

Case Study

Digital Health

Systems Integration and
Wireless Technology

Wireless LAN is the Prescription for Innovation at The Alfred

Medical images and patient information delivered wirelessly to bedsides help improve patient care and boost staff productivity within Australia's largest ICU facility

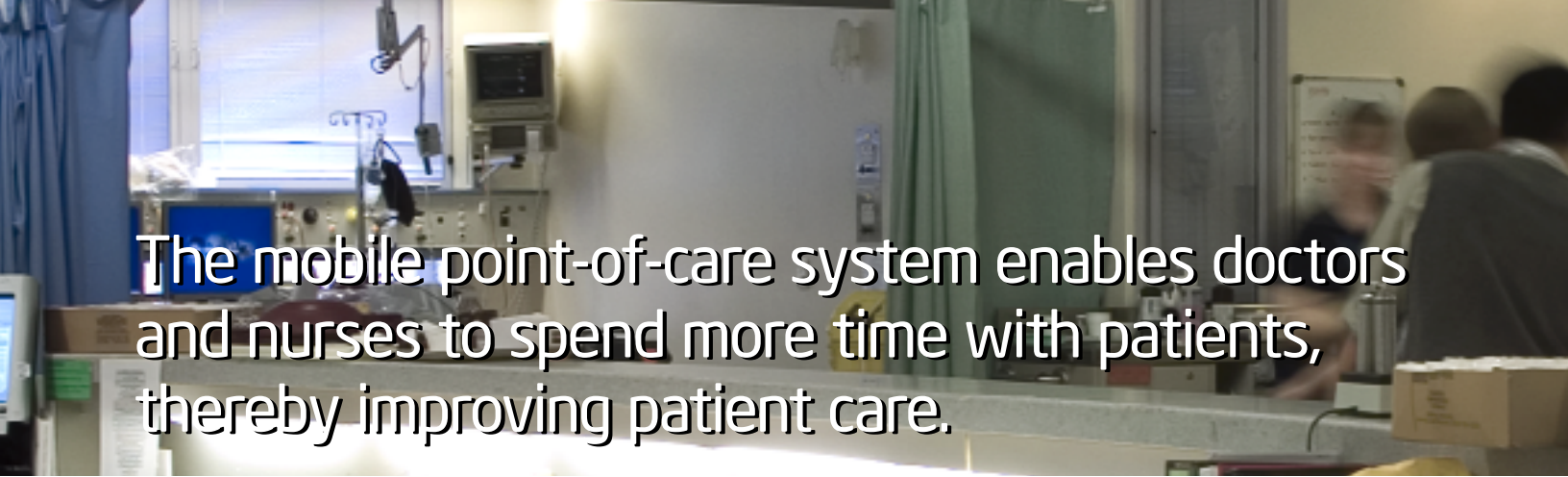
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- Challenges**
- Deliver electronic medical images (such as MRIs, CT scans, and X-rays) as well as patient information, test results, and Internet access to bedsides within the ICU to improve patient care
 - Determine the best way to display digital information at bedsides
 - Ensure reliable operation in the ICU environment

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- Solutions**
- Studies of how clinicians use digital images and other information drove the design of a wireless information delivery system for the ICU
 - The Intel team designed a new wireless network and a mobile system to display images and patient data at bedsides
 - Consultants deployed a mobile point-of-care system for the ICU in three phases to ensure reliable operation
 - Successful tests led to a full deployment in the 41-bed ICU

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- Benefits**
- Access to medical images and other information at the bedside enables more timely and accurate care decisions
 - The risk of cross-patient infection can be minimized by staff accessing hospital systems at each bedside, eliminating the need to exit the patient bedside area, which is a slow and costly process: staff must de-gown to use the PC at the nurse's station and then sterilise, re-glove, and re-gown to return to a patient bedside area
 - Staff productivity is improved by eliminating this time-consuming process, which can increase the time caregivers can spend with patients and their families, thereby improving patient care

The Alfred hospital's AUD 21 million Critical Care Complex is one of Australia's leading healthcare facilities dedicated to adult medicine. Within the ICU, administrators are always looking for innovative ways to harness information technology to help improve patient care. With the increased use of picture archiving communications systems (PACS) to deliver digital medical images at The Alfred, management asked Intel® Solution Services to recommend the best way to deliver those images to bedsides for use by ICU doctors and nurses. Intel worked with the Australian Centre for Health Innovation to identify how technology could provide operational benefits to The Alfred.





