Building the Connected Hospital

A joint White Paper from Cisco Systems and CNA Group

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Executive Summary

Healthcare organizations around the globe are realizing the benefits of information and communications technology (ICT) by making it integral to the delivery of healthcare. A number of complex, interconnected issues are driving this transformation, including the aging population in many countries in the Asia Pacific; the increasing sophistication and cost of treatments; the shift in treatment delivery from invasive treatments performed in the hospital to more technical approaches delivered outside the hospital; and the increasing emphasis being placed on prevention as well as treatment, and on "health" rather than "care".

Healthcare industry executives are encountering new challenges to provide quality healthcare within limited budgets. An aging and increasingly literate population has resulted in unprecedented expectations for healthcare service and quality of life. The Internet makes it easier for prospective patients to identify superior healthcare providers. Patients increasingly choose a hospital based not just on location, but facilities and reputation, as demonstrated by the growth in medical tourism.

At the same time, the cost of care is rising, a result of advances in the tools, treatments and techniques used to prevent and cure disease. And yet the financial resources available for hospitals are limited, even in the richest nations. Therefore, hospital administrators must grapple with staff shortages, higher patient loads and reduced budgets.

The Connected Hospital framework helps address these challenges. Its premise is that the traditional approach to designing hospital buildings – deploying multiple proprietary networks for voice, video, data, HVAC, security and access, energy, lighting, fire and safety and other functions – unnecessarily raises capital and operational expense. When developers and builders incorporate the Connected Hospital framework into their buildings, all building and IT systems are converged onto a single Cisco Medical-Grade Network. Not only do operational and maintenance costs drop, but the hospital IT group can deliver innovative new services that improve caregiver productivity and patient care.

This white paper is intended for two audiences. One is executives and managers in the construction, real estate and property services industries, who can make their buildings more attractive to healthcare providers by planning for the IP network at the outset rather than adding it later. The other audience is healthcare providers themselves, who can take advantage of the Connected Hospital framework to meet their goals for service delivery and operational efficiency.

An overview of the healthcare industry

IP technology has permeated almost every aspect of our daily lives, influencing the way we live, learn, play, and work. However, today's building environments have, by and large, lagged behind in making these changes needed to support changing lifestyles. Other key trends are also driving the need for building transformation - such as globalization of the workforce, the drive for environmental and social responsibility, and a growing, worldwide population. Given the trends, real estate developers will have to include IP connectivity as the fourth utility next to the triumvirate of electricity, water and gas, in the way a building is designed. It is the former that will provide the basis of the advent of the Intelligent Building.

A good definition of an intelligent building is one in which the building fabric, space, services, and information systems can respond in an efficient manner to the initial and changing demands of the owner, the occupier, and the environment. While the real estate, design, and construction industry has been exploring the concept of intelligent buildings since the 1970s, this vision has not been fully realized, until now – thanks to the rise of integrated digital technology. With it, real estate professionals now have the capability of transforming the physical spaces of the future through technology innovation, delivering value-added, revenue generating services while streamlining processes that contribute to operational cost savings and increased productivity.

Building and managing the hospital of tomorrow

Every day, across the world, people make improvements in health as a direct benefit of information and communication technologies (ICT). Innovations like electronic health records, computer assisted prescription systems and clinical databases are transforming health today, and hold even greater promise for the future[1]. In addition, telemedicine has made it possible for individuals to have more direct access to care givers and take charge of managing their own health needs.

However, there are numerous challenges that are facing countries in the Asia-Pacific region, in the journey toward achieving a high standard of health. Those who set and deliver the healthcare agenda are striving to manage many complex challenges, including the aging population, the management of chronic diseases, managing rising costs of healthcare and how it is delivered, with the increasing emphasis being placed on prevention as well as treatment, and on health rather than care. Some of the challenges include:

Healthcare costs spiraling out of control
Healthcare sectors in all countries are under enormous cost pressures. Healthcare executives are finding it harder to build the business case for long-term investment programs in order to keep up to date with the latest developments in medical technology and infrastructure. For patients, escalating healthcare costs is an ongoing concern that affects their ability to plan for the future.

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[1] Building Foundations for eHealth, Progress of Member States (Report for the WHO Global Observatory for eHealth, World Health Organization, Dec 2006, http://www.who.int/entity/ehealth/resources/bf_full.pdf

These challenges arise from a variety of factors: a rapidly ageing population, higher life expectancies – by 2050, the number of persons above 60 years in the world will exceed the number of young for the first time in history[2] – as well as growing affluence have resulted in a higher prevalence of chronic conditions such as hypertension and diabetes. One only need look at the long queues at hospitals and medical clinics to see that the existing infrastructure is coping poorly with the growth in demand. In addition, the easy access to information places greater demands on care givers facing patients with higher expectations.

