

Tips and tricks of the trade

Control Laboratory Devices with Embedded Systems

Using embedded systems instead of supercharged Windows PCs to control laboratory devices has a lot of advantages. With the advent of powerful and license-free Linux distributions like Ubuntu, the transition from proprietary Windows systems to embedded systems running on open software has never been easier than today.

Lab Hint

Today, most data measured in a laboratory is collected by computers operating under a Microsoft system. Usually, the physical equipment e.g. DNA, protein or water analysing devices, is linked via special interfaces to a standard PC. The processes triggered at this point by the computer are quite simple. The data is normalised and prepared for further studies. Standard PCs equipped with Windows XP or Vista, however, have lots of extra functions. You may watch television or listen to your favourite radio show while running and controlling a PCR with your PC. Nice! However, these additional features may cause problems like system crashes or artefacts. Since most biologists are not able to reinstall the laboratory software, they have to call the computer company responsible for the operating system. You can avoid such time-consuming and annoying problems by using embedded systems.

All embedded systems have one crucial thing in common: the operating system is firmly installed on the machine. There is no need for a hard disk or a floppy to boot the system. Buying an embedded system is like buying a new car. You take a seat behind the wheel, turn the key and the engine starts. There's no "Plug and Pray" as with so many Microsoft applications. Embedded systems are maintenance-free and are not prone to infections by malware. The boot-up is extremely quick, since there are usually no mechanical parts inside. Embedded systems may operate either with a Windows version, known as Windows CE, or with a Linux distribution.

I recently returned from the computer fair "CeBIT", which takes place annually in Hannover, Germany. A lot of exhibiting companies presented embedded systems for medical or physical readings. All the embedded machines I saw at the fair were equipped with the Linux operating system

"Ubuntu". Ubuntu is open, well-documented software, enabling developers to optimise hardware and software. A representative from SBS, a Chinese company, told me that the advantages of these solutions were overwhelming in contrast to that offered by the "Windows world". Ubuntu is based on a modular configuration, making the construction of tiny machines possible. "Slim construction" is the keyword, aptly suiting the job in hand. SBS aims to produce systems for water quality control that operate for years offshore without further maintenance. Just think of a robot sent to Mars. Everything the robot needs has to be embedded; any superfluous parts would only endanger the project. Ubuntu is readily used as an operating system because it is not owned by a company. Ubuntu is a sponsored license-free project. Almost every embedded system I saw at the CeBIT was based on open software. This is astonishing, considering the very proprietary software industry.

Silent revolution

SBS, Digital Logic and other vendors at the fair cook the embedded systems to your liking. They help build the interfaces and provide the necessary modules. Data received from the physical device is collected and presented on a network drive. The embedded Linux, however, has another advantage. Users may connect to the machine via a shell for maintenance purposes, without having to be next to it. Similarly, you can't get to Mars by simply boarding a plane. Remote control is included in even the smallest versions of Ubuntu. Embedded Linux is a silent revolution, unaccompanied by entertainment shows but nevertheless already present anywhere. Just look at the new Asus EEE PC which runs on an embedded system based on Linux.

Free systems enable small companies to concentrate on solutions. Providers like "Knoppix" or "fl41" have developed solu-



Runs on an embedded system: NASA's Mars Exploration Rover.

tions for biometric applications and invite scientists to enhance the software. Open products, open software and open solutions enable people in the whole world to join together. Restrictions on software which apply to machines powered by proprietary software like WinCE, which can also be seen at the fair, do not apply to open software. Open software also offers a chance for poor countries to be involved in the global processing of ideas.

Back in my lab at the University of Bonn, I still find all machines in the laboratory powered by a normal PC. The new chromatograph and EEG devices are driven by Windows XP. The chromatograph just shows strange behaviour. Malware? I haven't checked it yet, however, a recent announcement claimed that even the well known computer manufacturer Hewlett-Packard has delivered a worm with its devices.

MATTHIAS FAIX
(Poison Centre at the University of Bonn)

Do you have any useful tips?

Contact us at:

editors@lab-times.org