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Bumrungrad's Hospital 2000 Information System

*This case was written by **K. Prashanth**, under the direction of **Vivek Gupta**, IBS Center for Management Research. It was compiled from published sources, and is intended to be used as a basis for class discussion rather than to illustrate either effective or ineffective handling of a management situation.*

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Bumrungrad's Hospital 2000 Information System

*"We are a service business and people come to private healthcare in Thailand because they expect efficiency and top quality. Information technology has always been a way to provide that. Hospital 2000 helps us get patients registered quickly, helps get their pharmacy done, helps put information at peoples' fingertips when and where they need it; helps us get the bill out accurately and quickly and that helps us to be very competitive in the very competitive healthcare market here in Thailand."*¹

- Curt Schroeder, CEO, Bumrungrad Hospital.

*"Hospital 2000 is a key attribute helping Bumrungrad Hospital to maintain world class standing in medical care and service. Top quality healthcare is about getting the right information to the right caregiver at the right time and Hospital 2000 does this in world-class style. The fully computerized medical record insures that all information is available to the medical team and the service level, speed and efficiency is enjoyed by our 750,000 patients each year."*²

- Curt Schroeder, CEO, Bumrungrad Hospital.

INTRODUCTION

In January 2003, *Intelligent Enterprise Asia*, a leading IT magazine in Asia, announced the Intelligent 20 awards recognizing the top 20 IT-savvy companies in the continent. In its third year, the award was given to Asian companies, which employed innovative IT solutions to enhance operational excellence and customer service capabilities. Judges from the world's 10 leading consulting firms including IDC, Accenture and Gartner, selected the winners.

One of the awardees was the Bangkok (Thailand)-based Bumrungrad Hospital Public Company Limited (Bumrungrad), Asia's largest private hospital. Notably, Bumrungrad became the first hospital in Thailand and the first company in the healthcare industry to receive such an award. Bumrungrad was recognized for successfully implementing the Hospital 2000 information system (IS). The Intelligent 20 award was only one of several awards Bumrungrad received for its Hospital 2000 IS (Refer Exhibit I for other awards). In February 2003, *CIO Asia* magazine included Bumrungrad in its list of top 100 companies for its foresight in deploying an advanced hospital information system (IS).

Like most of the IS deployed by Asia's leading hospitals in the late 1990s, Bumrungrad's system mainly addressed the needs of the accounting and billing departments. The hospital's IT operations were scattered across four systems, running various mutually incompatible applications. This meant Bumrungrad had to put more staff on board for maintenance. Due to the incompatible applications, hospital staff could not access the latest patient data quickly, causing inconvenience.

Hence, Bumrungrad was looking out for an advanced hospital IS which could address several needs at one go. This included simplifying its internal operation (primarily billing) by connecting all applications from the pharmacy to eating outlets to the patients' medical treatment, so that

¹ Microsoft Shoots Video at Bumrungrad Hospital, Showcasing the Hospital 2000 Solution, www.hospital2000.com, July 2000.

² Bumrungrad Hospital Opens Internet Cafes and Celebrates the Successful Implementation of Asia's Most Advanced Hospital Information System, www.bumrungrad.com, March 27, 2001

consolidated medical bills could be generated instantly. Bumrungrad also wanted the IS to enable foreign patients of different nationalities to receive necessary information in a language of their choice and be able to book appointments and accommodation online. It also wanted the IS to facilitate quicker treatment for its patients at clinics within the premises, and in the process, save the hospital's time and money in administering medical services. All these requirements prompted Bumrungrad to adopt Hospital 2000 IS, which completely transformed the way the hospital operations were managed.

Hospital 2000 adhered to several ANSI³ standards, a global standard governing the exchange of clinical data and the management, delivery and evaluation of healthcare services. It kept pace with the IT requirements of a modern day healthcare business. Commenting on this, Patrick Downing, CEO, Global Care Solutions, the company which installed Hospital 2000 at Bumrungrad said, "It takes advantage of paper scanners, cameras, all of the modern devices found in a healthcare facility. It really allows them to capture what they need and to attach it to the Electronic Medical Record and give that patient better healthcare."⁴

BACKGROUND NOTE

Established in September 1980, Bumrungrad⁵ was originally a 200-bed facility. The initial investment was Thai Baht⁶ 90 mn. The hospital was jointly owned by the Bangkok Bank and the Sophonpanich family, one of Thailand's leading business families. In 1989, Bumrungrad went public and its shares were listed on the Thai Stock Exchange. Over the next decade, Bumrungrad adopted several innovative practices to emerge as the best privately managed hospital in Thailand. The significant increase in the number of domestic patients over the years led to a manifold increase in revenues.