The mobile point-of-care system enables doctors and nurses to spend more time with patients, thereby improving patient care.

“The technology expertise of Intel® Solution Services helped us create an infrastructure to deliver digital medical images and other information to the point of care. As a result, we are able to provide better care to our patients and our staff is more productive.”

Prof. Carlos Scheinkestel
Head of Intensive Care and
Hyperbaric Medicine
The Alfred

Business Challenge

A digital transformation is taking place in hospitals such as The Alfred. The hospital's intranet provides access to patient records, test results, and medical images such as MRIs, CT scans, and X-rays as well as other information. But every time ICU staff needed to use the intranet, they had to leave the patient's bedside and go to one of the PCs at the nurse's station. As they exited the bedside area, the doctor or nurse had to remove their gloves, de-gown, and wash their hands to avoid cross-patient infections. Then, to re-enter a patient's bedside area, they had to repeat the process in reverse. This was time-consuming and costly, so staff would wait until they had several tasks to perform before leaving a patient's bed area. This resulted in to-do lists being maintained on scraps of paper and occasional delays in ordering tests and obtaining patient information for decision making.

Underscoring the hospital's objective, Professor Carlos Scheinkestel, The Alfred's head of Intensive Care and Hyperbaric Medicine, says, “Our business is providing the best patient care possible. We must look for ways to use technology to transform how we serve our patients. We must analyse our own effectiveness and, through this self-evaluation, identify areas for improvement.”

Scheinkestel called on Intel® Solution Services to help determine the best way for his staff to access images and other information systems from inside the ICU. He adds, “We chose the Intel consulting organization because they had a vision of how technology could transform healthcare. Our hope was that the infrastructure they recommended would provide a foundation for many other digital applications within the ICU.”

Business Solution

The Intel consultants began by creating a formal project plan, which would guide the course of the engagement.

Spotlight: The Alfred

Founded in 1871 in Melbourne, The Alfred is one of Australia's leading hospitals. More than 250,000 patients are treated annually by a staff of 3,500 at the 330-bed facility. With 42 clinical units offering every form of medical treatment except obstetrics and paediatrics, The Alfred provides the most comprehensive medical and surgical services in the state of Victoria.

The Alfred is recognized as a trendsetter in acute care, research, and medical teaching. In addition, the facility is the state of Victoria's adult trauma and burn centre. Supporting the hospital is the Alfred Medical Research and Education Precinct, focusing on biotechnology research and comprised of the Australian Centre for Health Innovation, the National Trauma Research Institute, National Heart Research, Baker Heart Research Institute, and Nucleus Network (formerly Clinical Trials Victoria).

Today, The Alfred is part of Bayside Health, a group of healthcare facilities providing service to the greater Melbourne area as well as other regional and national communities.

www.alfred.org.au



The plan, accepted by the ICU staff, included:

- Assessing business and technical goals and requirements
- Designing architecture
- Creating a pilot test plan
- Defining success criteria for moving into production
- Executing a live demonstration and production pilot
- Creating a deployment plan
- Measuring benefits

To assess the requirements within the ICU, the Intel consultants documented how staff members use medical information when caring for their patients. The consultants observed the workflows and daily activities of the ICU staff to identify how technology could help improve clinical processes and procedures.

