On-site wireless communications for smoother patient flow

How better communications between departments and quicker response to critical information improves healthcare quality and productivity, and increases patient satisfaction.

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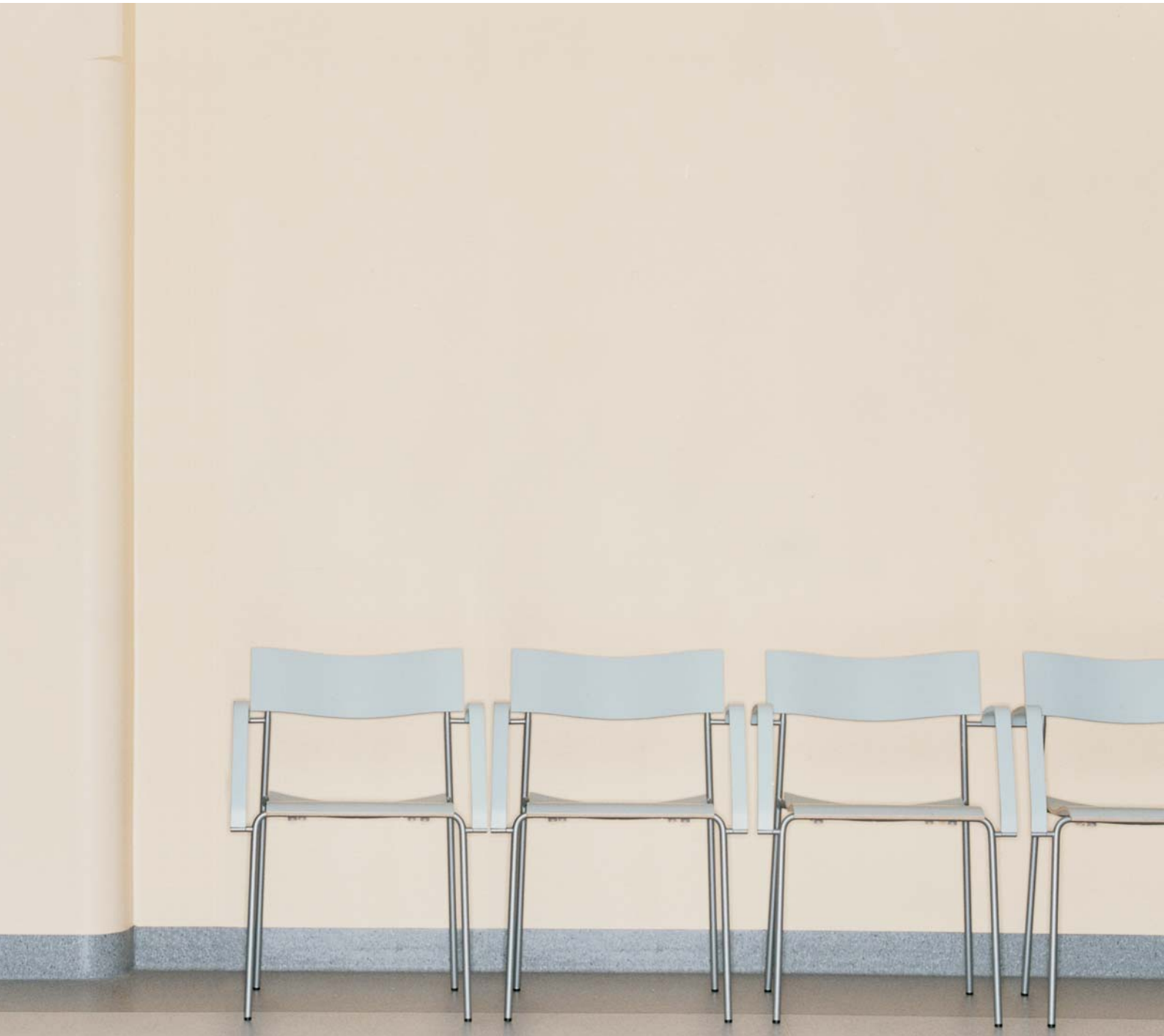

