WORLD CLASS IT SOLUTIONS
IN BETHESDA CHILDREN'S HOSPITAL, HUNGARY

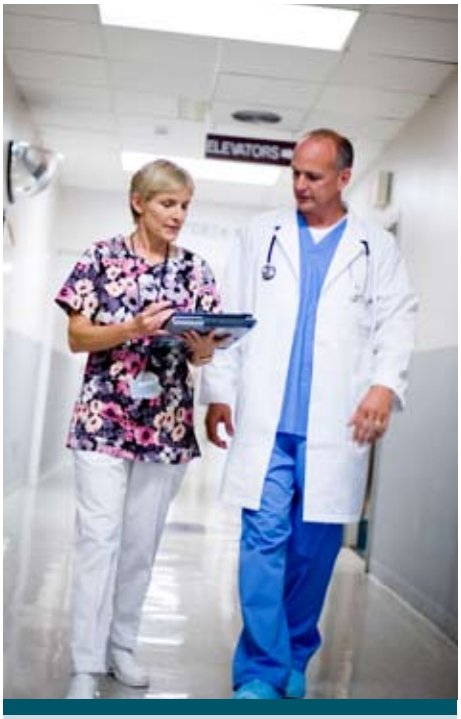
CASE STUDY, 2008

In the autumn of 2007, representatives of Cisco Hungary and T-Systems delivered a state-of-the-art hospital IT system to Bethesda Children's Hospital. In addition to deploying the most advanced information technology and communication (ITC) solutions, another significant result of the project was the White Book, a step-by-step documentation of the development project from the initial steps all the way through to the delivery of the system, which was prepared in cooperation with healthcare experts. Based on specific calculations, the various qualitative and quantitative indicators support the quick return on investment of the new ITC system. Therefore, the vast know-how gathered together in the White Book may well be a great help for other institutions building similar systems.

In the course of the project, the most advanced ITC devices and services were deployed in the two Budapest buildings of the 135-bed Bethesda hospital. Among others, a new wired and wireless system, new computers and printers were installed, clinic and hospital management software, a nurse call and patient management system, IT telephony and related dual-phone solutions, a Radio Frequency Identification (RFID) positioning system, electronic signature, distance learning and various other new features were introduced, all of which are designed to improve the quality of patient care, patients' comfort level and operational efficiency. In addition, T-Systems made a commitment to operate and provide back-office support for the new devices for a period of 3 years.

During the project, Cisco was responsible for the supply of the complete ITC devices of the system, while the professional competency of T-Systems ensured seamless deployment and operation of the system as well as effective project management.

"We are experiencing the positive impacts of the new infrastructure day in day out. Our physicians use the teleconference feature to hold professional meetings, access patient records and real-time patient data using wireless computers within the hospital and secure Internet connection outside the hospital. As a result of the nurse call and patient management system, waiting lists are shorter and the physicians' work has been made easier," explained Dr György Velkey, Chief Director of Bethesda Hospital, in his overview of the new system. "The investment is a great leap forward in economic terms as well. Instead of the former parallel systems (phone and computer networks), we now only need to operate a single IP network capable of transmitting all voice, data and video information. In addition, employees can call each other on site free of charge using all their fixed and some mobile devices and the RFID system prevents expensive equipment from disappearing," he added.



Technical Details

Cisco devices integrated in the system:

