CASE STUDY

Transforming Healthcare in Saudi Arabia

Intel® Xeon® Processor E5 Family
Performance, Enterprise Mobility
Healthcare

Challenges
• Increase access to efficient, high-quality healthcare. In the face of rapid population growth and rising rates of chronic diseases, King Faisal Specialist Hospital and Research Centre (KFSHRC) is committed to delivering comprehensive, coordinated care to rising numbers of patients in the Kingdom of Saudi Arabia (KSA).
• Optimize the cost and performance of healthcare IT solutions. KFSHRC needs powerful, cost-effective data center and client computers to take advantage of advanced informatics solutions that can improve the delivery of healthcare services.

Solutions
• Performance in the data center. KFSHRC is replacing many mainframe and RISC platforms with virtualized servers and storage systems based on the Intel® Xeon® processor E5 family. The center's servers use Intel® Ethernet Converged Network Adapters to enhance storage performance.
• Mobile productivity for healthcare providers. 2 in 1 devices with the Intel® Core™ i5 vPro™ processor enable busy physicians and nurses to access vital information when they need it to make more informed clinical decisions.

Technology Results
• Massive savings. By replacing its mainframe environment with an open environment based on Intel® technologies, KFSHRC has significantly reduced capital costs as well as ongoing costs for licensing, support, and maintenance.
• Optimized data center. KFSHRC leaders say their new systems and virtualized environment have reduced floor space requirements by 50 percent, and reduced cabling inside the data center by 70 percent.
• Improved uptime. KFSHRC reports that the new systems and virtualized environment have helped improved system availability in the data center by 90 percent, ensuring reliable access to vital healthcare applications and data.
• Enhanced agility. KFSHRC's IT professionals can deploy new capabilities quickly, and the flexible architecture supports rapid growth.

Business Value
• More coordinated, patient-centered care. Powerful healthcare IT solutions can help KFSH clinicians increase patient safety and organizational efficiency. They give treatment teams a fuller understanding of the patient and empower them to provide more coordinated care before, during, and after the patient's hospital stay. IT solutions that support the center's training, research, and telehealth activities can help improve care at other Saudi clinics and hospitals, including dozens that are being added to meet the Kingdom's growing need for healthcare services.
• Higher patient satisfaction and engagement. Patients and their families can experience shorter wait times, greater convenience, and fewer redundant procedures. Tools such as portals can help engage patients in managing their own health.
• Improved productivity. Healthcare IT solutions can help medical professionals work more productively and reduce stress. The use of advanced tools demonstrates KFSHRC's commitment to modernity and helps it attract and retain doctors, nurses, and other clinicians.
• Readiness for Healthcare 2020. KFSHRC is positioning itself to take advantage of technology-enabled advances – such as wearable health-monitoring devices, digital collaboration, and genomics-based personalized medicine – that are transforming medicine.
• Enhanced quality of life. By providing more efficient and comprehensive care, KFSHRC helps enhance citizens' quality of life, productivity, and satisfaction. This can free resources for innovation in other sectors of the economy.

Modernizing on Intel® technologies helps King Faisal Specialist Hospital and Research Centre improve access to efficient, high-quality care while realizing massive savings.
KFSHRC's technology strategy reduces costs and creates a foundation for continued innovation

**KSA's Premier Health Center**

With facilities in Riyadh and Jeddah, plus a children's cancer center, KFSHRC provides specialized referral healthcare in an integrated educational and research setting. KFSHRC is where the most seriously ill patients from anywhere in Saudi Arabia come to receive the most advanced treatments from the most highly skilled professionals. It leads the Kingdom in areas such as oncology, transplants, neurosciences, and medical genomics.

As a research center, KFSHRC is also where Saudi scientists develop new insights and breakthroughs. The center focuses on interdisciplinary work to further the understanding and treatment of human disease. Work ranges from identifying genetic variations that influence the development of cancer to clinical trials that determine the effectiveness and safety of new medications.

As a teaching hospital, KFSHRC helps train the next generation of physicians, nurses, and other clinicians. In addition to demonstrating today's best practices, this includes preparing tomorrow's healthcare professionals to apply the rapid, ongoing advances that will make Healthcare 2020 look quite different from today's care.