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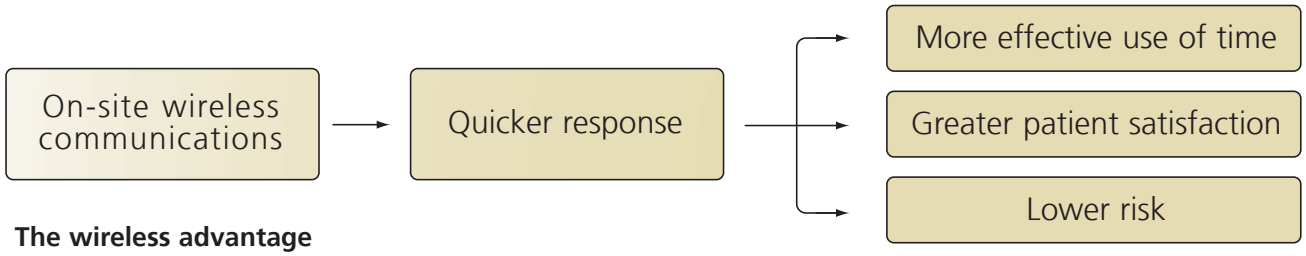
Executive summary

Why wireless?

Most hospitals have invested huge sums in information technology. This often greatly improves the effectiveness of their primary processes. But the benefits of the investments still cannot be used to the full. The problem is bottlenecks in information flows between departments. Modest investments in communications for quicker response can remove the bottlenecks and enhance the return on the primary investments.

On-site wireless communications improves productivity wherever staff is mobile over large areas and must respond quickly to time-critical information. That is why hospitals stand to gain more from the simultaneous mobility and accessibility of wireless than any other industry. This can radically boost productivity expressed as, for example, length of patient stay.

Ascom on-site wireless solutions also make it easier to comply with accreditation requirements, such as those of the HIPAA.



The wireless advantage

The benefits of quicker response

1. **More effective use of time:**
   - Less waiting for patients
   - Less waiting for colleagues
   - Less waiting for clinical information
   - Better utilisation of expensive equipment

2. **Greater patient satisfaction:**
   - Less waiting
   - More time with doctors and nurses
   - Better quality care
   - Improved patient hotel services

3. **Lower risk:**
   - Better patient safety
   - Better coordination of emergency resources
   - Support for accreditation efforts
   - Support for quality assurance
   - Improved staff security

How the benefits arise

Fragmentation of workflows and multiple information sources that lack integration plague most hospitals. Their information systems mainly support the primary processes and not the secondary ones. On-site wireless communications can make information flow freely between departments.

1. **Emergency care:** Excessively short planning horizon and continual change of priorities. Loss of time through difficulty to reach doctors and nurses, synchronise expert teams, locate equipment. Ascom wireless solutions simplify changing priorities, alerting emergency and other expert teams and finding critical equipment.

2. **Planned procedures:** Complicated planning and many deviations from plan. Loss of time from waiting for patients, medical staff, clinical information. Ascom wireless solutions reduce paging delays*, make results seek out doctors and nurses automatically, improve patient logistics.

3. **Hospital wards:** Patients are negatively affected by long waits for nurses, lack of information and having nothing to do. Ascom wireless solutions give nurses more time for patients. Also, patients get better medical information, communications and entertainment. This raises patient satisfaction and speeds recovery.

4. **Service providers:** Demands from several sources simultaneously and lack of integration between departments cause delays. Ascom wireless solutions simplify ordering, planning and delivery of services. This speeds up service to clinicians and patients, reduces waiting time and improves quality.

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* A study at a major teaching hospital showed that nurses in a typical hospital ward lose almost 900 hours a year to paging delays. Physicians calling unit nurses typically lose 700 hours annually waiting on hold. Ward staff lose more than 500 hours a year answering calls for nurses and tracking them down. Wards can reclaim 80% of time lost to paging delays and hold time with on-site wireless communications. Source: "The Impact of a Wireless Telecommunications System on Time Efficiency." The Journal of Nursing Administration. June 1995.