In January 1997, Bumrungrad shifted to a new facility located at the centre of Bangkok. Constructed at an estimated cost of \$110 mn (\$60 mn raised through offshore loans), the 12-floor building had 554 beds and 21 operation theatres. The hospital was equipped with the most modern equipment and had 600 physicians, nearly half trained in the US, and drawn from different parts of the world. The physicians, however, were consultants and were not on the hospital rolls.

Bumrungrad hired an international management team led by American professionals. Its CEO, Curtis Schroeder (Schroeder) had prior experience of running a hospital in California. However, in July 1997, Bumrungrad faced a tough situation when Thailand was severely hit by economic recession. Owing to the Southeast Asian currency crisis, the value of the Thai Baht dipped sharply. The crisis had its fall-out on the middle class Thai population, from whom Bumrungrad derived most of its revenues. They started shifting to government hospitals where healthcare was available free or at a lower cost.

In this adverse situation, Bumrungrad decided to change its strategy by targeting more foreign patients, including expatriates in Thailand and nearby countries. It also decided to tap patients in developed countries in Europe and the US. Describing the situation, Schroeder said, "We basically had two alternatives at that time. We could shut down the place and lay off employees, cut costs

³ The American National Standards Institute, an independent non-profit organization that creates and publishes U.S. national standards (such as FORTRAN, C, CGM, and so forth) taking input from all sectors of the technical community and the public at large. ANSI also works in collaboration with other standards organizations such as ISO (the International Standards Organization) and IEEE (the Institute of Electrical and Electronics Engineers).

⁴ Microsoft Shoots Video at Bumrungrad Hospital, Showcasing the Hospital 2000 Solution, www.hospital2000.com, July 2000.

⁵ In local Thai language, Bumrungrad means 'caring for people.'

⁶ Currency of Thailand. As on March 19, 2004, 1 US\$ = 39.42 Thai baht.

and turn off the lights and try to weather the storm, or we could aggressively use it as an opportunity to build market share. We went with the General Electric approach, the Jack Welch approach, which is that where you make your biggest market share is during down markets.”⁷

Bumrungrad began an aggressive marketing effort to project itself as a global hospital complying with international standards. The hospital had already applied for and received the ISO 9002 quality certifications⁸ for all its departments and systems in March 1997. In 1999, the ISO certified Bumrungrad as a *Comprehensive Tertiary Acute Medical Centre*⁹. With this, it became the world's first healthcare company to receive this certification. Schroeder said, “It's not a magic cure, but whether you're selling cement, steel or healthcare, without third party validation, it's difficult to get international recognition.”¹⁰

Bumrungrad also decided to use the Internet as an information and marketing medium to promote its healthcare services to foreign patients. It launched its website – www.bumrungrad.com - in 1997. The website had several user-friendly features to provide healthcare information sought by visitors. For instance, visitors could get information on the medical facilities and the range of treatment available at the hospital. One of the website's main features was the ‘Find a Doctor’ section. Using this, patients could choose from 600 doctors and book an appointment online, to suit their preferences and requirements. Thus, the patient's preferences for the type of treatment, the nationality or expertise of the doctor and so on were taken care of at the first instance. Appointments were confirmed within two hours. By mid-1999, the website was drawing 800 hits a day. Bumrungrad's management soon felt the need to further modernize its IS to serve customers better.

THE NEED

In view of the intensifying competition in Thailand's healthcare industry and to generate international appeal, Bumrungrad was looking for ways and means to enhance service quality. The management felt that providing the best possible customer service was critical for the hospital's growth. However, the deficiencies, which kept cropping up in its existing IS, were hampering the quality of customer service provided.

Bumrungrad's IT operations were handled by four Unix-based systems and several applications like Access and FoxPro, which varied from department to department. The existing IS posed problems and also had high maintenance costs. They required several people to operate them. Further, they did not generate the information required for the hospital to manage its operations efficiently. Moreover, the IS was not able to deliver information, which would help determine the direction of business in near future.

Bumrungrad required an IS which not only catered to its immediate IT needs but also those of the future. The IS must contain complete Electronic Medical Records (EMR)¹¹ to help it manage operations better. It must also provide the required information for its doctors and other support staff so that they could deliver better patient care.

⁷ “Thailand offers sun, sand and surgery,” *Financial Times*, August 12, 2002.

⁸ The ISO 9002 standard documents and formalizes the process and methods by which work is undertaken in all departments of the business. It was later replaced by ISO 9001:2000, a standard which incorporates the principles of continual improvement in processes and services and manufacturing.

⁹ A tertiary hospital is one in which technologically advanced medical treatment is administered to the patients in diverse medical disciplines including general care, heart care, sex transplants and cancer treatment.

¹⁰ “Bangkok Hospital Seeks Cure for Economic Ills By Treating Foreigners,” *Asian Wall Street Journal*, June 1999.

¹¹ An automated, on-line medical record containing clinical and demographic information about a patient that is available to providers, ancillary service departments, pharmacies, and others involved in patient treatment or care.