This in turn has led the healthcare industry engaging in short term "stop gap" measures – such as reducing the size of rooms to accommodate a higher number of patients, raising salaries to court hard-to-find clinicians and support staff, or purchasing point IT solutions that address specific needs - to help release the pressure somewhat. However, by addressing these challenges in a disjointed and silo-ed manner, healthcare businesses are getting diminishing returns from their initiatives simply because of the increased complexity that results. This leads to higher operational costs, which are inevitably passed on to the patient.

More demanding "customers"
Added to the mix is the fact that expectations of healthcare standards have risen dramatically: patients are now more knowledgeable about healthcare standards, medical treatments and technologies available, and demand a more active role in determining the type of care that they need. The rise in the prevalence of chronic diseases such as hypertension and diabetes demand long term care and with close monitoring that extends beyond hospitals, with patients needing more frequent communications and access to their healthcare provider.

To facilitate and encourage the public to proactively manage their health, it is important to provide each individual with easy access to his/her medical history and other relevant health information tailored to specific needs. This information needs to be authoritative and trusted[3].

By providing access to proper care information to the patients themselves, health services has the potential to support self-care by enhancing people's independence and expertise through investment in closer remote monitoring, information, skills and technology. A report[4] suggests that by 2020 visits to doctors could decrease by 40% and visits to hospital outpatient departments by 17% due to increased self-care, both for everyday health problems and chronic illnesses. This would help to reduce the burden on already overstrained building infrastructure.

Increased regional competition and cooperation
Medical tourism is growing rapidly, with the number of medical tourist visits to many countries swelling by 20 to 30 per cent a year. The industry in Malaysia, Thailand, Singapore and India, currently worth around half a billion dollars a year in Asia, is projected to generate more than US$4.4 billion by 2012. This has attracted strong government interest across Asia, and efforts to woo medical tourists have added further impetus to the growth[5].

[2] World Population Ageing: 1950-2050, UN Department of Economic and Social Affairs, 2002, http://www.un.org/esa/population/publications/worldageing19502050/

[3] Integrating Healthcare, empowering patients, Report by the iN2015 Healthcare and Biomedical Sciences Sub-Committee, Infocomm Development Authority of Singapore, June 2006

[4] Wanless, D. Securing our future health: taking a long-term view, London: HM Treasury, April 2002

[5] "Medical Tourism: Asia's growth industry", Hospitality Marketing, April 2006

As a result, hospitals are competing to provide leading-edge treatments, better facilities and value added services that make their destination a compelling one against the backdrop of intense competition in the region. For incumbents, the challenge is to ensure that the building facilities and its accompanying systems can scale up with growth and new demands, while potential new entrants will want to upgrade their facilities to match those of the leaders in the region.

In addition, hospitals are beginning to co-operate in providing health services by taking advantage of different cost structures and expertise across boundaries.

Health, security and safety concerns

The lessons of the recent SARS scare reveal how fragile the medical system can be when it comes to coping with medical crises of pandemic proportions. A hospital, by its very nature, houses people with potential serious conditions, some of which could become public health concerns if not managed properly. In the recent SARS episode, tracking of patients carrying the virus was also poor, which led to some infected patients walking out of the hospital and back into their communities[6].

Health, security and safety concerns can be addressed by proper monitoring, coordination and oversight. A poorly integrated medical system could lead to confusion and poor communications between the various departments in the hospital and with other providers outside the hospital, while inadequate building monitoring systems could also prevent hospitals from keeping tabs on high-risk patients.

Explosion in volumes of medical information

Finally, given the information-intensive nature of the healthcare sector, it's no surprise that information technology (IT) and management systems have become an essential part of the business. From the hospital to the clinic, providers are utilizing IT to capture, manage and access patient information; channel the information to the right experts; manage resources and personnel; and monitor ongoing patient care. Unfortunately, the challenges mentioned earlier are rapidly outgrowing the capabilities of existing information management systems, especially in the following areas:

- **Fragmented, error-prone information systems** – Over time, healthcare providers have invested in multiple solutions, each dealing with one specific requirement such as electronic health records, workforce management, clinical and office administration. Not only are providers saddled with high operating costs needed to manage multiple, non-integrated information systems, they also run the risk of increased information and administrative errors because of the existence of multiple databases and multiple data entry points. The impact to operations can be high: long waiting lines, cumbersome communications, slow diagnostic scheduling and treatment.

- **Lack of secure "anytime, anywhere" access to vital information** – Without updated and convenient access to patients' historical records and treatment received, caregivers are unable to accurately track patient follow-up care. Patients will need to depend on visits to hospitals or clinics for updated information, which is not always viable for critical patient conditions, with the knock-on effect of further congesting these facilities. Moreover, the need to collate data from multiple sources

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[6] "SARS man goes home", The Straits Times, September 2003

puts additional strain on the provider's ability to meet reporting and compliance guidelines to the health authorities.

