Cutting the Mouse Tail

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This paper will discuss a fundamental change in the way all input devices and peripherals will interact with the personal computer. A critical change, because it involves living the vision of the long-promised wireless office and home.

The Infrared Data Association (IrDA) is a direct outgrowth of the desire to cut the apron strings between Personal Computer (PC) devices and the user. There are times when we are as securely attached to the PC as the peripherals we use.

Infrared data links allow us to move around and establish links without always plugging something in. Printing while visiting another office, sharing files and other applications are only natural, especially in an age of Handheld PCs and other smarter, useful portable information tools.

IrDA members started to look at other needs in the IR application space. A common question was how to get rid of other cables, when it clearly made sense to do so. Also, how about getting rid of the multiple remote controls on the coffee table and developing a single intelligent tool to manage the tasks currently handled by multiple remote controls? There are multi-function remotes on the market, but isn't it possible to combine these with a PDA or Handheld PC and do more?

A lot of questions to answer. The net result was a series of meetings to address whether there was sufficient interest to tackle the problem. There was, and after two years of work, a new proposal was forwarded through the IrDA committees for approval.

This new proposal is known as IrDA Control, as this technology directly addresses control inputs from peripherals. The current IrDA Data specifications are data transfer oriented, such as printing, sending a file, sharing file data and so forth.

The IrDA Control specification was created to handle control data inputs from mice, keyboards, gamepads and joysticks, as shown in Figure 1.

The system structure is one where the host polls a series of peripheral devices and services them in a regular manner.

These technologies are available today. It is a change that is happening now.

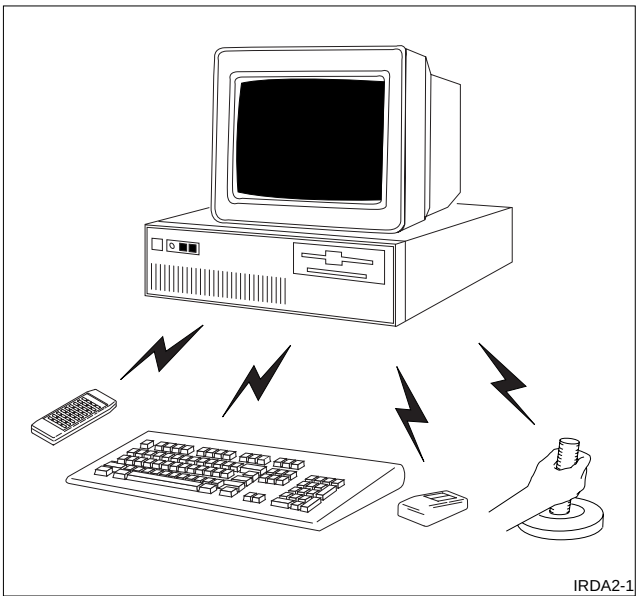

Figure 1. Cordless Input Devices

This proposal to the IrDA is a result of the combined effort of engineers at Hewlett Packard, Intel, Microsoft and SHARP, with suggestions from a number of other companies.

The basic idea was to cut the tail off the mouse, and allow it to roam free on the desktop. This would also cut loose the keyboard and allow greater freedom over when and how it is used.

Gamepads and joysticks were a natural fit into the system, and had to be considered in the beginning to ensure that they could be properly serviced.

The IR medium has to be shared between a number of devices at the same time, so a Time Division Multiplex system was chosen. The host device was selected to be the system manager, as in many applications the peripheral devices talk to it and not each other. Also, it is more likely to be connected to an AC outlet for a continuous power supply.

In this architecture, each peripheral is allocated a time slot by the host and polled in the order required to properly maintain an adequate level of service.

The system requires bi-directional communication between the peripherals and the host. The host polls each peripheral, and receives a response. If the host does not receive a response, it knows that it did not hear back and can try again.

Meeting the minimum turn-around requirements for an input device such as a joystick during game play drove the system response time requirements and the overall system data rate of 75 kbps.

The net result is a system that polls up to four peripheral devices in 13.8 ms and starts the process over. The polling rate is fast enough to keep up with gaming devices and multiple users simultaneously.

When gaming devices are used, they need guaranteed 13.8 ms link latency, and the system moves into this mode. These are known as Critical Latency (CL) devices. Mice and keyboards do not require guaranteed latency, and are known as Non Critical Latency (NCL) devices.

A 16 Phase Sequence Modulation (PSM) data coding system utilizing a 1.5 MHz subcarrier was chosen for the Physical layer of the IrDA Control system. Data bytes to be sent are converted to a data set that has sixteen possible combinations of data strings.

The 16 PSM system with the subcarrier helps reduce or prevent interference between classic IrDA applications and IrDA Control. The two systems are not directly compatible, as they are intended to accomplish different functions.

Figure 2 shows a block diagram of the system Architecture. The Physical layer resides at the bottom of the overall stack of hardware and software.