Retaining the best doctors was another major challenge for Bumrungrad. As the doctors were consultants, who hired Bumrungrad's facilities, they could choose anytime to offer their services to other hospitals. Thailand had nearly 250 hospitals at that time. The management was aware that patients preferred leading doctors and, the choice of hospital came only after that. Providing an ideal environment with good infrastructure and the most advanced IS, to attract the best doctors in the country was, therefore, essential for Bumrungrad. Commenting on this, Schroeder said, "It is the hospital with the best physicians that will win. We need to create an environment that will allow our doctors to practice medicine in the best way and create the best relationships with their patients. At the core, it comes down to good people as well as an exceptionally well-designed information system. We wanted clinical information at the fingertips of our doctors to enable them to make better decisions."¹²

In the healthcare industry, service efficiency is assessed in terms of quality of treatment as well as time taken for treatment. The less the time spent at the hospital, the less the expenditure incurred by patients. Schroeder said, "Patients assess their level of hospital care in different ways. How quickly they move through the system is a key measure. We'd reached a plateau on reducing patient time in the hospital and we knew that better information was the only way we could continue to provide excellent service and get patient days down."¹³

Bumrungrad also wanted the IS to boost its online initiatives. This meant enabling its customers, primarily international ones, to book their appointments online through its website. It also wanted online communication with Bumrungrad's suppliers and insurance companies, with whom it had to maintain daily contact for billing and other administrative purposes.

All these requirements prompted Bumrungrad to go in for a complete replacement of its existing IS in 1999. It chose Global Care Solutions (GCS)¹⁴, a Luxembourg- based IT company to implement the new IS at the hospital.

SYSTEM IMPLEMENTATION

On December 17, 1999, Bumrungrad successfully switched over from its old IS to its new customized Hospital 2000 information system. However, implementing the system was not easy, considering the number of tasks involved. These included conversion of data contained in the four existing UNIX systems; providing training to the 1200-strong staff and more than 200 doctors; and installation of required hardware and software.

DATA CONVERSION

The first major task was data conversion. The four systems from which data had to be retrieved were a commercial out patient system, a commercial accounting system, an in-house in-patient system and a document management system (DMS). Each system was run on different database engines – Oracle, Ingres, Informix and Sybase - complicating matters further. Most of the information had to be filtered to eliminate unnecessary and ambiguous information. It was also difficult to map the data to suit the Hospital 2000 IS, as a significant portion of the data was in the Thai language.

¹² Bumrungrad Hospital-Patients a Day kept Healthy by Microsoft Windows 2000, www.microsoft.com, September 18, 2000.

¹³ Bumrungrad Hospital-Patients a Day kept Healthy by Microsoft Windows 2000, www.microsoft.com, September 18, 2000.

¹⁴ GCS is a global provider of IT solutions developed exclusively for the healthcare industry. It provides a single vendor solution for the entire hospital including software solutions, hardware, network design, project implementation, training and business process re-engineering.

While converting the data, the major challenge encountered by GCS was with the DMS of FileNet Corporation. This was because FileNet had its own communications protocol.¹⁵ About five mn documents pertaining to out patient records of three and a half years had been scanned into the DMS. The records could be instantly accessed by physicians, nurses and other support staff. To convert this significant amount of data, the GCS staff wrote a program called 'FileNet Converter', which converted each document in the DCS into TIFF files¹⁶ and saved it in a Microsoft NTFS file system.¹⁷ The program was administered without interruption for six months. To ensure that the operations at the hospital were not disturbed, the program was run during particular times of the day and throughout the night.

At the time of installation in 2000, Bumrungrad needed 450 desktop computers 100 network printers and 120 scanners to be placed in various locations across the hospital. The Bumrungrad IT team did this job. Once it was accomplished, GCS installed the Hospital 2000 software on all the PCs (terminals) from a remote location using a proprietary software distribution method. The advantage of this method was that it facilitated upgradations in the application at any time without disturbing clients significantly. With active participation and co-operation from Bumrungrad's IT team and the GCS staff, the installation of Hospital 2000 was completed quickly.

One of the critical operations of installing the new system was the formal switch from the old system. Rather than allowing the new system to be in use for some time while continuing with the old system and then switching, Bumrungrad opted for a one-time switch over. Needless to say, this move was risky, as there was danger of failure of the new system when the old system had been switched off. The GCS staff was on guard to meet any such eventuality. However, proper planning and preparation ensured that the formal installation went off smoothly. Within 48 hours of full-time operation, GCS and hospital staff addressed all major issues relating to the system. GCS personnel were available on site for the next 15 days so that the systems and networks were properly attuned.

TRAINING

Another important task was training the 1200 hospital personnel and 200 physicians. Training was imparted by GCS staff in association with Bumrungrad's education and training department. For this, senior members from each work area in the hospital were selected and trained on the complete usage of the Hospital 2000 system, pertaining to their area of responsibility. They, in turn, became trainers for personnel in their respective work area. To ensure that both trainers and staff gained full knowledge of the practical usage of the system, a simulated training set up comprising 40 PCs connected through a network was created at the training centre. This set up resembled all the departments of the hospital.