After extensive analysis of both workflow and environmental conditions in the ICU, Intel Solution Services consultants began to define a new mobile point-of-care

system that would meet the hospital's goals. The consultants drew upon their prior experience in the healthcare field as well as other industries to develop a solution for The Alfred.

The system, shown in Figure 1, would deliver information to the bedside through a desktop computer using a wireless adapter and Intel® Centrino® mobile technology. Scheinkestel suggested the use of two monitors to enable doctors and nurses to view medical images alongside patient records and test results. The staff could also order tests and view test results without the need to write notes and remember orders until they could be entered into the computer outside the patient bedside area. The Intel consultants designed the mobile desktop with two large flat-panel monitors mounted side-by-side on a cart for easy portability. An uninterruptible power supply within the mobile desk provides power in case the system needs to be unplugged and moved to accommodate a special procedure or move the patient. After seeing the demonstration, Scheinkestel says, "We know medicine and Intel knows technology. The cart design is a great solution to our problem in the ICU."

Services Provided

- Intel® Solution Services assessed the ICU workflow to identify areas for improvement, documented requirements, and evaluated alternative technologies, including applications and networks
- Intel consultants developed, tested, and deployed a mobile point-of-care system in the ICU
- Intel Solution Services measured results and documented the benefits received

Key Technologies

- A wireless 802.11a Wi-Fi* network
- Desktop PCs using Intel® Pentium® 4 processors with Hyper-Threading Technology, 802.11a wireless adapters with Intel® Centrino® mobile technology, twin graphic adapters, and large flat-panel displays
- Laptops with Intel Centrino mobile technology



The network connecting the mobile point-of-care system to the outside world had to be secure and continuously available. Intel consultants selected the Mobile Edge Wi-Fi* network infrastructure from Aruba Networks for its security and flexible, self-healing architecture. Multiple access points were installed in the ICU, all managed by a central controller. The resulting network is self-calibrating and self-healing in the event of a single access point failure

A three-phase pilot proves successful

Having identified the components of the mobile point-of-care system, the consultants proceeded with a pilot test. First, all of the necessary equipment was configured in an Intel® Solution Centre lab in Sydney. Once the system was tested for functionality there, it was moved to a lab at The Alfred, where it was tested alongside other hospital equipment to ensure there would be no interference between systems.



Figure 1. The mobile point-of-care system provides wireless access to digital images and other hospital information systems.

Once the lab tests were completed successfully, the consultants deployed the 802.11g Wi-Fi network in the ICU. The Intel team had already determined where best to locate the access points to prevent dead zones. The pilot mobile point-of-care system was moved to a bed within the ICU. Scheinkestel wanted the wireless system to provide at least 98 percent availability over the course of several weeks. But as the consultants monitored signal-to-noise ratios, they uncovered quite a bit of radio frequency noise in the ICU. A cordless phone on the ward was interfering with the wireless network, causing occasional losses of connectivity.

The consultants recommended moving away from the 2.4 GHz 802.11g network to the 5 GHz 802.11a band to improve availability. That change required additional testing and approvals to ensure that the 802.11a network would not interfere with other medical equipment on the ward. After two days of testing, the consultants demonstrated that no interference existed between the 802.11a Wi-Fi network and the medical equipment.

The single-bed pilot demonstrated the viability of the concept—that it could make doctors more productive so they could spend more time with patients. In addition, bedside access to the hospital's information systems eliminated the need for nurses to carry paperwork for doctor approval, chase down test results, and hunt for medical records. With nurses able to spend more time at patient bedsides, care was expected to improve.

The next step in the pilot program was to demonstrate that the mobile point-of-care system could support all 41 beds in the ICU. Could the system provide speedy access to digital images while staff members accessed medical records, the Internet, and the hospital's intranet? This scalability test was



accomplished by expanding the pilot test to six beds in the transplant ICU ward, where patients are isolated from other patients for infection control. There, the mobile point-of-care system enabled nurses to access all The Alfred’s information services without leaving their patients.