- **Inconsistent patient discharge, tracking and care management** – To deliver consistent care, it's vital to get information correct right from the start. The complex scoring processes involved in certifying if a patient is ready for discharge can result in inconsistent decisions if they are not supported by an integrated system that provides updated and accurate patient data, using processes that meet business and compliance standards. Then, there's the challenge of managing referrals from multiple sources, which can increase administration time. Finally, ongoing patient tracking and care management can be tricky if there is no one single 'point of truth' that gives the patient and his multiple caregivers a real-time view on the status of treatments and follow-up care.

- **Resource and workflow scheduling pains** – Given that there are less than 1 doctor and 2 nursing staff to every 1000 patients in some Asia Pacific countries, resource and workflow scheduling needs to be managed well to ensure that patients get the right care at the right time. And since caregivers are spread thinly on the ground, it's even more imperative that they are supported by a system that allows them to collaborate effectively across the care continuum.

A unified IP network: the fourth utility in a hospital

Given the incredibly high levels of investment required for new medical facilities, any investor – public or private – will demand a suitable social or economic return on their investment. Operators of these facilities are looking at new ways to drive up the efficiency levels of these valuable assets, and one of the most effective ways is through the intelligent and sensible adoption of appropriate technology.

In the Asia Pacific region, large investments are being made to create new, advanced healthcare facilities (by both governments and the private sector). Built from the ground up, the systems that will be deployed in these facilities will need to last a considerable amount of time. The depreciation period for hospital buildings (in a government context) is 50 years and for the private sector, it is usually the tenure of the land (about 30 years).

For a healthcare facility to cope with growing demand and rapid changes in the industry, the design must place interoperability, standards, and flexibility high on the list of vital features. This allows the solution to evolve, and configure itself to the needs of the business as demands change according to the healthcare needs of the population, even if the physical building itself may not change over time. As internal ward designs get reconfigured, the communications infrastructure and IT infrastructure that support the clinical and business processes needs to be adapted to provide value added and timely care.

The provision of care has moved beyond the single care giver, and today, care is provided through a multi-disciplinary team across a spectrum of services

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in a hospital. Thus, the supporting infrastructure must be able to connect and consolidate the care from the various team members, across distances, time, methods of communication and types of medical devices, both onsite and in remote locations. This convergence is the hallmark of care in the new century. The convergence demands a converged infrastructure for the benefit of the patient.

This convergence is one of the key elements addressed by the Connected Hospital. The vision of a Connected Hospital promotes the planning, designing and management of a facility where the environment itself plays a significant part in the patient care process.

Key components of the Connected Hospital

The Connected Hospital framework provides hospital and medical facility operators with the optimal path towards achieving this vision of convergence. The framework places a unified IP network utility into the very foundation of modern medical buildings, driven by three converging market forces:

- The convergence of multimedia voice, video and data services onto a unified IP-based infrastructure, with the potential to consolidate separate technology-specific and proprietary networks onto a single network

- The emergence of IP-based multi-function building systems that brings together separate applications such as security, access, building monitoring & management, as well as heating, ventilation and air conditioning (HVAC) systems onto one integrated platform

- The growing importance of energy conservation and "Green" buildings where the network serves as a platform to collate information from various environmental sensors, which in turn is used to make more informed decisions in the management and control of HVAC, lighting and power systems.

The Connected Hospital framework features a converged network that should be included as early as possible in the design phase of the construction of a healthcare facility. Services embedded in the network to support end-to-end application integration results in a network that can provide much more intelligence for delivering new applications to support a hospital's ever-changing business requirements.

This network offers hospitals the power and flexibility to deploy interactive services that support greater collaboration and productivity. In the healthcare context, a converged network with embedded services offers several business benefits, including:

- **Presence** – A healthcare organization can utilize the network to determine the status and availability of clinical staff, thereby dramatically reducing the amount of time taken to contact a colleague in the case of emergencies.

