eko systems, inc.
SUN’S JINI™ TECHNOLOGY CONNECTS MEDICAL DATA AND EQUIPMENT DYNAMICALLY AND RELIABLY

“...the last thing you want to worry about is whether your equipment is going to work. For doctors and nurses to accept new technology in their work environments, especially in acute-care settings such as operating, recovery, and emergency rooms, it has to meet stringent requirements for reliability, usability, and manageability or it will never fly.

An anesthesiologist with more than 15 years of clinical experience, Dr. James Koch has a keen appreciation for what medical workers need to get their jobs done. When he set out to design a system that would create electronic patient records at the point of care, and include data output from a wide variety of medical equipment, Koch knew that nothing about the system’s interface or implementation could distract hospital staff from their top priority: patient care.

To design an entire system that’s easy to learn and use, and has no maintenance overhead, eko systems relied on a team of top technologists, including Jim Edmiston, chief technology officer and cofounder. The technologies we are using are making our product more reliable. Jini technology allows us to distribute the application, compartmentalize any possible failure, and hot-swap components while running.”

—Jim Edmiston, Chief Technology Officer and Cofounder, eko systems, inc.

Jini technology gave the system, called Frontiers, the capability to connect to any type of medical equipment—including physiologic monitors, ventilators, and anesthesia machines—without requiring clinicians to even think about configuration data or software drivers.

“A critical part of making these systems usable is making them manageable,” said Koch, cofounder and chief medical officer at eko systems, in Fairfax, Va. “The whole point of using Jini technology is that the device interface can be managed by the clinicians, and all they have to know is how to plug things in and read an LCD (liquid crystal display) screen.”

Top Technology

To design an entire system that’s easy to learn and use, and has no maintenance overhead, eko systems relied on a team of top technologists, including Jim Edmiston, chief technology officer and cofounder. It was Edmiston who figured out how to remove the technologic complexity from the hospital environment. Because it uses the
full capabilities of Java and Jini technology, the Frontiers system is engineered to be self-configuring, have a high degree of fault tolerance, and be self-administrating, so it can perform under any conditions without human intervention. At the back end, Frontiers uses the open communications protocols of the Internet and Enterprise JavaBeans technology to connect to the hospital’s legacy systems.

“There are three critical components that make Frontiers what it is today: reliability, maintainability, and ease of use. We owe a large part of our success to the Sun hardware and software we have incorporated into our product,” said Edmiston. “In this environment, you can’t crash and reboot—it simply isn’t acceptable to the clinicians to have the system go down. With Frontiers, we maintain the network remotely, so not even the hospital Information Services department needs to get involved.”

“Inova Fairfax Hospital, one of the nation’s top 100 hospitals and a premiere teaching and training facility, a four-year pilot program with Frontiers has given it the capability to capture and analyze patient data in real time. The result has been an improvement in how nurses, doctors, and clinicians perform their jobs, and a degree of visibility across departments that paper records could never provide.

The benefits are clear: consistent, complete records of each patient that can be logged and retrieved at the point of care. The business benefit to hospitals is substantial: more complete record keeping leads to more accurate billing, so hospitals can recoup a higher percentage of their fixed costs. But more importantly, electronic records mean that hospital staff has immediate access to patient data, even as they are being created. For the first time, physicians and administrators can review and analyze a wide swath of therapeutic data to discover which treatment plans have the best outcomes, and set hospital-wide protocols that will result in higher quality of care.

Frontiers’ technology also reduces the time it takes to do charting on a patient—the day-to-day log of drug dosages, medical procedures, and observed recovery rates of each patient—from ten minutes to less than two minutes per patient.

“I can chart with one finger while I’m holding a screaming baby that’s just come out of the operating room,” said Jane Preisman, a registered nurse at Inova Fairfax Hospital. “Plus, in Frontiers everything is consistent, so it’s easier to find out what’s going on with other people’s patients because it’s all done the same way.”

**Built to Perform**

Frontiers is most valuable in settings where a great deal of concurrent, critical care is being given to unusually sick patients. In operating rooms, that means connecting machines that monitor fetal heartbeats, measure cerebral pressure, administer anesthesia, or pump a patient’s
blood—equipment that sustains vital functions and must not go down. To get the best in reliability and fault-tolerance, eko systems took every precaution that no system would fail, and not even a second of data would be lost.

Failover safeguards in the Frontiers system include:

- The reliability of the Solaris Operating Environment at every point
- Redundant network interface cards that keep all Jini technology devices connected at all times to the network via an internal switch
- Network-optional applications that can run in stand-alone mode in the event of a local- or wide-area network outage
- The reliability of Sun StorEdge™ disk arrays for long-term storage of patient records

“We have taken the strong requirements of the acute-care environment and folded them directly into our product,” said eko systems’ Edmiston. “The technologies we are using are making our product more reliable. Jini technology allows us to distribute the application, compartmentalize any possible failure, and hot-swap components while running.”

**Looking to the Future**

Over the next three months, Inova Fairfax Hospital will broaden the use of the Frontiers system, bringing it into acute-care settings in every department. The system is also being tested in the operating, recovery, and emergency rooms of hospitals across the nation.

eko systems is preparing for the hurdles medical treatment centers like Inova Fairfax are going to have to clear in the coming years. Legislation such as the Health Insurance Portability and Accountability Act (HIPAA) will require hospitals, doctors’ offices, and even medical equipment manufacturers to meet stringent new guidelines for the electronic storage and transmission of patient data. Sun Microsystems tracks the development of HIPAA regulations closely, and stays in close contact with its development partners who need to know about them.

“Under the HIPAA regulations, eko systems would be viewed as a business partner. That means we have contractual obligations we have to meet with our clients,” said Glenn Hazard, president and chief executive officer of eko systems. “We have a compliance officer who oversees all that. When the regulations are finalized and made available for public review, we’ll be sure that Frontiers adheres to the appropriate guidelines. Those capabilities are being built into our system today.”

**Executives**

Hospital administrators see clear business advantages to updating existing paper-based billing and record-keeping systems. Jini network technology enables deployment of electronic systems that are secure, reliable, and easy to use, so new technologies can be introduced in a staged manner that supports established practices.

**System Administrators**

For hospital Information Technology (IT) administrators, a system that relies on a Jini technology-enabled network can be managed remotely, adding no new tasks to their workload. That way, IT staff can stay focused on maintaining local-area networks and databases, as well as legacy applications, to be sure physicians and caregivers have full access to the hospital’s information resources at all times.
Users

A Jini technology-enabled information system such as Frontiers will not distract clinicians from their top priority: taking care of patients. Because Jini technology-enabled networks are dynamic and self-configuring, hospital staff will never be confronted with IT hassles when connecting medical equipment or opening patient records. And Frontiers is set up to mimic existing hospital procedures, so new technology will not upset established routines of care.

Developers

As more Jini technology-enabled networks are put in place, developers in any vertical market can learn from the implementation efforts of others. For example, eko systems created a semantic structure on which to base data exchange between devices in its network. In the future, industry groups will want to establish standards that every developer can use to create applications for his or her target audience.

“Jini network technology enables the rapid and cost-effective development and deployment of new applications and services over networks.”