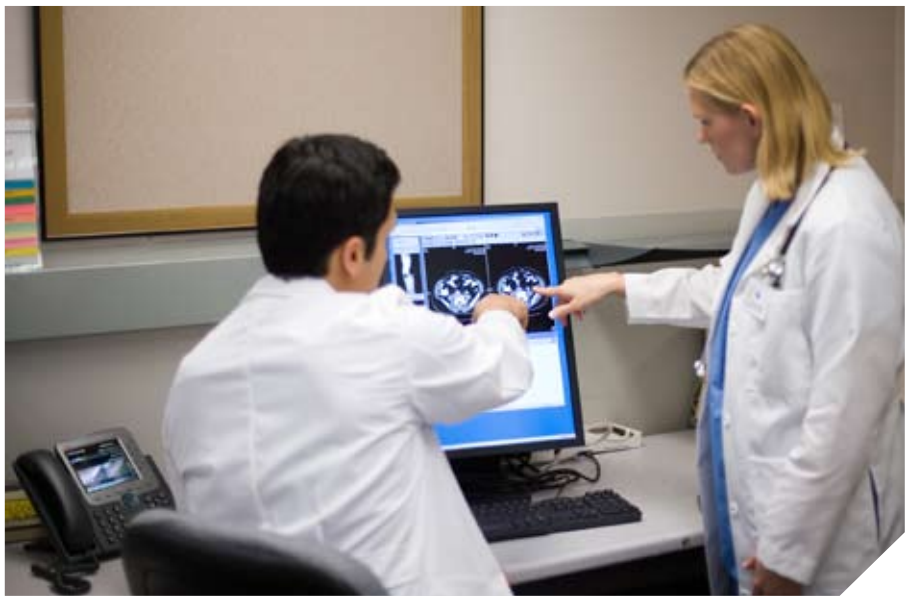
- WiFi Access Points (AIR-AP1010-E-K9)
- AP Management and Positioning
- Call Manager cluster
- IP Phones (wired and wireless)
- IP Video phone (Cisco 7985)
- Voice Gateway (C2801)
- LAN switching (3750, 3560)
- Security (CSA, ACS, ASA)
- Nokia E61, E71 phone Cisco/Nokia Licence
- Shared Support (3-year warranty)

"Healthcare decision makers have now realised that the network can play an important role in meeting their strategic objectives. In healthcare institutions, the intelligent network works as a digital nervous system connecting various hospital applications, systems and devices including wireless equipment, virtual conferences between medical specialists or applications providing a means of communication between patients and their family members or those offering entertainment opportunities for patients. These IT solutions not only increase efficiency, but also offer an opportunity for new income types previously unheard of in healthcare institutions. These include remote diagnostics where, based on a partnership agreement with an institution anywhere in the world, Hungarian physicians can set up a diagnosis based on medical results received from the remote location, such as high-resolution X-ray, CT or MR images," explained Tibor Rékasi, Managing Director of Cisco Hungary.

"The project was designed to deploy an ITC system that improves the quality of patient care and the efficiency of physicians' work. Hospital employees receive all the ITC support they need for their work; using this modern IT equipment allows physicians to spend most of their time and energy healing patients. In addition, this new system is a model to be used as a reference in other Hungarian hospitals for deploying and operating high-quality network infrastructures. In the long run, when similar systems are deployed and additional hospitals are involved, a unified and efficient system could be created to improve the quality level of the entire Hungarian healthcare system," said Zoltán Tankó, manager of T-Systems.

The White Book

The White Book produced by the project contains the results of the new IT system in terms of figures and highlights the benefits achievable with such projects and the fast return on such investments. The White Book says, for example, that even a "small" hospital like Bethesda can save



Device and service portfolio provided by T-Systems:

Devices:

- Replacement of the older computers (above 3 years) with 75 new desktop (Pentium IV, 3 GHz, 1 GB of RAM with XP) and tablet PCs.
- Fujitsu Siemens PDAs for physicians with support for the basic functions of the MedWorkS solution.
- Installation of a new wireless (WiFi) network with close to 70 endpoints
- Expansion of the existing 150-endpoint wired structured network with 45 additional endpoints
- Active RFID bands/markers for locating services
- Nokia E61 WiFi enabled mobile phones

Services:

- ISDN 30 with voice gateway to connect to the IP phone traffic of the conventional (PSTN) phone network
- e-Signature digital certificate (5 pcs) and time stamp for management. In the future, the MedworkS system will enable the expansion of the use of e-Signatures to the electronic authentication of patients' lab test results and hospital release reports.
- Remote access (5 ADSL modems) for the management
- e-Learning to inform users about the use of the new hospital IT system and the newly deployed devices
- Patient call system
- Project management for system deployment
- Operation of the whole IT network until 31 December 2009

HUF 5.5 million annually through the improvement of outpatient care and HUF 5.2 million in operating costs thanks to the integrated operation. The data also reveal that the hospital can save 712 working hours annually thanks to the electronic X-ray, ultrasound and laboratory appointments, that it can free up 2000 data entry hours annually by connecting the automatic laboratory equipment into a system, or that the remote control of the boiler house and the heating system can also bring in an annual saving of HUF 1.7 million. Here are a few more interesting facts from the White Book, although there are many more which could be cited:

- IT cost per patient care decreased from HUF 197 to 164.
- The specific operating cost of the equipment decreased from HUF 10 to 0.3.
- Patient logistics functions increased from 2 to 10.
- System downtime per year decreased from 120 to 2 hours.
- The average age of the IT assets decreased from 5.5 to 1.5 years.
- The percentage of wireless equipment increased from 0.7% to 22%.
- The percentage of telephone sets offering premium services increased from 2% to 30%.
- Digital signatures increased from 1.6% to 9.6%.
- Workstations with internet access increased from 70 to 177.

Background of the Bethesda Hospital project

The two companies selected the Bethesda Children's Hospital in a process that lasted almost a year. The selection criteria included a well-definable project size, transparent hospital operational processes, a positive management approach and the provision of the professional background and co-financing by the hospital indispensable for the success of the project.

Patient tracking

This positioning technology is ready to be applied with patients in the future. In numerous cases, it may save human lives (e.g. with unconscious or psychiatric patients) and prevent the application of a wrong medical treatment if patients get mixed up. In addition, patient service becomes more efficient if the physician knows that a patient scheduled for a test

Hardware upgrade

Most of the PCs in the hospital were over 3 years old with some as old as 10. As the first step of the hardware upgrade, the most up-to-date servers running the applications were deployed and the related peripheries (printers, monitors, operating system) were replaced.

In order to facilitate rapid administration, printers can handle office tasks and prescriptions supported by the MedWorkS system simultaneously. The new PACS monitors offer the best possible resolution for the operations in the surgical department. Servers with 4.2 GHz dual processors have been deployed, designed to run the MedWorkS system and provide remote access. As part of the modern hardware, Pentium IV 3.0 GHz PCs with 17-inch TFT monitors, laser printers printing EU type prescriptions as well as tablet PCs offering full mobility for physicians were delivered.

Local area network

As part of the project, the wired local area network (LAN) was extended to the entire campus area and the outdated active network devices were completely replaced with Cisco intelligent network devices. As a result of these intelligent devices, all data, sound and video traffic is transmitted over a single unified network, which simplifies system operation and communication.

Network operation, network management: The newly deployed devices of the IT network are enabled to send regular reports to the management centre of their status and operating load.

is undergoing another test at a different location in the hospital and he therefore has time to call in a waiting ambulatory patient.

IP telephony

As part of the project, the outdated telephone exchange accepting only analogue lines was also replaced. Cisco's IP phone system, Call Centre and Unity messaging service all use the new local area network. As a result, only one network is operated instead of the previous two parallel ones.
Instead of analogue lines, T-Systems provides the most up-to-date connection type to ensure that calls from the hospital devices are transmitted all the way to the centre of Hungarian Telecom using IP technology.

Complemented with the Call Manager software, Cisco's IP telephone system has brought a number of new features into the hospital operation. It supports videoconference calls between hospital buildings and thereby reduces time spent on the morning briefings. Videoconference and teleconference is, of course, supported with other institutions.

Using a secure VPN connection, hospital management can access the hospital phone and information system either from home or from any other location worldwide. As a result, physicians can be called at their regular work extension numbers even when at a conference (at no extra charge), i.e. they can have completely free phone conversations with the hospital . Later, this free connection may be expanded to include general practitioner offices allowing general practitioners to schedule test appointments and request information or test results about their patients over the phone.

IP cameras

Wired and wireless IP cameras may be added to the network at any time. Any user with appropriate system authorisation can access the images from these cameras from any location in the hospital. In the future, video surveillance of wards may help the work of caregivers, allowing a single nurse to monitor multiple wards simultaneously. Unless limited by the legal environment, IP cameras may be installed next to specific hospital beds; using these parents can even monitor their little ones' recovery process from the comfort of their own homes.