- **Location Awareness** – The network can be used to determine in real-time the location of staff members, patients, hospital resources, etc.
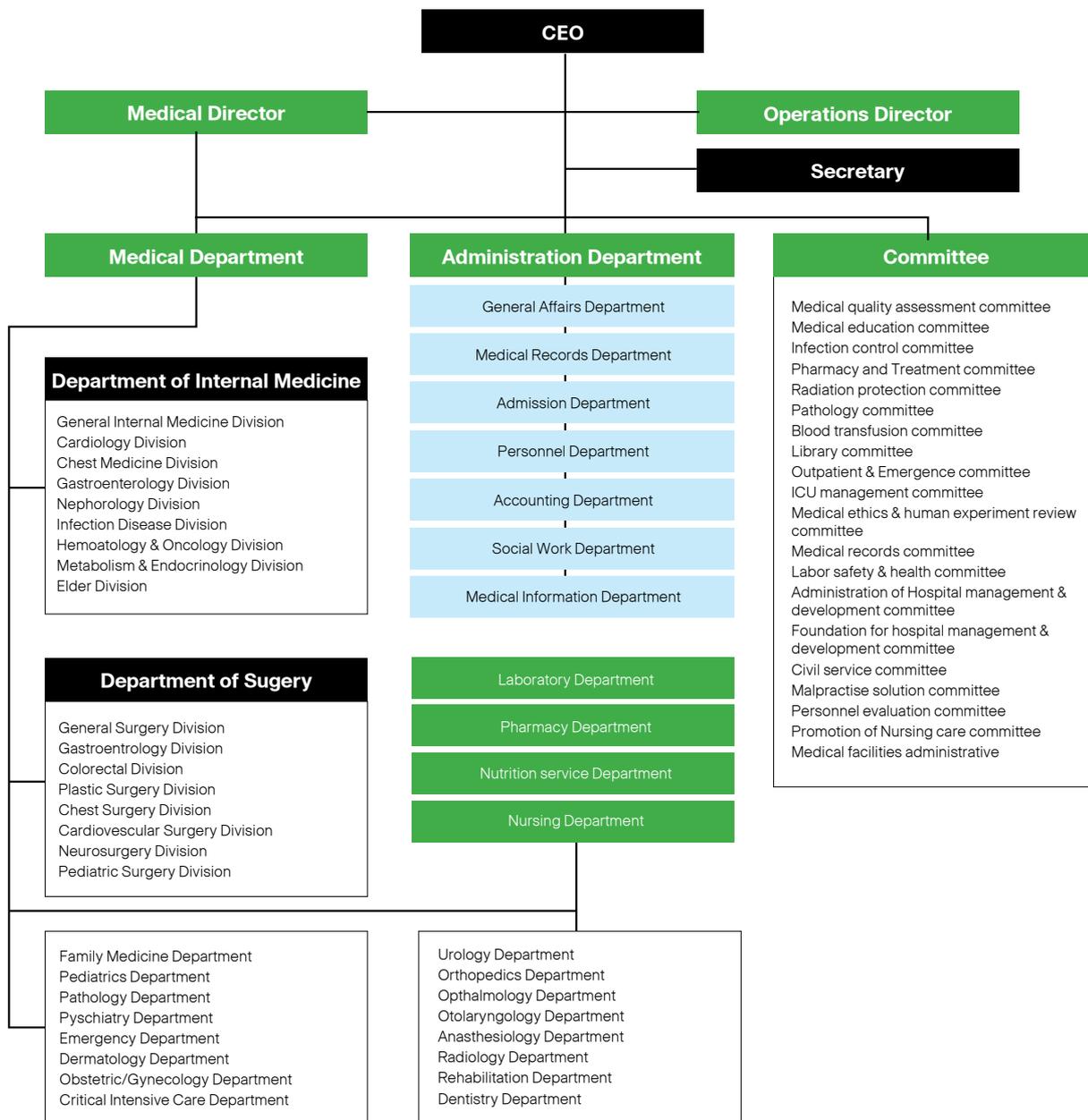
Figure 1: A typical organizational chart depicting the various departments in a hospital

The network thus becomes an intelligent building infrastructure and the foundation for integration and transformation of the medical facility and processes. This "intelligent hospital" infrastructure creates an unprecedented opportunity for improved services, enhanced processes, and cost-effective operations. Embedding information networks as the fourth utility - as fundamental as physical plumbing, piping and wiring – provides the following benefits:

An IP-based communications infrastructure
As hospitals are highly complex organizations (see Figure 1), the main challenge is to ensure that the various departments can integrate, communicate and collaborate effectively with one another. A major consideration should be the design and deployment of a medical-grade IP network that will be used to support a range of complex, integrated, and
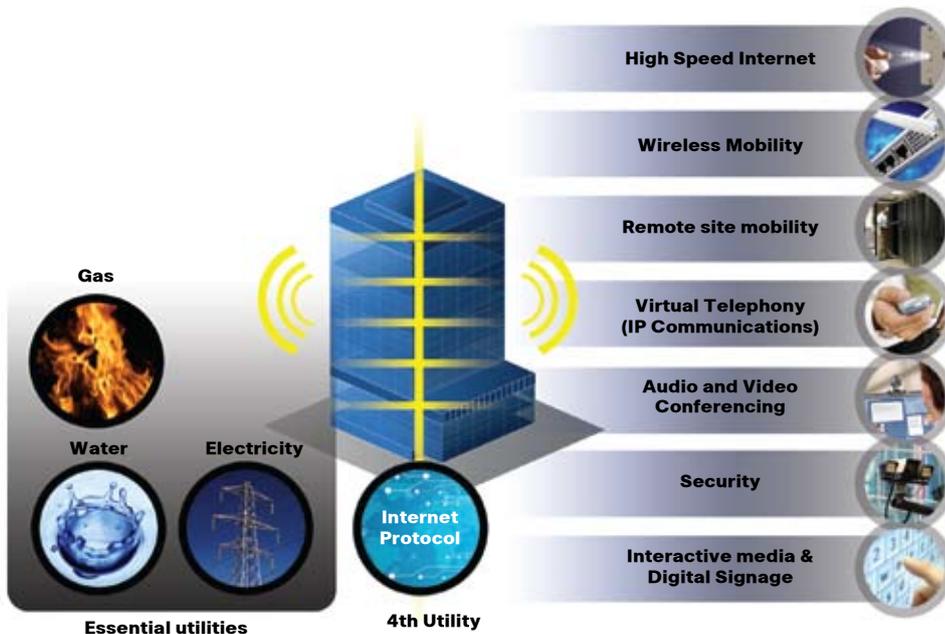
Figure 2: Information as the fourth utility