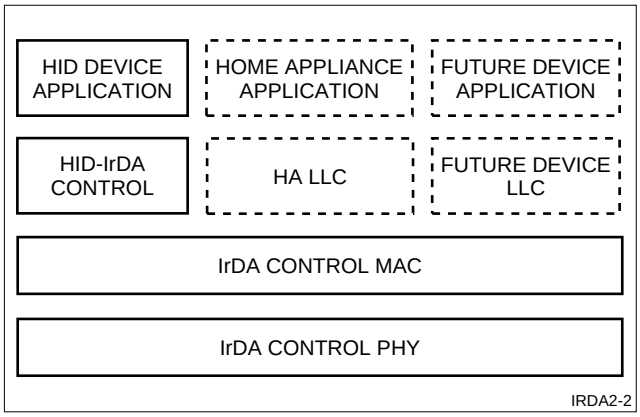

Figure 2. System Architecture

Signals are transmitted in the IR medium through a transceiver incorporating both the transmitting LED and receiver circuits.

The Media access Control (MAC) layer manages the device addresses and flow of data between the host and the peripheral devices.

When the system is operating, the host will poll for peripherals in its reach space. If a peripheral wants service and has not previously been used on the system, an enumeration process will be initiated. Once enumerated, the peripheral address ID will be held in the device enumeration list at the host.

The peripheral device will be added to the active device-polling list, and bound to the system. If the peripheral has previously been enumerated, it will move directly to the binding step.

When a peripheral no longer needs service, it will stop acknowledging hails from the host and become dormant.

If the host no longer has any bound devices, the host will move into a sleep state. If a peripheral device needs service, it can send a command to wake the host, and the binding process can immediately occur.

The Logical Link Control (LLC) layer manages the flow of status messages between the upper level applications and the MAC layer to provide reliable communications. It sends and receives commands, sends and receives data, prevents duplicate frames and acknowledges transmission functions such as Acknowledge (ACK) and No Acknowledge (NACK).

END PRODUCTS

One of the key concepts behind the IrDA Control proposal was the ability to create an entire set of cordless input devices that operate in exactly the same manner as the wired version.

Any IrDA Control keyboard should work on any IrDA Control system that supports a keyboard. Any mouse appears the same as a wired mouse from any other manufacturer. Appropriate drivers may be needed on the host device, however other functions should be exactly the same. The wireless products can emulate and use the same drivers as their wired counterparts.

One of the first areas where this should appear is in combination with USB host devices operating on a PC with Windows 98. When the peripheral device is enumerated, Peripheral Info fields are requested by the host device operating system to identify what service the peripheral needs, and how it is to be identified.

The MAC and LLC layers will handle this data conversation between the peripheral and the operating system. Windows 98 incorporates USB drivers to facilitate this communication. A Common Class Driver will be available to enable multiple peripherals to communicate through a single host node.

An extension of this concept is a move into the consumer product arena. Once we have a host device in place, such as a multifunction PC/TV, the addition of a keyboard and integrated mouse for use with e-mail applications or an Electronic Program Guide is not a far-fetched idea.

Such a consumer product host can easily recognize standard devices. The addition of joystick or game controller functions is not far behind, as a single PC/TV or integrated Set Top Box can take the place of several other products in the home, or office.

Once the combined product has access to external media such as cable television, satellite reception or the Internet, a wide range of information now comes into the home. It is natural to try and move some of that information to other devices. Managing that information becomes more demanding as well.

The Home Appliance (HA) portion of the system stack provides for new devices that bridge from the PC environment to the consumer product arena. The distinction between PC and a TV is already blurred, and other smart appliances are likely to follow with the advent of digital media and pipelines to the home. Moving small amounts of information between your appliances does not require a high-cost wired system.

Suppose you have a smart remote control that can talk to your now smarter consumer device. Information from a program can be downloaded to your smarter remote. The IrDA Control specification allows for the transfer of long packets under the condition that Critical Latency devices are not demanding guaranteed service from the system.

It is then possible to download a recipe from a cooking program and load it into your microwave oven. Add the list of ingredients for the recipe to your shopping list. Download the command set from your new Digital Television to your touch screen remote so that you can customize the controls.

Download your Electronic Program Guide and program your VCR and other appliances to satisfy your schedule. A smart remote with a touch-screen LCD allows for displays in a variety of formats. Font sizes can be changed for easy reading or for those who need a bit more help seeing the listing.

Product functions can be simplified as compared to existing remotes, listing only the basic first layer of services. Additional layers with more detailed functions can be placed on another application level, so that they are available when you need them, but not displayed when you do not want them.

The system stack also provides a path for Future Device Applications. This path is for the development of devices that have not yet been defined. New products are constantly redefining the marketplace, and the IrDA Control specification has made allowance for new ideas to use the system capability without requiring a complete redesign of the system.

The view from Sharp is one of crafting meaningful system-level solutions from both electronic components and standards like those set by the IrDA.

Companies that fully realize the promise of wireless peripherals, file sharing and data transfer will be those looking at more than just building and selling products, but of providing valuable services. The end result is shared efficiencies that create far greater customer loyalty.

A wide variety of possible products and applications are waiting to be created. What would you like to cut the tail off of today?

The Infrared Data Association: IrDA was established in 1993 to set and support hardware and software standards, which create infrared communications links. IrDA standards support a broad range of computing, communications, and consumer devices. International in scope, IrDA is a non-profit corporation headquartered in Walnut Creek, California, and led by a Board of Directors, which represents a voting membership of more than 160 corporate members worldwide. As a leading high technology standards association, IrDA is committed to developing and promoting infrared standards for the hardware, software, systems, components, peripherals, communications, and consumer markets.

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