This service includes continuous monitoring of device operation and, in the case of any malfunction, devices are repaired on site within 3 hours. If any device sends an error message, an alert is displayed on one of the monitors in the system management centre. The first step is remote troubleshooting, when the system management uses a secure line to adjust device configuration settings. These IT experts, of course, have no access to hospital data during the troubleshooting process. If remote troubleshooting cannot solve the issue, a specialist is dispatched with a replacement device and repairs the problem as soon as possible. As a result, the hospital is only informed after the fact of this intervention. The IT problem itself remains hidden to them and it does not impact system operation.
This is a great advantage in terms of hospital operation, since all critical data including patient data, the medical system and device IDs are accessed through the LAN network.

The hospital only has a three-member operating staff.

Network security

The software based firewall has now been replaced with Cisco's new generation ASA (Adaptive Security Appliance) device. All servers and PCs are pre-loaded with the Cisco Security Agent software, which creates network

Wireless network, RFID (Radio Frequency Identification)

In addition to the wired network, both buildings of the hospital are connected to the state-of-the-art wireless (WiFi) network providing mobile communication within the institution. Using this network, IP technology can transmit both data and voice traffic under strict security protocols, allowing users not only to access the World Wide Web from their wireless devices (PDAs, Tablet PCs), but also to call each other's mobile phones free of charge within the building using their Cisco IP phones or Nokia dual-phone mobile phones. The WiFi network also supports the deployment of a positioning system. Using the RFID tags attached to the devices, the system can identify their whereabouts within the hospital at any given time. Using these so-called active RFID tags and Cisco's wireless technology, the hospital can prevent the disappearance of this expensive technical equipment and shorten the time required to locate these instruments. If further developed, the system can automatically issue alerts if protected equipment is taken to an unauthorised location. The service is available from anywhere in the hospital grounds using any computer or wireless device.

The RFID system can later be connected to the hospital warehousing and logistic systems, resulting in additional cost savings and more transparent operation.

Call Manager

Cisco's Call Manager system allows users to place calls to predefined groups of people, i.e. they can call a specific group or even all hospital telephone sets and reach more than one participant at the same time. A higher level priority may be assigned to managers or on-duty doctors, so that in emergencies, calls with higher priority can interrupt those with lower priority and connect the called party. Calls for information or scheduling appointments may be received on a single central number.
The Cisco Unity voicemail system is also a new feature at the hospital and ensures that important messages are always received by the addressee. This service may be used as a dictaphone to record certain phone conversations.

The system is also enabled to transmit not only voice but also video signals from patient beds to hold a so-called distance conference of doctors. This is particularly useful when, in critical cases, the physician in attendance or resident physician requests the senior or specialist physician to take a look at the medical condition of the patient and advise on their treatment.

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security by monitoring behavioural patterns. The firewall can connect 250 simultaneous IPSec VPN and 12 SSL connections allowing 250 staff members to access internal resources of the institution based on preconfigured user permissions. As a result, users with the appropriate permissions can access the hospital network from any computer with Internet access (see the section on remote access). Cisco Secure ACS supports a high level of user and device control, differentiated user provisioning and limitations on devices attempting to connect to the network. Network security developments can eliminate system downtime, hacking and unauthorised access.

Remote access

Managers and physicians of the hospital can access the MedWorkS system from the comfort of their own homes. They have access to all system features via remote access using an ADSL connection. Remote access is primarily designed to view management statistics and, in emergencies, medications and treatment assigned to a specific patient.

Secure access is guaranteed by SSL protocol based communication.

In the future, general practitioners can use the MedWorkS Connect module to connect to the integrated system to schedule their patients, post test requests and view their lab test results. They would use the same secure ADSL connection as described above. General practitioners get special, limited access to the MedWorkS system and the data stored in the system.

Cisco's IP telephony and Unity voicemail solution may later be complemented with a voice recognition system allowing physicians to dictate their diagnosis to their IP phones instead of having to type it into the computer. The system then automatically converts the voice file to a text and attaches it to the patient's record.

In addition, the open-source XML interface of Cisco IP phones allows medical equipment with digital interface to send automatic alerts to wired and wireless IP phones resulting in faster response times in emergencies.

