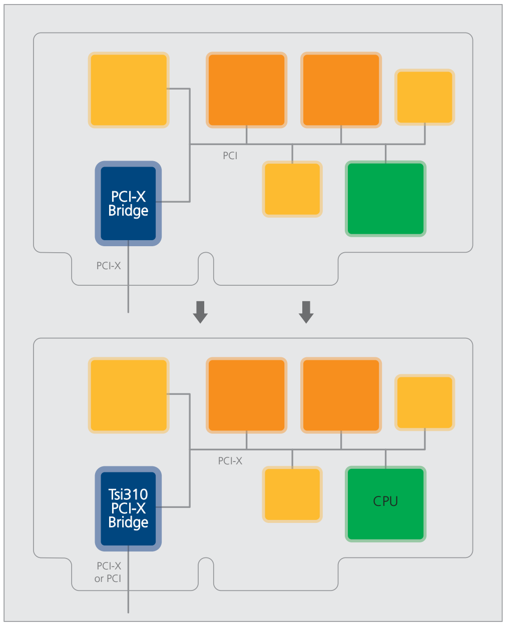


1.5 Migrate to PCI-X on Secondary Bus

In the three previous approaches, the performance of the adapter was constrained by the inefficiencies of the PCI protocol, the PCI bus speed limitations, and, to some extent, an inability to take advantage of Tsi310's full capabilities. To remove these constraints, the next logical step is to migrate all the devices on the secondary bus to PCI-X mode (see Figure 4).

Using the fourth approach, the PCI-X bridge operates in true PCI-X-to-PCI-X mode, which is the configuration around which the chip design is optimized. The full benefits of the PCI-X protocol — the increased PCI-X bus speeds and the robust buffer structure — and the other features of the Tsi310 should be realized with this approach. This design also remains fully backward compatible with PCI operation on the primary bus. Therefore, it is possible that an adapter vendor's single design point may satisfy leading-edge and legacy applications.

Figure 4: Migrate All Devices on Secondary Bus to PCI-X Mode



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