Making the most of what you already have

Most hospitals could treat 25 per cent more patients than they do today without adding more personnel, equipment or premises. Some hospitals could double the number of patients while simultaneously improving the quality of treatment.

If only . . .

Yes, there are many "ifs" and "buts". Wireless communications cannot answer them all. But surprisingly many.

The following pages explain how to remove bottlenecks, straighten out patient flows and improve productivity. This is based on long experience and a thorough understanding of the specialised healthcare requirements. More than 20,000 hospital installations, mainly in Europe and the U.S., are using Ascom wireless solutions. No one else has even half as many installations.

Quicker response

On-site wireless communications reduces waiting time and speeds up response in critical situations. Doctors, nurses, administrators and other personnel receive time-critical information right into their pocket devices – as voice, text, alarm or data – and in an interactive form.

Information can be received from patients and other caregivers, from computers and databases, from monitoring equipment and medical devices. It will reach the right person immediately, wherever he or she is. The receiver will know instantly when new information is available. This makes the whole organisation more agile, more productive.

Smart integration

We are not promoting a particular wireless network technology or type of wireless device. Different technologies and devices are suitable for different needs and applications. They are complementary rather than competitive and work well together.

Nor do we want you to rip out your old communications systems. Many parts of today's systems will deliver value for years. And separate networks will continue to exist in many cases. But adding on-site wireless communications between departments, work processes, individual caregivers and administrators can make established applications and procedures far more productive.

Customised solutions

Ascom communications systems support all hospital departments and processes. They can create a seamless flow of information from appointment scheduling or emergency intake to registration, clinical care and billing. We customise solutions based on the needs of each department or specialty. We adapt functionality to support existing work processes and integrate wireless communications with other systems already in use.

Our solutions help streamline patient flow, enhance the quality of clinical information and reduce paperwork. They increase the efficiency of administrative and clinical staff, reduce patient risk and improve quality and profitability. They contribute significantly to patient satisfaction.

One step at a time

Wireless systems should be phased in only where they have a clear potential to speed up processes, cut costs, improve patient care and create a competitive advantage. The investment must be affordable and present benefits up front. So, it usually has to be modular, since most budgets are very tight.

Implementing a totally converged network will then occur over time – but within the framework of an enterprise-wide wireless strategy. This is necessary to prevent the hospital from becoming an archipelago of isolated islands of information that cannot communicate with each other.

Ascom can help to specify the requirements necessary for achieving long-term, enterprise-wide integration.

Small investment yields big return

Installing wireless solutions and integrating them with existing applications and systems is relatively inexpensive. The investment is only a fraction of the hospital's total investment in information and communications technology. The time to fully pay back the initial cost of a wireless solution is usually much shorter than for other technology investments.

The return on investment comes as savings or productivity increases. Putting instant information into the hands of the caregiver can result in less waiting time, quicker response to critical situations, less paperwork, higher patient satisfaction, better inventory control and lower liability risks. Wireless relieves stress. It improves job satisfaction.

Removing bottlenecks

A bottleneck is anything that restricts the throughput of a system – where people are waiting or work is piling up. "Any resource whose capacity is equal to or less than the demand placed upon it," is the classical definition. Bottlenecks abound in most hospitals.

Bottlenecks are not necessarily caused by lack of resources. Most bottlenecks are caused by poor communications that hold back the efficient use of existing resources.

Wireless communications is a potent tool to eliminate bottlenecks. It puts people in the same system. It contributes to building a collaborative approach to patient care. It can give people a common purpose and provide a basis for optimising the larger system. It can prevent valuable resources from sitting idle.

What the future will bring

Healthcare, one of the most complex enterprises on the planet, is changing with great speed and turbulence. Growing and ageing populations stretch already limited resources. New advanced therapies require heavy investments. Healthcare costs continue to increase much faster than inflation. Political struggles rage over rising costs and scarce resources.

Purely medical changes also endanger healthcare. Overused antibiotics are losing their effectiveness against rapidly evolving pathogens. Cheap international travel allows new epidemics to rapidly become global. These and other changes are posing great problems for many national health systems.