mission-critical information flows; and to consolidate the disparate networks onto a common platform. Cisco offers a Medical-Grade Network (MGN) which delivers this requirement: it acts as the digital nervous system of a healthcare organization; is designed to be exceptionally secure and resilient; and self-monitors, self-defends, and self-repairs so that critical applications and data remain safe and accessible at all times. This secure, intelligent, high-speed infrastructure is built with open standards and interoperability in mind, with the ability to support all manner of data, voice, and video applications concurrently – wired or wireless.

Specific departmental solutions

Specific departments will require different uses of the IP network. Once in place, the Cisco Medical-Grade Network provides the foundation for advanced functionalities that provide benefits in Operating Theatres, Wards, and Accident & Emergency, etc.

- **Operating Theatres (OT)** - Operating Theatres are by far the most costly real estate in any hospital. Saving just five minutes per hour of unused time in a theatre can lead to substantial cost reductions in a hospital's budget. Multiply this across the multiple OTs that most hospitals are equipped with, and the savings are further increased. While the financial benefits are important, there are other major benefits such as being able to accommodate a greater number of patients on the OTs list per day, thereby potentially reducing hospital waiting lists and ensuring the best use of a substantial asset.

  One major area of efficiency where technology can assist is in reducing the time to turnaround OTs. Informing the appropriate staff team that a procedure has finished, and that the room needs to be prepared for the next procedure is often an area of delay. By equipping staff with wireless IP phones, and being able to direct such messages to them in real-time, tracking acknowledgements and escalating to other staff members or the OT Manager, turnaround times can be reduced.

OT environments necessitate the need for critical systems and services that can be delivered over the Cisco MGN. For example, lab work, blood work, X-Ray, cleanup, turnover, surgical material, porters and many other requests can be made from an OT monitoring station and relayed to the appropriate staff member wherever they are.

- **Wards** – Applications can be deployed over the MGN to provide an up-to-date display of occupied and available hospital beds, as well as the current status of each one. From this display, staff can tell from a glance whether the bed was booked, ready, or being prepared. They can also tell whether the patient in that bed was soon-to-be discharged, had already vacated, or was being transferred. The system can facilitate the coordination between the various departments, such as porters, housekeeping and bed management, automatically matching empty beds to new patients. Other applications that improve communications, patient care plans and critical information can also be deployed over the MGN.

- **Emergency Room (ER)** – The fast-paced environment of emergency rooms requires systems that help improve triage (classification of patients according to severity of condition), improve access to patient information, and can track patients within the department as well as coordinate services between separate departments throughout the organization. For example, electronic whiteboards can be used to provide a unified view of a patient's location, problem, triage state, physician and up-to-the-minute lab and ancillary results. All views of information can be customized to the clinician's preferences and stored centrally.

Enabling collaborative care, right to the patient's bedside

- **Location-based Services** (LBS) make it easier to monitor and find the right equipment and people. An LBS system uses a combination of PCs or mobile device, a location engine, and Radio Frequency Identifier (RFID) tags placed on designated equipment, or worn by patients. The RFID monitoring system continually updates their locations to any PC. The system provides alerts when equipment or people stray outside a designated "zone".

- **Collaborative Care** solutions uses audio and videoconferencing technologies to interconnect teams on demand, leading to better decisions and more effective care. The system enables clinicians and first responders to consult as needed with colleagues or experts across the medical campus, across town, or across the country.