Many factors are increasing the demand for healthcare services and are making KFSHRC's work more important than ever. These include:

- **Rapid population growth.** The Kingdom's population rose from 9.8 million in 1980 to 29.37 million in 2014 and is projected to reach 40.4 million in 2050. It grew approximately 50 percent in the last decade alone.

- **An aging population.** Although KSA has a youthful population, its citizens are living longer and the number of older Saudis is rising. By 2050, an estimated 18.4 million Saudis will be 65 years or older, with life expectancy expected to reach 81.8 years.

- **Increases in lifestyle diseases and risk factors.** A 2014 study conducted by the Ministry of Health found that more than 1.1 million Saudis are diabetic, 1.9 million have hypertension, and 1.1 million have high cholesterol. Nearly 28 percent of the population and 48 percent of those ages 55 to 64 are obese. Saudi Arabia ranks 23rd in the world in the number of smokers per capita, with tobacco use increasing. Traffic-related injuries are also on the rise.

**Technology Choices to Advance Care at KFSHRC**

KFSHRC is adopting a variety of healthcare IT solutions to support the Kingdom's healthcare and eHealth goals. "Our vision for Year 2020 is to be a world-leading institution of excellence and innovation in healthcare," says Dr. Osama Al-Swailem, chief information officer of KFSHRC. Like many enterprises, KFSHRC recognized that modernizing its technology infrastructure would be essential to meeting future challenges in a reliable, cost-effective way. "We were dealing with the common challenges that face any large organization that has its own data centers and is running on legacy platforms with proprietary RISC and mainframe architectures," says Waheed Y. Khayyat, director of IT infrastructure services at KFSHRC. "At the top of the list were the high costs of acquisition and ownership for hardware, especially servers. We also incurred high ongoing costs for matters such as power usage, cooling, hardware maintenance, and hardware support. In addition, the physical space requirements to host the servers were problematic. We knew that as we added more applications and collaborated more with healthcare providers throughout the Kingdom, the problems would only get worse." Storage presented additional challenges. Storage capacity at KFSHRC has expanded at an average rate of almost 20 percent annually for the last three years, driven by the expansion of digital images in the picture archiving and communications system (PACS) as well as the electronic medical record and other eHealth tools.

KFSHRC's data center experts researched the available platforms and architectures, looking for robust systems that would provide reliable, scalable performance for their fast-growing environment. Then, they began migrating older workloads whenever possible to high-performance servers and storage systems with the Intel Xeon processor E5 family inside, using virtualization to enhance resource utilization. They chose high-speed network solutions also based on the Intel Xeon processor E5 family to improve storage performance.

**Benefits in the Data Center**

"In our environment, downtime is unacceptable, and our requirements for performance and capacity are expanding very quickly," says Khayyat. "We chose Intel technology-based servers as a standard hardware architecture to have a robust and unique virtualization architecture that gives us excellent performance and lowers our capital and operations costs on many aspects of hardware and server ownership. We are able to utilize our servers much more efficiently, and the costs of cooling and power usage inside the data center are much lower. We also have reduced the physical space requirements for hosting the servers. This is important since it helps us support new healthcare services at KFSHRC."

"One of the goals and objectives for the IT personnel of a healthcare institution is to make information available to the care givers – physicians, nurses, and others – with the least effort on their part. This lets them focus more on the patients themselves. This is one of the main improvements we expect to achieve from using the Intel® processor-based computing platforms."

Waheed Y. Khayyat
Director, IT Infrastructure Services, KFSHRC
applications without having to build out the data center. By replacing much of our old mainframe environment and implementing the Intel technology-based standards for our enterprise, we are seeing massive reductions in cost, along with improvements in return on investment (ROI).”

Improved availability is an especially important benefit. “Using virtualization on the Intel processor-based platforms, we have improved the availability of our systems by 90 percent,” Khayyat says. “We have also been able to improve and simplify our disaster recovery procedures. This helps us ensure that clinicians have access to resources and information whenever they need them.”

The virtualized environment improves the IT department’s ability to support KFSHRC’s clinical and business environments. “The environment is simpler and easier to manage and maintain, so our staff has more time to support new applications,” says Khayyat. “We can also be much more agile and responsive in responding to business and clinical requirements because we can provision servers in almost no time.”