Some bright spots

There are, however, a few areas that show great promise for improving people's health:

1. New, high-tech medical procedures – are less invasive and often cheaper than the older procedures they replace.
2. The use of genetic markers – to screen mass populations, and to prevent (through diet, gene substitution, or other special therapies) the diseases that individuals are likely to develop.
3. New modes of pharmaceutical research – go far beyond the old trial-and-error techniques to building the molecules, or evolving the bacteria, that can carry out specific tasks, lock onto specific receptors or defeat specific pathogens.
4. Nanotechnology – holds the promise of molecular-scale devices with the intelligence and tools to perform specific tasks – kill certain viruses, repair certain cells, manufacture certain needed proteins or enzymes.

New inventions of medical techniques will continue to bring important advances.

International standards

Global standards are emerging for medical education and medical treatment. Healthcare legislation is being harmonised across national borders. So are healthcare accreditation and quality certification requirements.

International standardisation also includes patient safety, requiring hospitals to initiate specific efforts to prevent medical errors, and to tell patients when they have been harmed during treatment. Standards are also emerging in support of confidentiality and security of patient information. The health insurance systems of different countries are converging.

Standards that enable the efficient use of information and communications technology across borders are of urgent concern. Such standards will allow access to information and expert knowledge worldwide, independent of time and place. As far as possible, they will be independent of the level of local communication infrastructures.

Restructuring

Much healthcare will move out of the acute-care hospital and back to clinics, to doctors' offices, and even into schools, workplaces and the home. As healthcare moves upstream, the number of nights per citizen in a hospital bed will drop. Hospitals will continue to shrink. Many will close – in some countries half or more of all hospitals.

While acute healthcare is contracting, long-term geriatric care is expanding. In an ageing population, chronic diseases are accruing over time. This population segment will account for an increasing share of the number of nights in hospital beds.

Increasing competition

Regardless of ownership, private or public, competition among healthcare organisations will increase. Patients are becoming more knowledgeable and demanding. Service, speed, comfort and convenience will be key to success and even to survival. Patients will want more, but they will not want to pay more for it. Hospitals will need to differentiate themselves through branding and marketing communications.

To remain competitive, hospitals must continuously improve the utilisation of their existing resources.

Going wireless

The changes described above and others will fundamentally transform the organisation of healthcare. Advances in information and communications technology will lay the groundwork.

Wireless communications will remove many of the bottlenecks that restrict the efficient use of resources. Caregivers will be able to communicate instantly, wherever they are. The relevant information will search out the caregiver instead of the caregiver having to hunt it down: health records, test results, monitoring information, diagnostic studies, and all other data that are critical to patient care and reimbursement.

Empowering patients

The named nurse system, where a particular nurse is allocated to each patient on admission, can improve care and increase patient satisfaction. The named nurse plays a key role in planning and evaluating individualised care throughout the patient's stay. With wireless integration, nurse calls, whether by button or telephone, can be routed directly to the patient's named nurse.

This Ascom multifunction patient terminal allows patients to call for assistance and operate lighting, blinds and other installations. It offers functions such as telephone, television, email, the internet, hospital intranet, video on demand. It can also serve as a point-of-care terminal for viewing a patient's medical record and providing direct access to the pharmacy system.

The use of information technology and wireless communications can dramatically improve standard processes. Less waiting, better information and more personalised service can raise patient satisfaction. This, in turn, may result in faster and more complete recovery.

The well-informed patient

Empowering patients will require a radical shift in relations between patients and medical professionals. Patients will demand more information and better control over their healthcare decisions.

Patients want access to their own medical records. They want to learn as much as possible about their illnesses and how best to treat them. The internet makes this easier than ever before. As a result, some patients will know more about their diseases than their doctors do. This may apply particularly to those with long-term illnesses, such as diabetes or asthma. Patients can ask the "right" questions and sometimes provide doctors with new insights in a process of mutual learning.

This is making patients important members of the care team. Involving them in treatment decisions, and helping them to use their knowledge to manage their own conditions, can alleviate anxiety and improve outcomes. Installing systems that enable patients to access information, receive education and communicate with members of the care team can generate huge rewards, both for individuals and for the system as a whole.

