Case Study

Intel® Centrino® Mobile Technology
Intel® Pentium® Processor
Intel® Xeon® Processor
Intel XScale® Technology
Healthcare
Voice over Internet Protocol

Transforming Hospital Communications

Taiwan hospital improves voice communications through VoIP technology

Modern hospitals like the National Taiwan University Hospital (NTUH) need to continually examine and transform their work processes in order to provide the best and most effective medical care possible, yet keep it affordable. Realizing that being able to quickly and easily contact their clinicians and providing seamless voice communication channels between them is vital to the delivery of quality healthcare, NTUH decided to deploy a Voice over IP (VoIP) pilot to determine its viability in the hospital.

Challenge

- **Improve communication and collaboration.** Improve ability to contact clinicians, and provide easier voice communication methods for faster collaboration.
- **Reduce costs, deliver better ROI.** Deliver better return on investment (ROI) and lower communications costs.
- **Improve clinician's work, patient outcomes.** Enable a better, more rewarding work environment for improved patient care.

Solution

- **Deploy Intel® architecture-based** servers, desktop PCs, notebooks and handheld devices to fulfill VoIP infrastructure and client systems requirements.
- **Install an Intel® NetStructure® PBX-IP Media Gateway** to bridge and provide interoperability between IP network and legacy phone system.
- **Deploy Customer Interaction Center® (CIC) from Interactive Intelligence Inc.® together with Intel® NetStructure® Host Media Processing Software** on an Intel® Xeon® processor-based server to handle IP call processing.

"NTUH aims to provide the best medical service to our patients, hence we bring in or develop the latest medical facilities and equipment."

Professor Feipei Lai
Director, Computer & Networking Center
Vice Superintendent, National University Hospital

Assessing the Situation

NTUH is a large, well-known medical center in Taiwan that looks after the healthcare needs of approximately 9,000 patients every day—2,000 inpatients and 7,000 outpatients daily. Despite these large numbers, the hospital believes in providing individualized care. NTUH is designed to support the concept of "patient-centered" care, in which treatment is delivered at the bedside whenever possible. The hospital endeavors to provide appropriate, effective, and compassionate care that is accessible, affordable, and culturally sensitive, and in all these respects it serves as a model for other hospitals and clinics across the country to emulate.

To provide quality and effective medical care, NTUH needs to continually examine and transform its work processes to take advantage of emerging technologies that can improve efficiencies in its administration and operations. Many hospitals like NTUH have or are already transforming themselves into Integrated Digital Hospitals where, for example, information technology (IT) is used to facilitate the movement of electronic patient records and other forms of information quickly to the healthcare professionals who require them.

National Taiwan University Hospital helps clinicians deliver the best healthcare possible by improving voice communications through IP telephony.

For this reason, NTUH recognized the valuable role technology could play to facilitate better healthcare and support their concept of "patient-centered" care. The efficient flow of communications in a hospital is vital in providing clinicians with accurate and immediate information for patient diagnosis and emergency situations. Towards this end, NTUH had previously worked with Intel to introduce new technology into the hospital, implementing a hospital-wide wireless LAN and deploying Intel® Centrino® mobile technology-based notebooks and tablet PCs. That project enabled NTUH to better handle data workflows within the hospital. But voice data was another matter altogether that the hospital needed to address.

Being able to contact clinicians on duty or specialist staff for emergency conference calls are essential in enabling seamless and efficient communications workflows. NTUH's existing telephony system, based on a legacy private branch exchange (PBX) and connected to the public switched telephone network (PSTN) was not integrated into their existing IP network. Voice calling was separate from their other forms of data communications that formed the vital workflows in the hospital.

The limitations this legacy technology presented to NTUH are numerous, including:

- Inability to integrate voice data with other forms of data in the hospital data workflow network
- Unable to detect online presence of available staff within the hospital
- High cost of traditional voice calls, especially when routed to expensive cellular mobile phones
- Low coverage of paging systems, which are dependent on the person being paged to call back
- Limited call functionality like broadcast calling, conferencing, voice mail and more
- Difficult to use as legacy phone features are hard to remember, including maintaining multiple phone numbers of all staff

Spotlight: National Taiwan University Hospital (NTUH)

- NTUH began operations in 1897, and now has 4,000 staff serving approximately 2,000 inpatients and 7,000 outpatients daily.
- NTUH is a well-known and highly-renowned medical center in Taiwan.

Converging voice and data networks into one infrastructure has the potential to reduce costs of delivering communications across multiple locations. To transform its legacy telephone system and improve communications efficiency, NTUH approached Intel. The Intel team pulled together technology vendors, local system integrators and fellow travelers to present a custom working VoIP solution for the hospital. The hospital decided to implement the Intel proposed design and the pilot was rolled out to a section of the hospital site to demonstrate the viability of the VoIP solution.

This is the first healthcare VoIP implementation in Taiwan, and for Intel, the first healthcare VoIP implementation in the Asia Pacific region.

Delivering the Solution

Intel proposed a custom VoIP solution that not only delivers rich, reliable and cost-effective services, but is also scalable to adapt to future escalating requirements. The Intel team called upon a variety of partners to help put together a customized end-to-end solution for NTUH. These included Microsoft for the operating system and software development platform, Aruba Wireless Networks for the Wi-Fi environment, BCM Communications/Gemtek for Wi-Fi phone OEM, IP-PBX provider Interactive Intelligence Inc. and Phitech for technical support, Dell for hardware support, Dopod for PDA Smartphones, and Asus Tech for notebooks/tablet PC provision and support.

The team designed a solution to build upon the existing wireless IP network infrastructure, which included the Intel Centrino mobile technology-based notebooks and tablet PCs that NTUH had previously deployed.