Integrating mobile phones into Cisco's IP phone system

Using Cisco's WiFi network, dual-phone enabled mobile phones Nokia E61 and E71 may be used as hospital extensions while on site and they automatically switch to GSM mode when off site. This is significant in terms of cost efficiency, because assistants and nurses often call physicians on site who rarely stay in a single place for long on their mobiles, which results in very expensive fixed line to mobile calls. This issue may be eliminated by using these new handsets.

Distance Learning (e-Learning)

The large number of mandatory annual training courses (e.g. fire protection, labour safety) may be implemented using distance learning based on already available materials. This solution is, of course, is perfectly suitable for testing and reinforcing users' knowledge. Two of the great benefits of this system are mobility and flexible scheduling (non-stop availability). Later, special medical professional materials or supporting materials providing help in the management of the new medical system may be created.

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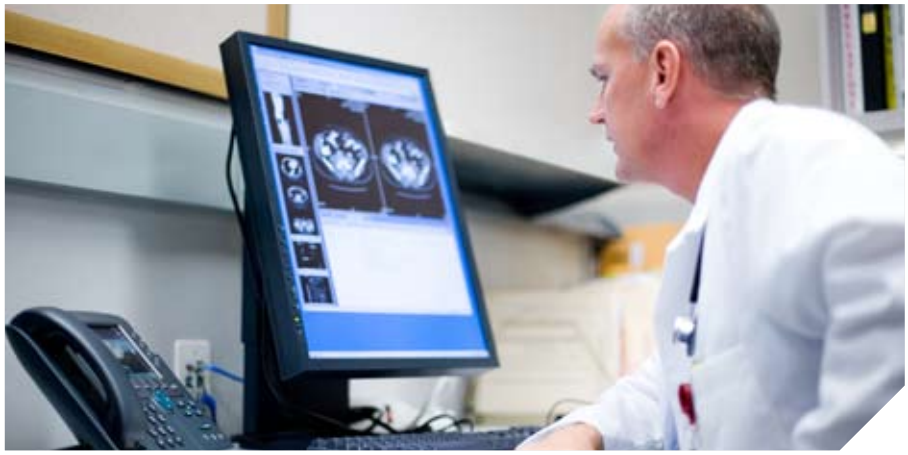
WiFi Internet access for hospital visitors

Parents staying with their children for an extended period of time may use the hospital network to do remote work and keep in touch with the “outside world”.

MedWorkS hospital system

GlobeNet Zrt. supplied the hospital with the MedWorkS integrated hospital IT system covering all areas of patient care, also including imaging and laboratory diagnostics, as well as the processes of medication, controlling, finance and business management. Applying state-of-the-art software and hardware technologies, this solution offers very high (above 99%) operational reliability and system availability.



Patient call system

The new patient call system is based on the integrated hospital IT software MedWorkS also deployed as part of the project. This software runs the patient management and patient call system. Patients arrive for their scheduled appointments. The software automatically allocates patients to a specific hospital ward/physician based on the treatment they require. The printed waiting list number shows the number of waiting patients scheduled earlier and the exactly where they should go. The intelligent system can manage cases when a specific test is relocated (to a different building, floor or room). In addition to calling patients by numbers, VIP patients can jump the queue without upsetting the existing order. The modular design of the clinical software supports the development of a future Internet login protocol.

Tablet PC

Tablet PCs (lightweight portable computers) are designed help the administration of doctors’ visits and the necessary treatment work. Physicians can use these devices while standing next to patients’ hospital beds to access lab test results or request new lab tests. Tablet PCs connect to the medical system using the WiFi wireless network.

e-Signature and time stamp

The electronic-signature and time-stamp functions simplify the administrative duties of the hospital management. With these, they can have secure communications via open networks (such as the Internet) and perform electronic administrative tasks (home banking, e-commerce) using the most advanced security services (PKI) and the so-called third party (TTP) commercial services.

The time-stamp service assigns a time stamp issued by the time-stamp servers of Hungarian Telecom to electronic transactions or to a digital file to legally authenticate the date and time of the completion of a transaction or the creation of a file. Time stamps are usually connected to electronic signatures. While e-Signatures authenticate the person signing the document, time stamps verify the date and time of the action.
In the future, the MedWorkS system will enable the expansion of the use of e-Signatures to the electronic authentication of patients’ lab test results and hospital release reports.

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