More face time

Despite the best intentions of nurses, physicians, and other staff, policies, procedures and care processes often prevent providers from doing

things in the most patient-focused and effective manner. There is a gap between what patients need and what is being provided.

The amount of time patients spend with their doctors is declining. The nursing shortage forces nurses to devote less time to each patient. Given the pressure to increase productivity, it is no surprise that many patients feel neglected.

An increasing percentage of care providers' time goes to non-direct care tasks such as scheduling, documenting and communicating with other hospital departments. On-site wireless communications can radically reduce the time spent on administration and increase the time spent with patients.

Just like home

Patients are beginning to expect and demand similar services in hospitals as they have access to in their own homes. Many hospitals are changing their look and feel to become more like a home or a hotel. Some are introducing food delivery systems that allow patients to order what they want, when they want it. Most are upgrading their entertainment, information and communications services.

Having access to homelike amenities reduces the isolation, boredom and stress that most patients experience when hospitalised. This improves patient satisfaction, and it is important to the healing process.

Many types of interactive services can be delivered on demand right to the bedside. For example, the internet, music, radio, television, movies and games. Via its intranet, the hospital can distribute information about its facilities and services, about illnesses and their treatment, and interactive education. Patients can stay in touch with family, friends and colleagues by telephone and email. Such patient-directed interactive systems increase patient satisfaction, optimise staff utilisation and improve operational efficiency.

Bedside terminals

Easy-to-use terminals that combine communications and entertainment functions offer advantages to both patients and caregivers. The terminals can be connected by wire to the hospital's network, or by wireless broadband for greater flexibility and lower installation costs.

Bedside terminals can also serve as point-of-care terminals with security technologies that support medical privacy standards, such as the HIPAA. Patients and providers can gain quick and easy access to medical records. Using an authorisation system such as smart cards, doctors and nurses can get into medical records and pharmacy systems. And patients can be authorised to look at their own confidential, and often highly sensitive, medical data.

With a card reader, data authentication and security technologies, patients can also pay their bills via the terminal. And patients can go shopping on the internet while confined to bed. Patients who are keeping themselves busy will require less attention from nurses. In addition, if patients feel content and relaxed, they may recover faster.

Empowering nurses

Studies have shown that registered nurses on the average walk six kilometres (just under four miles) in a shift. This takes about one and a half hours. Wireless talk-before-you-walk communications can free at least two-thirds of the walking time for qualified work. A large percentage of all nurse calls are non-medical simple requests and assistants may well handle these.

A wireless telephone system enables nurses to spend more time with patients. The system integrates seamlessly with the hospital's existing wired telephone system and nurse-call system. Wireless communications can be deployed on a single hospital floor, in a single facility or throughout multiple facilities.

In most countries, the demand for nurses is increasing while the supply is declining. Demand is increasing because patients are getting older and sicker while care is getting more complex. Supply is declining because the nursing profession has lost much of its earlier attractiveness. In the U.S. alone, more than 125,000 nursing positions are vacant. The situation in Europe is similar.

The right remedy

Hospitals are trying to address the nursing shortage with better staffing levels, more flexible schedules and higher salaries. But it is also necessary to reduce the time nurses spend on administration, paperwork and other indirect tasks – and to increase the time they spend at their patients' bedside.

In many cases, nurses must be empowered to make more clinical and administrative decisions. And there is a huge need for better technology to support nurses in various aspects of their work.

No single solution or magic technology will immediately improve nurse recruitment and retention. But better communications and easier access to relevant information can go a long way to addressing the issues that have aggravated the nursing shortage.

Smarter communications

Nurses are at the centre of information coordination – among patients, families, physicians and staff. They are busy and mobile, delays and difficulties in communication often occur. This creates frustration for nurses, other clinicians, and patients, and may negatively affect patient care.

A variety of applications and tools, including handheld wireless telephones, PDAs, automated messaging and email, can facilitate communication.