The training lasted for four weeks during which hospital staff learnt how the various departments were connected through Hospital 2000. The GCS staff also cleared any doubts about the system's functionality. The willingness of the hospital staff to learn, and the education department's efforts ensured that the training phase was completed successfully.

¹⁵ A set of rules or standards designed to enable computers connect with one another and exchange information with minimum possible errors. Examples are Hypertext Transfer Protocol (HTTP), Transmission Control Protocol/Internet Protocol (TCP/IP), and Systems Network Architecture (SNA).

¹⁶ Tagged image file format are files that contain images (pictures).

¹⁷ An abbreviation for the new technology file system. A file system designed for use specifically with the Windows operating system. It supports long file names, full security access control, file system recovery, extremely large storage media and various features for the Windows POSIX subsystem. It also supports object-oriented applications by treating all files as objects with user-defined and system-defined attributes.

HARDWARE AND SOFTWARE

The hardware for Hospital 2000 comprised 450 Dell Optiplex PC's (clients), with a 400 MHz Celeron processor with 64-128 MB Read Access Memory (RAM),¹⁸ 4 Pentium®-III Xeon™-based Dell Power Edge 6300 Clustered Servers and a Dell Power Vault 650F Fibe Channel storage system. The combination of a pair of clustered servers and a PowerVault 650F supported the 450 clients operating at different locations in the hospital simultaneously. The Power Vault 650F channel storage system ran on the MS SQL platform and formed the database for Hospital 2000 IS.

The configuration of the clients was standardized so that they could be easily integrated with Hospital 2000 IS. Further, uniform configuration meant easier maintenance, as the hospital's IT team could develop a basic understanding of the system. These systems could also be easily upgraded at any time to meet future requirements.

The Operating System used was a combination of Microsoft Windows 2000 and SQL 2000. Bumrungrad was one of the first sites on which this combination was employed. The systems were connected to the Internet through leased lines and through satellite connection (Refer Exhibit II for a list of hardware and software used in Hospital 2000 IS).

SYSTEM ARCHITECTURE

The Hospital 2000 IS was built on a three-tier architecture, comprising PC-based clients, clustered servers and the database (Refer Exhibit III for a diagram of the system architecture.). The clients represented the face of the IS, through which data relating to various hospital operations could be keyed in, and through which data stored in database could be extracted. The complete Hospital 2000 suite was available in each of the clients located across the hospital.

The middle tier comprised clustered servers, also called transaction servers, as they facilitated transactions taking place in the hospital. The clustering¹⁹ of the servers was done through the MS Windows 2000 clustering service. This was essential for the systems to handle high workloads, especially during peak hours. The middle tier served as an interface between the clients and the database. Any transaction taking place in the hospital (like queries posted into the clients as well as data fed into the clients) passed through the middle tier. Its function was to retrieve required data from the database and make it available to the clients. It also ensured that the database was updated with every transaction occurring at the clients (like data keyed in, images stored, images scanned and so on). This would ensure that integrity of data was maintained.

The database server received and processed queries received from the middle-tier transaction servers. The major function of these servers was to support data warehousing²⁰ and online analytical processing (OLAP).²¹ It facilitated storing and extracting valuable information, which was critical to run the operations at Bumrungrad. During peak hours, the server database processed 170 SQL statements per second.

¹⁸ RAM consists of memory chips or chip modules, which attach to the computer's logic board. Memory modules can continue to be added as long as open slots are available on the logic board.

¹⁹ A technique in which two or more servers are interconnected and can access a common storage pool. Clustering prevents the failure of a single file server from denying access to data and adds computing power to the network for large numbers of users.

²⁰ The process of gathering data from various internal and external sources and storing it in a subject-oriented database, designed to help executives, managers and business professionals make better business decisions.

²¹ A category of applications and technologies for collecting, managing, processing and presenting multidimensional data for analysis and management purposes. OLAP systems allow workers to, quickly and flexibly manipulate operational data using familiar business terms, to provide analytical insight.

NETWORK ARCHITECTURE

Within the hospital, the clients, the transaction servers and the database servers had to be properly connected in a network arrangement to enable uniform flow of information. The database server and the middle tier servers were together called the data centre, which supported the clients. The servers and the clients used the TCP/IP protocol.²² (Refer Exhibit IV for the network architecture diagram)

Across the hospital, a group of clients were clubbed together, based on the commonality of the purpose being served (for example, clients in a department) or on any rational basis. They were linked to network hubs, placed in the respective departments or on each floor in wiring closets. Each hub was linked to a switch unit point.