- **Patient services** such as ordering food and beverages can be optimized and enhanced using bedside devices such as IP phones. The benefit is threefold - nursing staff already know what the patient requires, thus saving a trip to their bedside to ask them, the patient receives quicker service, and with no overhead paging, the ward remains quieter, offering a more restful environment for patients to recuperate. Workflow efficiencies can be further boosted by integrating this service into the IP nurse call system, with patient requests being automatically routed to the appropriate staff (i.e. only the staff on that floor, or
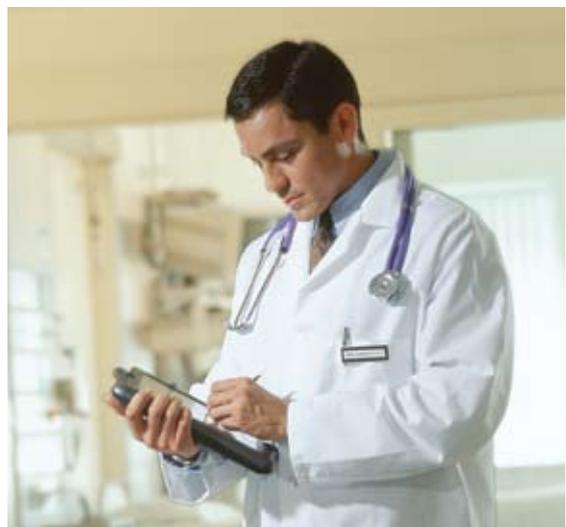
responsible for that ward etc.) to their wireless IP phone with the same degree of logging, auditing and escalation management as any other category of nurse call request.

- **Patient monitoring and medical records access** allows doctors and nurses to obtain records, waveform data, radiology images, and other forms of data over the wired or wireless IP infrastructure, so that they can provide improved bedside care. Real-time data gathered from bedside monitoring equipment can be carried over the IP infrastructure and routed to mobile caregivers and clinicians, allowing them to respond to incidents faster than they might otherwise. The data can reach them via their wireless devices, such as IP phones, or wireless enabled laptops. Such wireless devices may not have the necessary image resolution to be used for diagnostic purposes, but can be used by a clinician to aid in the discussion of a patient's condition or upcoming procedure right by their bedside, rather than having to schedule an appointment with them in an office.

- **Workforce productivity tools** – In today's context, broadband or high-speed connectivity is a must have for medical operations. By putting a medical grade IP-based network in place, medical employees have building-wide access to various workforce effectiveness tools, such as IP telephony for integrated communications and wireless services for added mobility. In addition, audio or video conferencing tools can also improve the speed at which decisions can be made. Finally, VPN services provide employees with the ability to work remotely.

- **Unified communications for healthcare** - Healthcare providers must contend with a variety of communications environments featuring a wide array of communications methods. These combinations may include phones, voice messaging, e-mail, fax, mobile clients, and rich-media conferencing. However, having to switch between methods to access different type of information may result in information overload and misdirected communications that delay decisions, slow down processes, and reduce productivity.

A unified communications platform is designed to carry any combination of voice, video, and data across the same links and through the same devices. It allows users to benefit from timely alerts, enhanced collaboration during consultancies, improve patient response, and enhance reporting capabilities.

Making healthcare mobile

- **Nurse call systems** can help nurses keep in constant contact through a small, wireless IP phone or hands-free communicator badge they carry with them or wear. With the wireless IP phone, nurses can not only make and receive on-net calls anywhere in the building, but can have system or patient requests sent directly to their handset with text details of what is required, by whom, and where. They can also press a pre-configured soft-key to escalate any service requests to alternate staff members if they are unable to respond to the request, or press one button to call the requestor to further discuss a request.

  With the badge option, the nursing staff can make a call simply by touching a button then speaking the name of the person or group they wish to talk to. No knowledge of a telephone number is required, just a name – be it an individual's or a team's. With the latter, the call request

can be directed to all members of a team currently logged in, allowing the first available member to accept the call. This system will eliminate overhead paging systems; and improve workflow, efficiency, and patient satisfaction with faster response times.

Managing the hospital real estate environment

The drive towards a Connected Hospital is not just about providing new services and improving the work efficiency of employees – it's also monitoring and managing building systems on an integrated basis so that medical environments provide the optimal amount of comfort to its patients, whilst minimizing wastage in terms of resources and maintaining hospital's effort in maintaining a "green" environment.

That's the promise of the Connected Hospital vision. In conjunction with regional leaders like CNA (see box), Cisco offers intelligent and integrated facility management systems that monitors and manages diverse building systems in a hospital in real time. These include:

- **Optimal Energy usage for critical area** – With usage data shared real-time, the Hospital Facility System can adjust the demand of cooling and lighting at critical area, e.g. operating theatre, isolation room, etc, thus reducing energy wastage.

- **Automated and networked HVAC systems** – This allows end-users to adjust the heating, ventilation and air conditioning (HVAC) requirements in their individual spaces, thus conserving energy and controlling costs. In addition, sensors can monitor equipment for an indication that preventative maintenance is needed.

- **Automated On-Demand Facilities control** – Common facilities (meeting room, auditorium, training room, etc) HVAC and lighting can be turned on/off based on booking status from the facilities booking system, thus saving energy and manpower.