During the four months of pilot testing, the mobile point-of-care system maintained 100 percent availability. Based on that track record, hospital administrators have decided to deploy the wireless component of the system to all 41 beds in the ICU during its upcoming refurbishment.

Increased productivity leads to improved patient care

At The Alfred, success is measured mainly in terms of patient outcomes rather than simply return on investment. At the conclusion of the engagement, the Intel consultants documented the benefits of the mobile point-of-care system. A survey was conducted with doctors and nurses to capture their reaction to the new system. Results are shown in Figure 2.

From a workflow standpoint, the system speeds up ward rounds and eliminates the need to leave the patient bedside area to access electronic information systems. Critical decisions can now take place at the bedside during ward rounds, which helps improve care. The mobile point-of-care system also enables doctors and nurses to spend more time with patients. Says Scheinkestel, “Every extra minute a clinician can spend with patients and their families is a valued improvement in patient care.”

The hospital’s teaching staff uses the new mobile point-of-care system to show students medical images on the displays while pointing out the reality of a patient’s condition at the bedside. Students can view test results at the bedside while walking through protocols and treatments.

Because the staff is now more efficient and is able to spend more time with patients and their families, many report a reduction in job-related stress, which can improve employee retention. In addition, being under less stress can itself translate into improved patient care.

A quick financial payback makes the system affordable

The financial impact of the project is in the hospital’s favour as well. The hospital’s investment of AUD 400,000 is expected to be recouped in only seven months¹ due to the improved productivity and supply savings from not having to de-gown to access the hospital’s information systems.

“By gaining the expertise of Intel® Solution Services, we shortened dramatically the time needed to introduce innovative new techniques into our hospital.”

Prof. Carlos Scheinkestel
Head of Intensive Care and
Hyperbaric Medicine
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Number of Respondents	Observation
64%	Patients receive better care
45%	Can spend more time with patients (averaged 43 minutes)
36%	More productive
82%	Realized benefits during ward rounds
55%	Decision making is enhanced
100%	Electronic ordering is more efficient
73%	There are opportunities to save on supplies
90%	Happy with the solution
36%	Felt empowered to do better job
36%	Experienced reduction in stress

Figure 2. Observations of The Alfred’s ICU staff regarding the mobile point-of-care system pilot.

The ICU network leads to further innovation

The success of the network in the ICU has led to the hospital embarking on a campus-wide Wi-Fi network. Also, plans are on the drawing board to integrate patient monitoring devices into the network so data can be delivered over the Internet to doctors using handheld devices. In this way, doctors can receive real-time updates on the condition of their patients.

When asked to comment on the work done by Intel Solution Services, Scheinkestel says, "We asked Intel to figure out how best to display medical images at the bedside, but they went way beyond that. They took a comprehensive look at our ICU operations and made several recommendations for using IT to improve patient care. The productivity gains enable staff to spend more time with patients; we have faster access to patient information now, which helps us make better decisions; and we have improved infection control by eliminating the movement of staff and equipment between beds and computers outside the ICU."

Like most hospitals, The Alfred has precious little funding to experiment. Says Scheinkestel, "By gaining the expertise of Intel Solution Services, we shortened dramatically the time needed to introduce innovative new techniques into our hospital."

Return on Investment

Access to patient and research information at the patient's bedside gave staff more time with patients.

- Fewer trips in and out of the room enhanced infection control. Also, fewer gloves and gowns were required by staff when treating patients.
- Electronic ordering of prescriptions and tests increased efficiency, and fewer transcription errors were reported by users.
- Immediate access to diagnostic information streamlined workflows. For example, clinical staff saved 5 to 10 minutes per patient during rounds, and bedside nurses saved approximately 38 minutes per shift.

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¹All test results taken from: The Alfred—Mobile Point of Care or Information at the bedside in the ICU, Intel Creative Brief, 2006. Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, visit www.intel.com/performance/resources/limits.htm.

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