This unique network architecture facilitated a rise in the number of clients as the hospital's operations could expand without affecting workflow. This could be done by just adding more hubs or switches. The fibre optic cables facilitated transmission of data at quicker speeds between the clients and the data centre.

The well-planned deployment of Hospital 2000 IS enabled Bumrungrad to operate the system without major problems and avoided unnecessary expenditure for the company. The fact that the entire deployment, including data conversion, training and rollout of hardware and software was completed in 45 days, was testimony to the kind of co-ordination and team work among the hospital IT staff and GCS employees. According to company estimates, Bumrungrad spent US\$ 6 mn on the system. Over the years, as the size of operations increased, the number of clients increased from 450 in 1999 to 900 in 2004.

INTRODUCING NEW FEATURES

Over the years, Bumrungrad made constant efforts to upgrade the Hospital 2000 IS to provide better service to patients. In February 2002, an interesting and useful feature – Picture Archive Communication System (PACS) – was incorporated into Hospital 2000 IS. Known as Amalga, it was run on a Microsoft Windows 2003/SQL Server platform (Refer Exhibit V). The estimated cost of the PACS was 28 mn Thai baht.²³

PACS comprised all X-Ray images stored in digital format. This enabled Bumrungrad to process radiology studies digitally instead of using films. The system comprised diagnostic software with a complete package of image manipulation and reporting tools for radiologists. All radiologists in the hospital could access digital images instantly through PACS. It also provided them access to medical studies and reports through the Internet and through local area networks. PACS facilitated exchange of information in various languages.

The system drew enthusiastic response from the doctors at Bumrungrad. Within six months of implementing the system, 99% of X-ray studies at Bumrungrad were done through PACS. The doctors explored the system with much enthusiasm. Commenting on the advantages of PACS, Pat Downing said, "With all historical study information at their fingertips, doctors can look at the whole picture – the result is better informed decisions. Digital radiology offers numerous advantages: reporting times on digital studies are greatly reduced, providing results more quickly; lost films are eliminated ensuring medical records remain complete; multiple doctors can collaborate and view images simultaneously without waiting for hardcopy films and reports are available online in real time as soon as they are submitted."²⁴

²² Short for Transmission Control Protocol/Internet Protocol, the suite of communications protocols used to connect hosts on the Internet. TCP/IP uses several protocols, the two main ones being TCP and IP. TCP/IP is built into the operating system and is used by the Internet, making it the de facto standard for transmitting data over networks. Even network operating systems that have their own protocols, such as Netware, also support TCP/IP.

²³ As on October 31, 2004, 1 US \$ = 40.9739 THB.

²⁴ Global Care Solutions Wins Microsoft 2003 Certified Partner Award for Best Data Management Solution, www.microsoft.com, October 2003.

On an average, nearly four gigabytes of images were stored at the Amalga PACS every day. The physicians and hospital staff could access these images at any point of time from any PC in the hospital. The efficiency of the system could be seen from the fact that an X-Ray image of size up to 7 MB could be retrieved and viewed in less than 2 seconds.

PACS also obviated the need for the hospital to use X-Ray films, and in the process, significantly cut costs. It eliminated the cost of storage and maintenance of films and, more important, removed the risk of X-Ray images being damaged or lost. It was estimated that since its implementation at Bumrungrad, the hospital generated savings to the tune of 17,000,000 baht every year. The database size at Bumrungrad increased by an estimated 1.5 terabytes between February 2002 and October 2003. Another advantage of PACS was that soft copies of X-ray reports could be sent to other hospitals, both within Thailand or abroad, upon specific requests by patients who needed further examination and treatment.

THE BENEFITS

Hospital 2000 IS led to a significant improvement in the efficiency of operations at Bumrungrad. Hospital 2000 was the first IS in the healthcare industry in Thailand that combined all front office systems, all medical, nursing and ancillary departments, and back office accounting functions into one database. The IS was used across all departments including labs, radiology, pharmacy, cardiology, patient registration, administration, operation theatre scheduling, billing, purchases, inventory management, room management and medical records. The database comprised details relating to 2 mn patients treated at Bumrungrad dating back to the past 20 years. It even included prescriptions.

A major benefit of the new system, which differentiated it from other healthcare systems, was its multi-lingual capabilities. Files containing medical records, bills and drug labels could be instantly translated and printed in Japanese, Chinese and English. (Refer Exhibit VI for the unique features of Hospital 2000 IS). Every year, the system processed 1.7 bn transactions. Since its installation at Bumrungrad, the system has been operating at 99.9999% uptime.

The IS also facilitated quicker patient treatment, helping Bumrungrad to treat an estimated three thousand patients every day. The results of any medical test administered on a patient, whether simple blood examination or high-tech magnetic resonance image scans, could be accessed at 900 clients across the hospital. This largely simplified workflow within the hospital. Every detail regarding the patients, be it the doctors' prescription or an X-ray image, could be scanned and recorded in the database in real time. The doctors had the option to type or scan their comments on patients, whichever was convenient.

