Thoughts on Embedded Systems Interfacing

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Introduction

GPIO (General Purpose Input/Output) Pins

A big disadvantage nowadays is that most Linux single board computers have 3.3V or even 1.8V or less GPIO's. These are not particularly suitable for direct interfacing to lab equipment and will require drivers and/or level translators. The ULN2803 works well for loads that can be connected in a high side fashion (like relays or lamps).

RS-232 Serial

The ubiquitous serial port is still present on many, many devices. It is perhaps the lowest common denominator for an intelligent interface. Most Linux single board computers provide at least one serial port. Depending on how many RS-232 serial devices need to be controlled, it is probably better to use a USB serial cable per device or to use an Ethernet terminal concentrator like the DECserver 700.

USB

USB is now the standard interface for low cost embedded systems. Most new test equipment and computer peripherals (external disk drives, scanners, printers, etc.) now come with USB interfaces. Practically any legacy equipment with other interfaces (RS-232, GPIB, SCSI, parallel I/O, or whatever) can be controlled with an appropriate USB adapter cable.

GPIB (General Purpose Interface Bus)

GPIB, also known as HPIB (Hewlett Packard Interface Bus) and IEEE-488, has been around since the late 1960's. It was first designed for instrumentation control, and is still used for that purpose, especially with older lab equipment such as high end digital volt meters and the like.

No Linux single board computers support GPIB directly, as far as I know. National Instruments sells GPIB controllers with Ethernet and USB interfaces with support for Linux, but they are extremely expensive ($1000 per unit). Other vendors sell similar interfaces for about $500. Spark Fun Electronics sells USB and Ethernet GPIB controllers for $150 and $200 respectively.

Although relatively expensive, GPIB support will be necessary for many applications because of the large amount of legacy equipment with GPIB interfaces in service.

SCSI (Small Computer System Interface)

SCSI is seldom used for anything but interfacing to disks (that is what it was invented for) but there do exist SCSI scanners, film recorders, printers, and plotters. USB to SCSI adapter cables are commonly available for about $100.