One of the most powerful tools is integrating wireless telephones with the nurse-call system, with the telephones doubling as alphanumeric pagers. Ascom's simultaneous, interactive voice/messaging establishes a more direct line of communication with both patients and hospital staff.

Patient calls can be directed to their nurse's wireless telephone with priority tones and call details insuring that the call is answered. This reduces the amount of overhead paging and increases the security of patient information.

Talk before you walk

With a wireless telephone, the nurse can speak directly to the patient and immediately assess his or her needs – without taking a step. This saves movement and time, reducing the nurse's workload.

The system allows the nurse to forward a patient call and assign services by initiating predefined tasks, or automatically escalate the call to the assigned secondary caregiver. Even if the nurse is busy with another patient, the call will not be delayed and the patient's needs will still be addressed in a timely manner.

Many nurses spend a huge amount of time going back and forth to take calls from fixed-line phones. They have to leave the bedside, and the telephone line is busy while calls are being answered. This can make it difficult to get through, especially in emergencies.

Similarly, physicians requiring urgent information, or returning a request for information, have to page nurses who then must leave their stations to find a fixed telephone to respond. This causes delays and wastes time that would be better spent looking after patients.

Integrates with existing systems

With a wireless telephone system, nurses can make and receive calls from anywhere in the hospital. They can talk to doctors, hospital staff and patients' relatives, wherever they are and without leaving the patient's bedside. Security increases too, because nurses can instantly contact another nurse, doctor, porter or security guard. The system can automatically determine the location of a user in case of an alarm.

Ascom wireless telephones integrate seamlessly with the hospital's fixed-line telephone system and with nurse-call systems of almost any make. This transforms the telephone into an individual, lightweight nurse-call master that every nurse can carry. The telephone can store multiple messages from the nurse-call system in its resident memory. Prompt group paging of teams of up to 20 people is another important capability.

Every second counts in a hospital and so does every step. Wireless telephony that integrates with existing communication networks helps nurses evaluate patient needs and deliver appropriate care faster, with fewer steps and less noise.

Empowering physicians

A main reason doctors and patients are losing out on face time is that indirect tasks are becoming more onerous. Typically, these represent one-half to three-quarters of physicians' workload. Smart wireless integration will give physicians more face time with patients.

Physicians are increasingly using advanced clinical information technology to enhance decision-making for faster, safer patient care.

Wireless devices and applications support diagnostics, charting and emergency services. They help admit patients, access and update medical records, fill prescriptions, and bill insurance companies. They reduce paperwork and give physicians more face time with patients.

There is no need to wait for the coming of the "all-digital, real-time, paperless, filmless and wireless hospital of the future." Many of the benefits can be made available right now, in any hospital, with smart wireless integration of existing systems and applications.

Time bandits

Physicians need time to build relationships with patients, take good clinical histories, explain diagnoses and procedures, and answer patient's questions. Since they are held accountable for any mistakes, and for the ultimate outcome of patients' care, they are acutely aware of the importance of time. If always rushed, they will never feel they are doing a good job.

But time is becoming a scarce commodity. Most doctors are spending progressively less time with each patient. This does not always mean they are treating more patients. The number of patients that doctors see each year is declining. The OECD average is about 2200. In one country, it has dropped well below 1000.

A main reason doctors and patients are losing out on face time is that indirect tasks are becoming more onerous. Typically, these represent one-half to three-quarters of physicians' workload.

They involve documenting their work, filling out forms required by payers and regulators, and in general, navigating a complex maze of administration.

Other time bandits are searching for information about patients or diseases, waiting on hold to schedule procedures and trying to connect with colleagues. There are disturbances from phone calls. Loss of notes and other data, notoriously X-rays, causes delays. A disproportionate amount of time is spent chasing test results. Much time goes to waste, impairing doctors' ability to give safe and effective care to patients.