- **Lighting control** – Lighting systems today can be accessed and computer-controlled by the building owner or by the tenant via web-based control systems. Lighting systems can now be linked to a centralized information system that

CNA SIRIUS™
For complete integration, management and control of hospital management systems

CNA SIRIUS™ is an integrated multi-thread and multi-tasking facilities management and control system which seamlessly integrates various hospital subsystems with the hospital management system to provide healthcare providers with effective, safe, easy-to-use, unified functions for efficient operation of the hospital.

CNA SIRIUS™ pulls together all aspects of running an hospital, manpower and equipment, security management and energy management and offers real-time data through a single management dashboard. This dashboard allows an entire range of hospital operations and building management tasks to be performed at ease, including:-
- Resource allocation of workforce and mobile assets
- Automated fault reporting and management for HVAC, elevators, and other hospital building assets
- Security and access control
- Real-time crisis management by directing events and alarms to the relevant security experts

By running CNA SIRIUS™ over a single Cisco IP network, healthcare providers can converge voice, video and data systems onto a single network, allowing a higher level of integration between different sub-system. Information can be shared quickly, thus increasing work flow efficiently. Ultimately a single network reduces operational and maintenance costs, and provides the platform for the healthcare provider to explore and deliver innovative solutions to improve worker productivity and provide a "hassle-free" hospital environment to its customers.

shows point-in-time usage or usage patterns for either a single building or an entire complex of buildings.

- **Elevator control** – By network-enabling elevator systems, their operations can be monitored and optimized. Access control cards allow employees programmable, selective access to certain floors. Interactive in-elevator terminals can stream content, ranging from news feeds to emergency instructions. In addition, elevators can be continually monitored for performance and breakdowns to drive proactive maintenance.

- **Energy management** – Hospital campuses consume large amounts of energy, and building owners want to minimize energy wastage and utility bills. Energy management systems such as environmental control systems, electrical power monitoring system, lighting, machinery and onsite generators can be network enabled. This allows hospital administrators to monitor the energy usage and devise methodology to optimize electricity and gas usage in the daily operation and reduces total energy costs.

- **Parking control** - Entry to parking areas can be controlled via access cards or other electronic identification methods. In addition to access control, parking systems can integrate with security, lighting, elevator and HVAC systems. These systems can be programmed to turn on and off for the individual tenant when they enter the parking structure. Parking costs can be monitored and accounted for electronically, reducing administrative overheads.

- **Access control** – Access control can also be managed on a granular level depending on the location, or status of the employee. For example,

CNA helps leading Singapore hospital deliver leading-edge medical treatments to patients

CNA's rich experience in harnessing technology to build the future hospital was amassed through its projects in Gleneagles Hospital, Changi General Hospital, and KK Women's and Children's Hospital.

For Tan Tock Seng Hospital (TTSH), CNA has introduced an integrated hospital management solution to enhance its operations.

Tan Tock Seng Hospital (TTSH) is the second largest hospital in Singapore, and operates the country's busiest accident and emergency department due to its central location. Set up in 1844 by an entrepreneur and philanthropist, Tan Tock Seng, the hospital came into the international spotlight when it was designated as the sole treatment centre for the SARS epidemic which struck the country in 2003.

As a member of the National Healthcare Group, TTSH continues to provide high quality holistic healthcare services to the people of Singapore. After three major moves in its long and distinguished history, the hospital now provides nearly all its services in one modern complex, comprising the Hospital Block, the TTSH Medical Centre and the Podium Block. The hospital is equipped with state-of-the-art facilities and medical equipment, as well as the latest communication and information technology tools, including a highly sophisticated Intelligent Building Management System (IBMS) – designed and implemented by CNA.

The IBMS integrates 17 sub-systems and provides round-the-clock monitoring and control of critical services. These systems include:

- HVAC
- Electrical, plumbing & sanitation
- Lighting automation
- Employee communications
- Security access control system
- Fire management system
- Lifts & escalators
- Nurse call systems
- Medical gas delivery systems

Thanks to CNA's integrated solution, TTSH has succeeded in creating an efficient, safe and comfortable environment for its patients and employees, and have helped the hospital win the coveted BCA Platinum Green Mark Award and the Asean Energy Efficiency Award in 2006.

non-OT staff may not have access to operating rooms during a surgical procedure. Hospitals may also want to control visitor access to wards during specific periods, especially those wards with quarantined patients.

- **Security and monitoring** - Ensuring the safety of patients is also a significant issue for healthcare professionals. By implementing RFID-based patient location and tracking, and combining it with video surveillance systems across the hospital compound, hospital employees can triangulate the position of patients at any given time, to ensure that they can be quickly located in case of emergencies, or alerted if they leave care areas. Additionally, they can obtain greater visibility into inventory, and track the real-time location of high-value assets and life-saving equipment, substantially increasing safety and operational efficiencies. Finally, such an integrated system will also be effective in identifying hazardous situations, such as fires, and to send messages rapidly to response teams, allowing for fast decision making and action.