The patients enjoyed the convenience of walking into the hospital at any time without carrying their prescription or test records or even without an appointment. The moment the patient entered the hospital, the computer systems would allot them to the doctors who had the shortest queue, thereby speeding up treatment. The low doctor-patient ratio of 24 patients per day per doctor also contributed to quicker patient treatment.

Most doctors still preferred to give handwritten prescriptions to patients. This did not cause any problem as all they had to do was to simply scan their prescriptions into the system. Schroeder said, "We had to give them an option because it is unlikely that our doctors, with the exception of a handful, will type their comments...we do not want to disrupt their methods of operation."²⁵ By providing as much flexibility as possible for doctors in their operations, Bumrungrad made administering treatment a pleasant experience for doctors.

²⁵ Raj Chotrani, *Love Thy Patient*, CIO, December 2002.

Once the entire patient data, including medical records, X-rays, were fed into the system, any doctor could continue the treatment for patients by viewing them. Unlike most leading corporate hospitals, which only provided access to the patients' hospitalisation records, the Hospital 2000 system made available a patient's X-rays, ultrasounds and other test records too.

The Hospital 2000 IS proved indispensable for Bumrungrad. This was clear from the words of Ruben Toral, manager of Bumrungrad's International Program, "We have 554 beds, over 2,500 outpatients a day and 800,000 patients per year. A similar 500-bed hospital in the US typically treats only 100,000 patients per year. Without our IT system, we would not be able to handle this many patients."²⁶

QUESTIONS FOR DISCUSSION:

1. Bumrungrad upgraded its information systems in the late 1990s. Explain the rationale for Bumrungrad to make significant investments in upgrading these systems.
2. Bumrungrad's previous information system had several problems which the new system had to address. Describe the features and the architecture of the new system. Discuss how it solved the problems of the old systems faced by Bumrungrad, earlier.
3. In the light of increasing volume of foreign patients handled by Bumrungrad, do you think the implementation of new information system was beneficial for the company? Discuss.

²⁶ Joris Laperre, Healthcare Tourism – IT reduces costs at Bumrungrad Hospital, *Automatisering Gids*, December 2002.

Exhibit I

Awards for Hospital 2000 Information System

Month/Year	Organization	Award
September 2002	Hospital Management Asia	Asian Hospital Management Awards for Information Technology
October 2002	Microsoft	Microsoft Fusion 2000 Business Solution of the Year award
2002-03	Intelligent Enterprise Asia	Intelligent20 Award
2002-03	CIO Asia	CIO 100

Source: www.hospital2000.com, www.bumrungrad.com.