The solution preserves NTUH's investment in its legacy PBX system by deploying an Intel® NetStructure® PBX-IP Media Gateway that bridges the existing legacy phone network to the IP network. This allows for a well-planned phased migration to the IP

"With VoIP, we can find our colleagues faster and more efficiently in times of emergency. That's the best advantage."

Dr. Chen Heng-Shuen
Department of Medical Informatics & Department of Family Medicine, National Taiwan University Hospital

"I think all services, regardless whether it's telephone service or medical treatment, will be integrated with the network in the future."

Professor Feipei Lai
Director, Computer & Networking Center
Vice Superintendent, National University Hospital

network, making it a smart solution for enterprises not yet willing to completely abandon their investment in legacy PBX equipment. The gateway allows calls to seamlessly pass between the two networks.

A key enabler to the solution is Intel® Netstructure® Host Media Processing Software, which can be installed on any general purpose server based on Intel architecture without the need for specialized hardware, and can deliver scalable, high-quality media processing for voice and video on standards-based platforms. Intel Netstructure Host Media Processing Software was installed on an Intel Xeon® processor-based server with Customer Interaction Center® (CIC) from Interactive Intelligence Inc® to process all voice calling data on the NTUH VoIP system. At the call-client end of the solution, NTUH deployed a variety of VoIP phones to 100 users across the hospital site. This covered five departments: emergency, pediatric interns, examination, home clinic and IT. These VoIP phones include softphones installed into Intel Pentium® 4 processor-based desktop PCs, Intel Centrino® mobile technology-based notebooks and tablet PCs, PDA smart phones running on Intel XScale® technology, USB phones and Wi-Fi phones. The users can hook up microphone headsets to these devices to enable hands-free wireless VoIP communications.

The new VoIP solution provides NTUH with enhanced voice facilities that are delivering better value across a range of communications needs. Any VoIP-enabled device, whether a notebook, smartphone or softphone that is powered on and logged into the hospital IP network has an online presence. Each user has a unique VoIP phone number or calling name which follows them regardless of what VoIP phone device they are using, as long as their device is powered on and logged into the system. This means clinicians can be easily and quickly contacted regardless of where they are located in the hospital, and has enabled paging to be replaced.

Nurses also found that they could continue to communicate with other departments using the hands-free function, which they found very useful since they often had their hands full. With online contact lists and a softphone's easy-to-use interface, doctors find it easier to immediately get the support they need from fellow clinicians, and even conduct an emergency conference to discuss urgent operations or other medical emergencies. In the surgery room, doctors are using hands-free VoIP on notebooks to communicate with other specialists outside the room.

Some of the features of the system that enable voice communications to be more efficient include the following:

- Seamless voice contact where a doctor using the softphone on his notebook can call a nurse's Wi-Fi phone, or PDA smartphone, or any legacy PSTN phone, and vice versa.
- Broadcast, conferencing, call-transfer, voice-mail and other features are much easier to use with a softphone's visual interface, compared to traditional PSTN phones.
- Automatic call transfer will, for example, route a doctor's call to a predefined backup nurse if the nurse on duty is busy and unable to take the call.

From the pilot, NTUH is discovering that shifting to VoIP is providing them intangible productivity

Key Technologies

- Intel® NetStructure® PBX-IP Media Gateway connects the legacy PBX telephony system to the IP network for interoperability.
- Intel® NetStructure® Host Media Processing Software is a key enabler to the custom VoIP solution, providing an affordable software-based alternative to delivering high-quality voice and video processing.
- Intel® architecture-based servers, desktop PCs and notebooks are the high performance client and infrastructure systems that are major elements of NTUH's customized VoIP solution.

Integral Answers

- Intel proposed and managed the custom VoIP solution that NTUH implemented, and called upon fellow travelers to contribute to its development.
- NTUH gained affordable, standards-based platforms and applications that simplify VoIP integration and support business communications and collaborative functions.
- Intel platforms and technologies are complemented by a network of alliance partners around the world, to ensure that customers like NTUH can have complete end-to-end solutions.

gains, and more flexibility to improve communications and accelerate healthcare processes. Some key advantages include:

- Enhanced productivity. From presence detection and instant messaging, to ad-hoc multi-conferencing, VoIP is enabling a new level of instant teamwork, reducing the time spent tracking down clinicians and information, and providing a single interface for users to manage their communications.
- Better patient service. By improving the integration of patient data, support applications, and voice to deliver more efficient, unified and increasingly automated services, clinicians have a better work environment and more time to attend to patient care.
- Flexible mobility. VoIP over wireless LAN can be used to enable seamless communications virtually anywhere in the wireless-enabled hospital with better quality than cellular services.

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Also, by integrating VoIP, the hospital can realize direct savings through lower service costs, especially for long distance and audio conference calls, as the cost of each VoIP call is significantly lower.

NTUH is pleased with the outcome of the pilot which has demonstrated that with Intel building blocks, the hospital can realize the benefits of an end-to-end VoIP solution for seamless communications. The hospital's future plans include integrating IP video messaging and conferencing, and expanding the system to cover more sites cost-effectively.

Return on Investment

- Intel® NetStructure® PBX-IP Media Gateway preserves NTUH's investment in legacy PBX telephony system by bridging it to the new VoIP network. This permits NTUH to continue utilizing existing legacy phones and allow seamless communications between the IP network and the PSTN network.
- By using the hospital's existing wireless LAN and Intel® architecture-based servers, desktop PCs, notebooks and tablet PCs, NTUH is able to minimize the costs of implementing a VoIP solution into the hospital.
- By enabling more efficient forms of communications among its healthcare professionals, NTUH is providing a better work environment for its doctors and nurses that help them make more informed and better medical decisions that can enhance patient care.

Solution provided by:

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