Considerations for a Connected Hospital

A hospital building lifecycle comprises four main phases – conceptualizing, designing, constructing, maintaining and operating the hospital, as depicted below:

- **Conceptualize** – The phase in which the hospital is scoped and financed, conceptualization consumes about two per cent of the total costs of the building lifecycle.

- **Design** – During the design phase, architects and engineers plan the detailed layout and the structure of the hospital

- **Construct** – In the construct phase the building is erected to its design specifications. Together, the design and construct phases account for some 20 per cent of the total costs of the building lifecycle.

- **Maintain and Operate** – This phase represents the time during which the building is used, typically 25 to 30 years in today's fast-moving environment. It accounts for 75 per cent of the total costs of the hospital's lifecycle.

- **Retrofitting** – This phase occurs when various elements of the building's infrastructure need to be upgraded to cope with new demands, deliver new services, or to renew or improve the operational efficiency of outdated assets.

With three-quarters of the total expense of a building occurring during the Maintain and Operate phase, rather than as initial capital expenditure, decisions taken in the design and construct phases can have far reaching

"Through ubiquitous connectivity, hospital employees will have the ability to interact and collaborate with one another more effectively, improve their productivity through the provisioning of new tools, and provide better levels of care to their patients with faster access to the right information."

financial and operational impact. Therefore during planning and design phases key stakeholders should carefully consider a hospital complex's underlying network. Decisions made during the early stages can effectively create the levers that reduce ongoing operations costs over the lifecycle of the buildings.

The inclusion of a Connected Hospital network in the building design process, and its installation as early as possible in the construction process, provides immediate gains for hospital operators. The Cisco IP network reduces capital costs during the construction process, because infrastructure can be laid more easily (rather than being retrofitted with consequent cost and disruption) and the single open standards cabling infrastructure reduces the requirement for multiple closed proprietary networks and the associated costs of installing them. Secondly, by installing networks early, building owners can extract value from the network over a longer period of time, increasing overall return on investment.

Conclusion

For the healthcare industry, the IP network is the transformational agent that transforms hospitals and medical facilities into the Connected Hospital. Through ubiquitous connectivity, hospital employees will have the ability to interact and collaborate with one another more effectively, improve their productivity through the provisioning of new tools, and provide better levels of care to their patients with faster access to the right information.

In the IT world, convergence combines data, voice, and video onto a common network. This network becomes the fourth utility alongside water, electricity, and gas. From the building-systems perspective, systems which include HVAC, lighting, physical security and access control, fire safety, elevator and electrical controls, are connected together using a single network, running on a centralized management interface. The building can be thought of as the embodiment of the network - the physical framework in which it's deployed.

As partners in delivering the Connected Hospital framework, Cisco and CNA are committed to realizing the vision of a truly Connected Hospital.

A worldwide leader in business networking, Cisco provides a comprehensive framework and networking solution for healthcare needs and offers a secure, adaptable, standards-based architecture that easily accommodates today's needs and future services while protecting network investments. CNA offers more than a decade of experience in implementing building management and automation solutions, and is unwavering in its focus on innovation, project execution excellence and integrity of service.

With proven best practices for deploying real estate industry network solutions, developed through close working relationships with real estate customers and industry groups, Cisco and CNA are well positioned to maintain the health of the healthcare industry, well into the future.

To find out more:
Cisco Connected Hospital –
http://www.cisco.com/web/strategy/healthcare

About Cisco

Cisco Systems, Inc. is the worldwide leader in networking for the Internet. Today, networks are an essential part of business, education, government, healthcare, transportation and home communications, and Cisco Internet Protocol based (IP) networking solutions are the foundation of these networks. Cisco hardware, software, and service offerings are used to create internet solutions that allow individuals, companies, and countries to increase productivity, improve customer satisfaction and strengthen competitive advantage. The Cisco name has become synonymous with the Internet, as well as with the productivity improvements that Internet business solutions provide. At Cisco, our vision is to change the way people work, live, play and learn.

About CNA

For more than 15 years, CNA Group has played a key role in delivering vital integrated solutions converging facilities, business and IT systems to airports, buildings and industrial plants around the Asian region.

CNA provides an extensive array of services and solutions to automate, control and manage virtually every facility in the hospital environment. The company's systems collect and integrate information from multiple points within the hospital or across a network of buildings, to optimize the performance of critical facilities like air-conditioning, lighting, intrusion detection, access control, energy monitoring, voice, data and video communication systems.

CNA solutions are built, integrated optimized on the Cisco Connected Hospital foundation, which results in lower initial costs and operational efficiencies that benefit hospitals.

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