ENEA

Customer Case Study

# Runtimes for a high-end medical device

Linux and real-time operating system platform for an advanced cataract surgery system

## The Problem

A multinational company in the medical industry needed a new software platform for a cataract surgery system. They were looking for a supplier that could provide a high-performance operating system, commercial support, customization and expert services

## The Solution

Enea delivered:

- Enea OSE, a high-performance multicore real-time operating system supporting the ARM SoCs
- A customized embedded Linux solution for the x86 GUI computer
- An IPC mechanism interconnecting the five subsystems
- Lab integration of hardware for maintenance and support
- In-house services capability to address unique requirements for customized hardware and software
- Development tools
- Training
- Support and maintenance

### A new generation software for phacoemulsification

The customer, with a global multibillion-dollar business in healthcare and medical devices, had made a strategic decision to develop a new platform for phacoemulsification devices used in cataract surgery. Being a competitive market space with several companies developing and selling phacoemulsification systems, the customer needed a technology edge to differentiate their offering from the competition, something that in turn required a more advanced computing platform.

The company designed the new product around four different surgical instruments, each controlled by its own multicore System-on-Chip (SoC) based on the 64-bit ARMv8 architecture. These systems would run a complex software stack with strict real-time requirements. The decision was therefore to use a true real-time operating system that could provide both determinism and high performance. In addition to the ARM SoCs, they used custom Intel x86-based hardware running Linux for the Graphical User Interface (GUI). With a solution distributed over five different subsystems, it was important to have an efficient mechanism for inter-process communication (IPC) that could handle communication between the control systems for the surgical instruments and with the GUI computer.

### Finding the right supplier for the runtime platforms

Developing the new software platform was a significant investment and the company wanted to get the new product to market without unnecessary delays. While the team had significant experience in embedded software design, they did not have in-depth expertise in either Linux or real-time operating systems. To speed up the process and make up for the lack of in-house experience, they used an expert consulting company to evaluate and select software components for the project, and to assist in software development.

One requirement from the customer was to keep the number of suppliers down, preferably finding a “one-stop” solution through a supplier that in addition to the software components also could deliver in-house customization services and long-term support for the complete runtime platform. With a single supplier, there would be no question about the support responsibility and it would be much simpler to procure services for customizations and integration of the subsystems.

### Phacoemulsification

Phacoemulsification is a method for cataract surgery in which the surgeon first makes a small incision in the cornea of the eye, then uses a probe with a small needle vibrating at ultrasonic frequecies to emulsify the intraocular lens (IOL) so that it can be aspirated through the tip of the needle.

When the emulsified IOL is aspirated through the needle, changes in the pressure in the anterior chamber occurs. To avoid damages on the cornea, advanced fluid mechanics is used to ensure as stable a preassure as possible.

Exact control of the vibration and motion of the needle is important to ensure efficient emulsification without creating excess heat energy that could harm the cornea.

Once the IOL is removed, an IOL implant is inserted and the incision is sealed.

## Enea is selected

After a thorough investigation and evaluation of several alternatives the expert consultant recommended Enea to the customer. Enea could provide the requested software and had the organization and expertise to provide support, customizations, and training as requested.

The customer followed the consultant's advice and selected Enea OSE, a high-performance real-time operating system designed for multicore devices, as the runtime for the four ARM based SoCs. Enea OSE could provide the customer with the real-time characteristics needed for the project as well as all features, including functionality to remotely update software in already deployed devices.

The GUI computer would run Enea Linux, a Yocto-compliant commercial Linux distribution. Enea adapted it to the customer's specific needs and delivered a customized board support package that included a number of custom drivers and custom support for a touch screen monitor, relieving the customer of the need to find expert Linux competence and take time from the project to configure and build the Linux distribution. Enea also delivered an SDK that allowed the customer to develop the applications from both Windows and Linux host machines.

Interconnecting all five boards using a high-speed inter-process communication (IPC) mechanism was an important aspect when selecting software components to the project. This was provided by Enea LINX, a message-passing link handler for IPC with autodiscovery of nodes and a minimalistic API that typically only requires applications to use send and receive calls after boot. Enea LINX combined with the seamless connectivity it provided between Enea Linux and Enea OSE created a simple, robust solution.

To simplify development and maintenance work on the custom Linux distribution, Enea set up a dedicated server in its lab. It allowed Enea and the customer to apply and test fixes, modifications and security updates very efficiently.

## Conclusion

The customer team was looking for a supplier that could provide a high-performance operating system solution, commercial support for the runtime platform, customization and qualified product services. Enea delivered a complete solution, including components, integration and customizations. The customer benefited from Enea's deep expertise through shortened development time, significantly reduced risks, and an optimized runtime providing improved hardware utilization.

### Enea Runtime Solutions for Medical Applications

Enea's Linux and Real-time Operating Systems (RTOS) are used by companies developing medical devices and embedded systems for the healthcare industry.

Our operating system products have been embedded in many different medical applications including:

- Infusion pumps
- Robotic surgery devices
- Defibrillators
- Liquid chromatography devices
- Blood analyzers
- Biometric sensors

### More information and contact

More information about our products and services for medical applications is available at:

www.enea.com/medical