Healthy developments

Software priorities for medical technology advancement. By ***George Brooks****.*

Medical specialists have seen how commercial organisations are using technology to respond quickly to market opportunities and to deliver cost effective services to larger numbers of customers.

There is now growing awareness that taking this technology into medical systems can contribute to disease prevention and speedier diagnosis, while improving patient comfort and convenience. For several serious illnesses, technology can facilitate the treatment and increase survival rates.

Advances in medical technology may also broaden access to treatment through reduced equipment and overall costs, shorter consultation times and less invasive treatments. Telemedicine will be a key enabler, with internet technologies improving accessibility and allowing more people to receive treatment at home. Telemedicine will also allow hospitals to better use their resources.

Improvements in software design are central to delivery of these advances. Developers need more flexible and robust platforms on which to build sophisticated features, such as graphical user interfaces to promote ease of use. Scalability is also growing in importance as vendors seek to extend their product ranges, leveraging existing applications and core competencies.

Increased use of networking technologies to access patient records is also focusing developers' attention on data security capabilities, as well as greater reliability and robustness to deliver devices that can simultaneously perform patient critical functions such as monitoring vital signs or supporting respiration. There is also a growing awareness of the benefits of 'plug and play' interoperability between instruments, as user communities seek to create systems based on standards to improve patient care and boost efficiency.

Broadband comms

Meanwhile, emergency equipment is improving by taking advantage of such technologies as broadband communications. As an example, one recent project has combined streaming video and secure connectivity in a portable defibrillator fitted with an infusion pump. Using this equipment, medics in the field with suitable access privileges can call up relevant patient records and may also view video based assistance to aid treatment of unusual cases. Challenges that have hitherto prevented these types of devices from being developed include the fact that the video and connectivity features cannot be allowed to interfere with the patient critical aspects of the device.

Hence to improve healthcare and enable new and more powerful medical equipment, software architectures and applications are evolving quickly. There is now greater emphasis on implementing operating systems in all types of devices, from portable monitors to complex, life critical equipment.

However, as far as more complex or critical equipment is concerned, the use of COTS components – including software components such as operating systems – is less well defined than in the military or aerospace industries. Proprietary operating systems are still widely used in high end or patient critical equipment, presenting barriers to future improvements in cost, time to market, functionality and interoperability.

To promote COTS design and to overcome these obstacles, authorities are now moving to adopt the certification and assurance standards already proven in industries such as avionics and automotive electronics. These include DO-178B, which provides a framework for certifying software to highest levels of confidence

for critical systems where failure can have catastrophic consequences.

A set of operating systems based on the UNIX framework and enabling easy migration and design reuse by conforming to the POSIX API standards provides a scalable platform for developers. This approach allows them to target the OS that best serves the requirements of a given application and to use existing applications unchanged on any system, as required.

"Emergency equipment is improving by taking advantage of such technologies as broadband communications." ***George Brooks****, LynuxWorks*

For example, a GUI or TCP/IP interface written for a system such as BlueCat Linux with soft real time capabilities can be migrated directly, or with minimal modification, to a hard real time OS, such as LynxOS. In addition to saving time in software development, application reuse also eases certification. Working within this environment, developers can meet the combined demands for competitive time to market and cost as well as satisfying critical safety assurance requirements all the way up to patient critical situations.

The POSIX standards define an open operating interface that promotes code portability between systems. It is important to note that a system can be described as being POSIX compliant even if only a subset of the full POSIX specifications is met. Only systems that are POSIX Conformant – thereby meeting all of the profiles shown in figure 1 – can guarantee code portability without modification. But this detail is often overlooked. LynuxWorks' LynxOS families of operating systems are POSIX Conformant and feature a native POSIX API, enabling portability of open standard Linux applications across all systems.

This also gives engineering teams the flexibility to develop applications on a low cost Linux system, then migrate the application to the optimum OS for the end product. Ultimately, the target may be a hard real time system, such as LynxOS, or a security partitioned system such as LynxOS-SE that allows multiple real time applications to run concurrently.

Medical equipment designers may also need to take advantage of native features embedded in more than one operating system to meet functional objectives quickly and cost effectively. Systems that require broadband network connection or which must play back video, for example, may need to take advantage of Windows XP and Linux. However, they may also require hard real time performance, or higher security than the standard desktop system can provide.

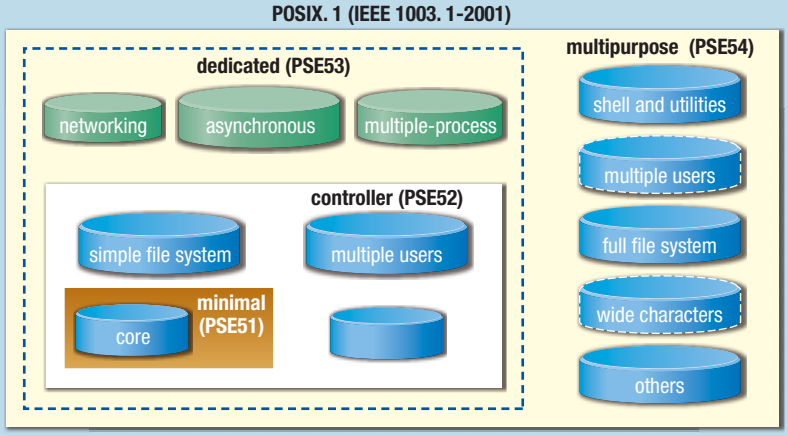
Equipment for remote surgeries provides a good example. While taking advantage of established Windows and Linux media capabilities to stream video across a network connection, other systems running in separate partitions will manage secure access to patient records or patient critical aspects such as control of surgical instruments.

A separation kernel, such as the LynxSecure hypervisor, achieves this by allowing virtualisation of several guest systems to operate in separate partitions. The kernel prevents an error occurring in any given partition from adversely affecting applications running on a separate guest partition.

Multiple dissimilar systems, including BlueCat Linux systems or ordinary desktop systems such as Windows XP, can operate alongside more robust systems such as LynxOS or LynxOS-SE.

As the medical community adopts reference standards from the aerospace and military sectors to promote the use of COTS components, including software, certified operating systems that also support open standards will allow developers to deliver increasingly robust and feature rich products to market quickly and cost effectively. ■

Figure 1: POSIX conformant profiles



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