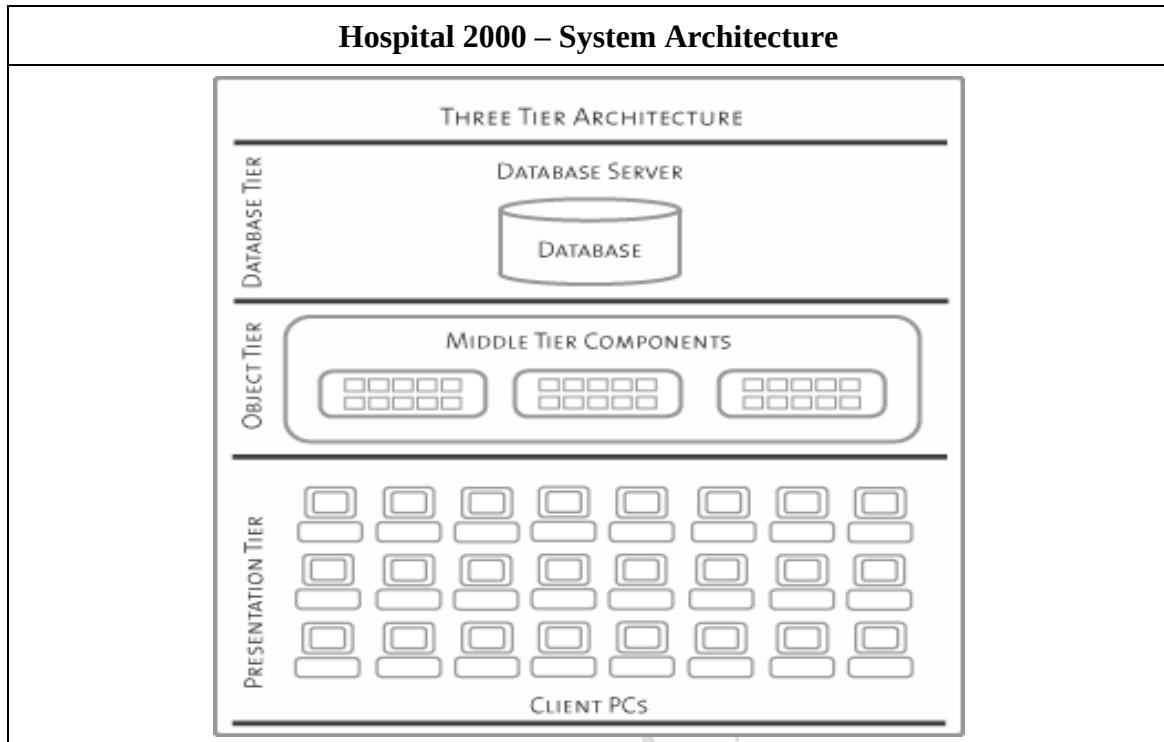
Exhibit II

Hardware/Software of Hospital 2000 Information System

- Global Care Solutions' Hospital 2000
- Dell 6300 clustered server
- Dell 660/650 FC storage units
- Dell 220S SCSI storage
- Dell Optiplex Desktop PC
- Microsoft Visual Basic 6
- Microsoft SQL Server 2000
- Microsoft Exchange 2000
- Microsoft Windows 2000 Advanced Server
- Microsoft Windows 2000 Professional
- Microsoft BizTalk 2000
- VideoSoft Flexgrid 7
- TAL Technologies TAL Barcode DLLs 1.0
- DBI Technologies Schedule 3.0
- Sheridan Active Toolbar 1.02.

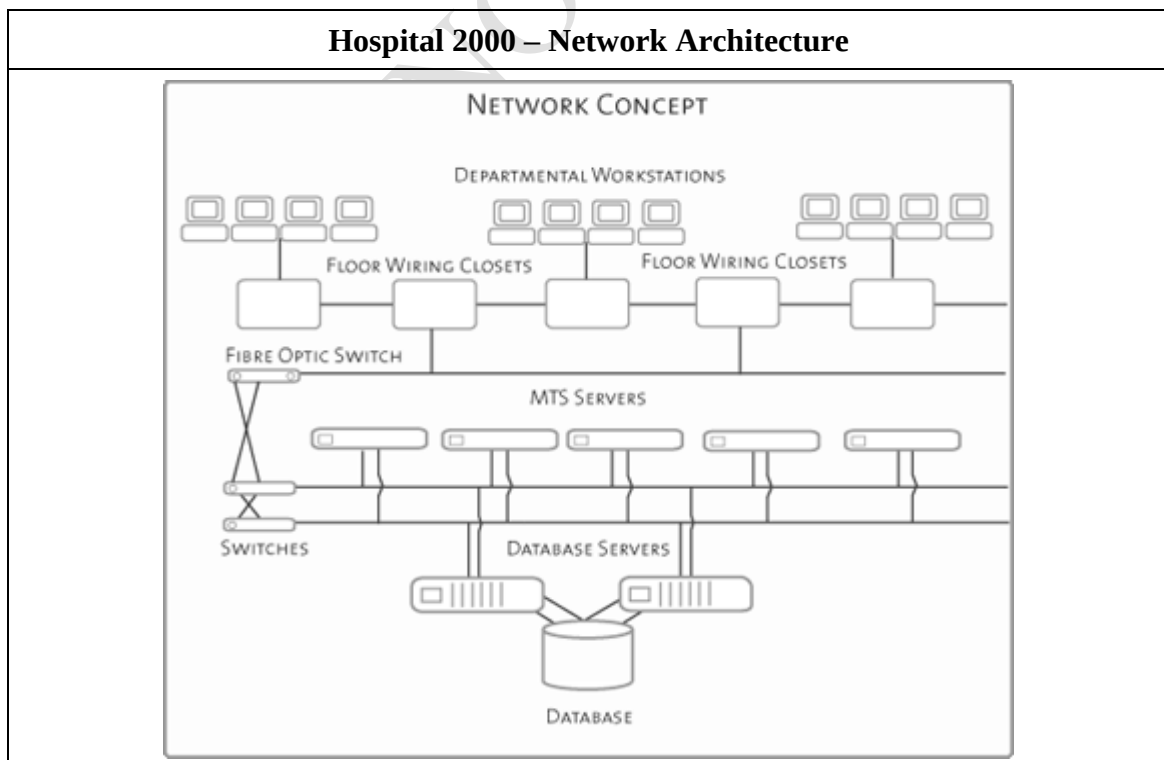
Source: *Bumrungrad Hospital*, www.intelligentasia.com, January 16, 2003.