The new environment provides practical benefits inside the data center. “We have experienced high consolidation rates and, as a result, we have freed up floor space in our data centers by around 50 percent,” says Khayyat. “We have reduced the amount of cabling within the data center by 70 percent. This made the setup much less complex. It also makes it much easier to troubleshoot any issues when we encounter them.”

KFSHRC data center experts say they benefit from Intel’s close working relationships with many technology companies that incorporate Intel® processors into their solutions. “Because of the collaboration between Intel and our server provider, we were able to implement and deploy these platforms with very little effort,” Khayyat says. “Both companies have a clear and compatible understanding about the proper architecture for the work we are doing. Their collaborative relationship, along with the clear hardware functional efficiencies from Intel and their clear road map of future advances – these factors together have strongly contributed to fulfill our expectation and satisfaction in terms of the systems’ performance.”

Managing Storage Growth

The infrastructure team also reports strong benefits from its choice of high-speed storage systems based on Intel technologies. KFSHRC replicates its storage environment across two Riyadh data centers, to enhance availability for virtual servers and virtual desktops. This environment supports all desktop tiers and connectivity types, including Flash®, SAS, SATA, Fibre, SCSI, and NAS. Intel Xeon processor-based storage platforms provide convenient backup-to-disk capabilities, and also support local storage needs at the KFSHRC’s Jeddah facility.

“The storage systems with the Intel Xeon processor E5 family give us good support for the different techniques we are using to optimize our storage environment,” states Suhail Bakhashi, KFSHRC computer engineer. “These include multi-tier data storage, data deduplication, and the use of Flash fast disks. We also increase storage throughput by using the most reliable, fast, and powerful SAN switching systems and cabling techniques. We have also been using Intel® Xeon® Converged Network Adapters to replace many of our old 1 Gb Ethernet networks with 10 Gb Ethernet networking. This is giving us a definite performance increase, along with better network support and management.”

Mobile Access to Vital Tools

To achieve the full value of its investments in digital health IT tools, KFSHRC’s physicians, nurses, and other clinical staff must be able to access them securely and reliably wherever they need them. So, in addition to using stationary PC workstations and thin clients, the hospital has implemented new wireless networking technologies and is developing a mobile strategy to guide the deployment of laptops, tablets, computer carts, and other mobile solutions.

“Our mobile strategy is to use laptops and tablets based on Intel processors due to their wide compatibility and optimization with our enterprise applications and client operating systems,” says Khayyat. “Our standard is to use the security and management capabilities of the Intel® vPro™ platform in order to have the optimum and end-to-end level of systems management. This allows us to maximize uptime for our clients systems and use our IT staff efficiently.”

In choosing devices, Khayyat says, “We go with the thinnest possible desktops and the lightest-weight laptops for users who are on the go. We recently started to use 2 in 1 PCs, which let users switch between tablet and laptop operations. We have already found it very beneficial and suitable for uses such as in physicians’ offices, inside the patient exam room at the outpatient areas, and in public areas such as patient check-in desks. Patients like to interact with them, and it saves them time and effort.” KFSHRC also uses 2 in 1 PCs as wall-mounted computers inside the patient rooms in the inpatient areas of the hospital.

About KFSHRC

King Faisal Specialist Hospital and Research Center (KFSHRC) is the apex of the healthcare system in the Kingdom of Saudi Arabia (KSA). Open by referral to all citizens, KFSHRC provides specialized care to KSA patients who need the most advanced resources. KFSHRC is migrating much of its data center infrastructure to Intel® technology-based platforms and adopting mobile computers for clinicians on the go. Leaders at KFSHRC say their use of modern healthcare information technology (IT) solutions and Intel technologies is helping them increase access to efficient, high-quality, coordinated care at KFSHRC and throughout the Kingdom. Their technology strategy also helps the hospital deliver a better patient experience, enhance productivity, and fulfill Saudi Arabia’s commitment to provide world-class, patient-centered healthcare for all its citizens.

Lessons Learned

Leaders at KFSHRC offer the following insights and advice to their peers:

“We always need to remember that the technology is out there to help us make our work and life better. It is always a matter of implementing the right technology in the right design and with the right configuration. Start with choosing the best underlying technology that suits your organization, now and in the future, because this is your base. Your infrastructure then can help you achieve your goals or present obstacles that make it harder to achieve them.”

