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Universal Serial Bus: A Brief Technical Overview

Introduction

The PC's I/O architecture with its limited I/O ports, addresses and interrupts, has been a problem since the first PC's became available. The current I/O architecture is designed to connect one device per port and with the ever increasing requirement for I/O resources, this problem is again generating a lot of attention. The problem of limited I/O resources and the evolving associated technologies are constantly being addressed to provide the end user and system manufacturer with a cost effective and user friendly way to connect their I/O devices.

Several serial communication buses have evolved over the years with each attempting to make it easier to connect peripheral devices. Recent technologies, such as multi-media and telephone connectivity, require that even more sophisticated and faster peripherals be added to the PC. The following provides a brief overview and insight into the past and present of peripheral connectivity.

Plug & Play Type Serial Buses: Access.bus, USB and P1394

The early serial bus technologies were Apple's 'Apple Desktop Bus' (ADB) and Hewlett Packard's 'HIL'. ADB was developed for connecting the mouse and keyboard to the MAC. ADB may be considered the forerunner of the Universal Bus Technology. It was not Plug and Play, did not support hot plugging or multiple cursors. ADB is a proprietary Apple technology. HP's HIL is a proprietary technology used on HP's computers which never extended beyond the mouse and keyboard.

ACCESS.bus, USB and P1394 are all open standard serial digital buses that were developed within the last five years. Each of these bus architectures attempt to simplify the cable connection "fur ball" we find behind our computers. They also provide us with hot plug abilities and allow multiple peripherals to share the same bus. Each bus also works best with specific application types.

Access.bus

Philips and DEC jointly developed ACCESS.bus in 1991. Based on the successful and low cost I2C technology, DEC and Philips released the architecture and made ACCESS.bus a open industry standard, providing free I2C licenses to any company implementing ACCESS.bus solutions. Originally conceived as a low-cost I/O bus, it has since gained acceptance in a wide variety of applications.

Monitor Control-DDC

In September of 1994, the Video Electronics Standards Association (VESA) announced the DDC (Display Data Channel), a new ACCESS.bus based bi-directional communication standard for monitor ID and control. DDC provides the end user with full software control of their monitor. Major monitor manufactures have developed ACCESS.bus monitors providing easier installation and configuration of monitors plus extended functionality for the end user. VESA has recently restated its support of the DDC and ACCESS.bus as the only control bus for monitors.

System Management

In December 1994, the ACCESS.bus specification was expanded to support Intel's 'System Management Bus'. With this expansion, ACCESS.bus provides two-way communications capabilities to on-board system devices. The 'System Management Bus' greatly improves the communication of internal power management devices and the reliability and functionality of portable systems.

P1394

P1394 (also known as "Fire Wire"), an IEEE open standard, was developed to provide an interface for analog to digital communications. High end devices require data rates between 100 and 400 megabits per second to transfer uncompressed video data. In the age of teleconferencing, P1394 may enable the easy connection of the VCR and Camcorder directly into the PC, and at the same time support devices that require less speed, e.g. high quality audio @ 1.4 Megabits per second.

Universal Serial Bus (USB)

Microsoft and Intel jointly announced USB in March of 1995. USB is an open standard designed to provide Plug & Play capabilities to low-speed and mid-speed devices. USB is intended to provide an easy method to connect communication peripherals to the PC. USB is designed to support a data throughput rate of 12 Megabits per second which makes it an ideal bus architecture for connection of digital telephony peripherals.

Technical Comparison**Access.bus**

Access/bus is a true plug and play technology allowing "hot plugging" of peripherals. It supports up to 125 devices of the same or different type and supports multiple cursors which is ideal for games, education, simulations and group work. It is geared toward low-cost, multiple input output devices, controlling monitors and managing internal system resources.

ACCESS.bus' and 'Universal Serial Bus' both offer plug and play functionality but each has its own performance and price characteristics.

Universal Serial Bus (USB)

At 12 Mbps the USB is optimally designed to support telephony devices. Offers both isochronous and asynchronous data transfer modes. Architecture assumes the connection of devices through "hubs" in a tree-like structure.

Like the ACCESS.bus, the USB transfers information on 4 physical wires on a shielded twisted pair cable. Low-speed devices are supported on the USB at 1.5Mbps.

IEEE P1394

Like the USB, P1394 is also a data transfer bus. It is similar to Plug & Play characteristics of ACCESS.bus and USB but is much faster than USB. With a scaleable architecture, the P1394 can operate at speeds as high as 400 megabits per second. P1394 supports high-end digital video and audio as well as hard drives.