Exhibit III



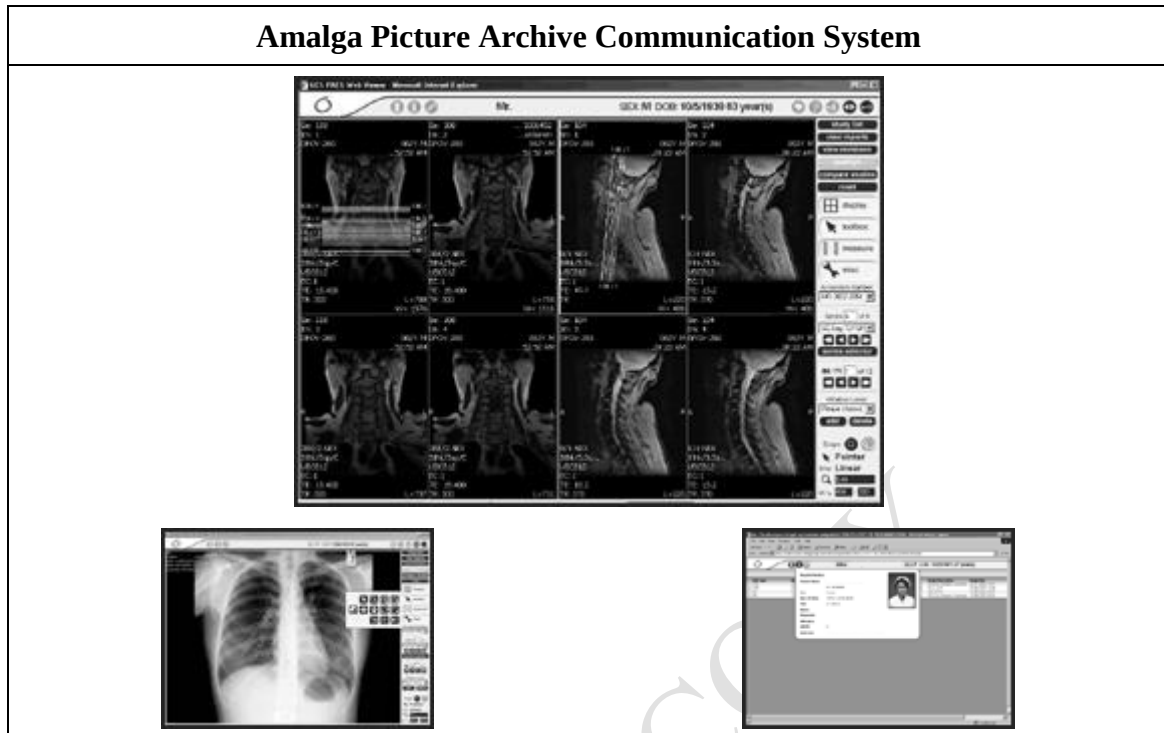
Source: www.hospital2000.com.

Exhibit IV



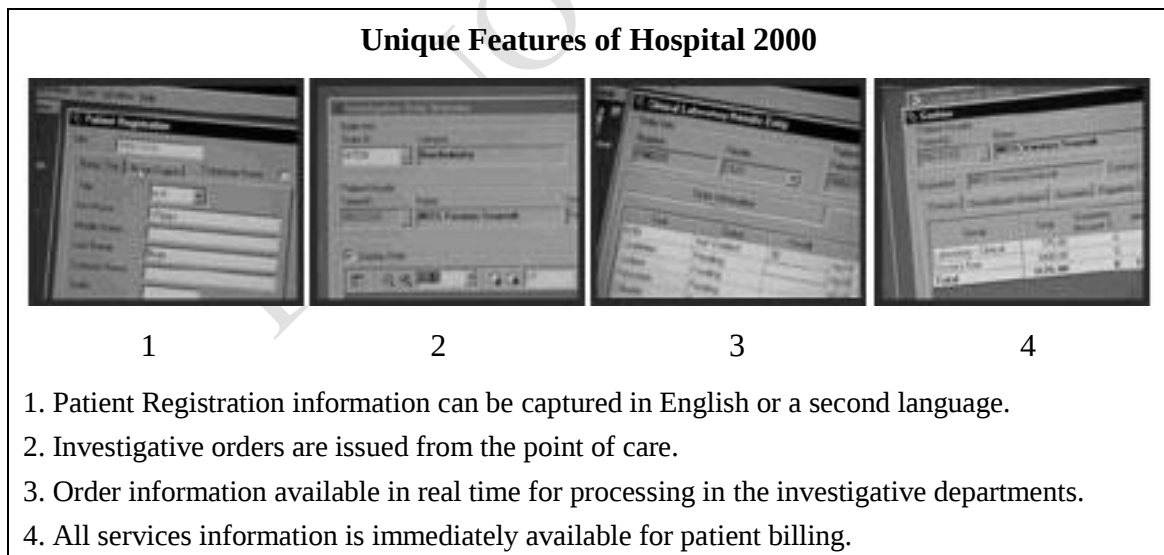
Source: www.hospital2000.com.

Exhibit V



Source: www.hospital2000.com.

Exhibit VI



Source: Microsoft Shoots Video at Bumrungrad Hospital, Showcasing the Hospital 2000 Solution, www.hospital2000.com, July 2000.

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