“Informatics and IT solutions must represent the strategic innovation to achieve future healthcare requirements. Healthcare IT should always deliver efficient services to provide healthcare institutions with access to the right tools and information through an integrated technology platform.”
Transforming Healthcare in Saudi Arabia

As a result of KFShRC’s mobile strategy, physicians, nurses, and other staff are able to serve the patient better. They can access the information they need and enter their clinical notes directly, helping to increase productivity and reduce the chance of transcription errors. Updated information is quickly available to authorized members of the patient’s care team, so their care is more highly coordinated.

There’s even a benefit to the environment. “By eliminating paper charts, using mobile devices, and enabling care givers to enter their case notes at the point-of-care, we are able to reduce our use of paper,” says Khayyat. “And of course, our data center with our virtualized Intel processor-based platforms is more energy efficient. We are 90 percent paperless, so we are reducing the carbon footprint of KFShRC.”

**Mission-Critical Healthcare IT Solutions**

With its modern infrastructure in place, KFShRC is deploying, planning, or designing IT solutions that are improving patient care, productivity, and efficiency. In addition to electronic medical records and digital PACS systems, these include examples such as:

- **An automated medication tracking and management system** that enhances patient safety and increases efficiency for pharmacists, physicians, nurses, patients, and family members.

- **Scheduling tools** that help ensure operating rooms and other expensive resources are used fully and effectively.

- **A secure patient portal** that allows patients and their families to schedule appointments, review diagnostic results, and monitor their progress toward achieving their health goals.

This is supplemented by in-patient entertainment and knowledge systems that enhance the hospital experience and educate patients and families about the patient’s condition.

- **An enterprise e-learning system** that the hospital’s Academic and Training Affairs department is using to help the staff participate in different training and educational programs. This approach reduces the cost of training while making it much easier for staff at any location to increase their skills and knowledge.

Advanced data analytics is a particular focus for technology innovation at KFShRC. “Big data is an important topic nowadays, and we are planning our big data strategy, including how we will use data analytics to improve operational efficiency, clinical decision support, and personalized medicine,” says Wadood Tawfiq, director of data and analytics at KFShRC. “We are researching big-data-enabled applications like Hadoop to harness unstructured data such as patient notes, as well as Oracle e-business suite* to help us gain insights from our data. We are also supporting genomics and genetics research using open platforms and hardware based on Intel technologies.*

**Advancing Toward KSA’s Year 2020 Objectives**

By providing powerful infrastructure to support these and other healthcare applications, Intel technologies are delivering clear value. Nurses, physicians, and staff have a more comprehensive, secure, and up-to-date view of patient’s health at the point of care. They can document their care more accurately and with greater efficiency. They can collaborate more powerfully and easily with colleagues, as well as with patients and their families.

All this is having a strong impact on both healthcare providers and patients. “One of the goals and objectives for the IT personnel of a healthcare institution is to make information available to the care givers – physicians, nurses, and others – with the least effort on their part,” says Khayyat. “This lets them focus more on the patients themselves. This is one of the main improvements we expect to achieve from using the Intel processor-based computing platforms. Through our technology investments, we can help clinical staff to work more efficiently and provide better care for the patient.”

“We believe this can help improve satisfaction for our health professionals,” Khayyat continues. “They will be able to be more productive because our systems provide faster response times. Because the whole system is more efficient, our care givers will be able to spend more time with the patient. They will be more relaxed and pleased with the performance and the high resolution of the display, and they may reflect this indirectly in the level of care that they can provide to their patients. And the patients, in turn, can be more relaxed and pleased. We also expect that our advanced healthcare IT solutions will improve our ability to recruit the best doctors and nurses. It shows that we are committed to delivering state-of-the-art care to every patient.”

As KFShRC looks ahead, its Intel technology-based infrastructure provides a strong foundation to grow and expand. “We will continue investing to provide efficient, robust, integrated, innovative, and state-of-the-art information technology systems, platforms, and tools,” says Dr. Al-Swailim. “This is how we will enable and support the different layers of the organization to fulfill the multiple missions of KFShRC and achieve the KFShRC Y2020 vision.”

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