Time-saving applications

Better information technology might ease or eliminate most of these problems. Healthcare is reinventing itself today. Just a few examples:

1. Electronic medical records – top most hospitals' agendas because they save time, simplify record keeping, enforce standards, prevent errors and improve patient care.
2. Access and updating – of patient records in real time. Replacing traditional handwritten notes on paper for transcription into a medical record saves time, improves accuracy and provides the care team with up-to-date information.
3. Clinical reference databases – with point-of-care decision support systems that blend reference content with practical, point-of-care direction to cut down on waiting time and improve the quality of care.
4. Physician order entry – systems that enable doctors to obtain drug information and submit prescriptions reduce the possibility of medication errors.
5. Delivery of radiology and lab reports – with the information automatically seeking out the doctor as soon as it is available, wherever he or she is.
6. Unified messaging – with alerts, messages, phone calls, reports and vital signs routed to the same terminal and prioritised according to the physician's work situation.

Quicker response through on-site wireless communications is a prerequisite for reaping the full benefits of these and other new applications.

There will be time

Systematically removing everything that steals time and slows down work is the only practical way to improve the quality and efficiency of healthcare. This requires electronic information and communications technology – not necessarily more technology than today but far better integrated and adapted to physicians' needs.

Doctors are more mobile today than they ever have been. Wireless applications – with secure communications that comply with all patient privacy regulations – will fundamentally improve the way physicians manage their patients.

Smart wireless integration will radically reduce the amount of time lost to administration, inefficiency and bottlenecks. There will be time for quality care.

Empowering management

On-site wireless communications improves productivity wherever staff are mobile over large areas and must respond quickly to time-critical information. This can radically boost productivity expressed as, for example, length of patient stay.

Competing for patients

With a rising demand for healthcare services and, in some countries, long waiting lists, the supply of patients does not seem to present a problem. At least not today.

But patients are becoming increasingly demanding and capable of well-informed choices. They are asking for more influence, a better quality of treatment and a higher level of service. These forces are moving healthcare towards market principles, away from traditional top-down bureaucracies. Individual patients will increasingly exercise their purchasing power to choose the service they prefer.

In some countries, the quality of hospital services is measured and the results are publicly available. In England, for example, newspapers publish like-for-like comparisons of the death rates in different hospitals. That movement will spread.

Competing for personnel

The state of the workforce is the most powerful determinant of a hospital's performance. If hospitals lose key physicians or are chronically short staffed in nursing, quality and safety are at risk. It is often difficult to recruit, for example, cardiologists and anaesthesiologists.

Investing in new medical equipment and sophisticated facilities is one way, although costly, to attract and keep physicians and nurses. Another way, usually more affordable, is to remove everything that steals face time from doctors and nurses. Enabling caregivers to spend more time with patients improves job satisfaction and reduces errors and delays.

Competing for financing

Faced with diminishing tax revenues and increasing social service costs due to rising demand, governments everywhere are looking for creative ways to save money. Reducing hospital reimbursement is a favourite strategy.

In many cases, patients' hospital selection depends on a cost-benefit decision by a third-party payer, such as an insurance company. The emphasis differs among payers, but downward pressure on reimbursements is nearly always present. Hospitals must then compete by providing the payer with the most cost-effective package possible.

Much for little

Better use of information technology can optimise care delivery and simplify operational and administrative processes, making hospitals more competitive. This does not have to involve big investments – just the right ones.

Wireless integration of existing systems and applications can be particularly effective in reducing costs, improving the quality of care and increasing preference among patients as well as physicians and nurses.

A modest investment can bring huge benefits. It can help hospitals get more out of legacy systems and applications, including HIS, RIS, PACS and LIS. On-site wireless communications enables information to flow smoothly between systems, departments and people. It removes bottlenecks and eliminates waiting time, promoting a smooth sequence of clinical events that helps to create rhythm and build momentum.

Non-clinical wireless

Wireless integration can also support non-clinical applications such as inventory and supplies management, tracking of durable medical equipment and other assets. Hospital admission staff can meet an incoming patient at the door and assign a room immediately. Billing clerks get better access to information. A hospital in Austria increased the effectiveness of its porters by 50 per cent using an Ascom wireless solution.

On-site wireless communications also makes it possible to automate many processes that previously required human intervention. For example, in building services.

Ascom wireless solutions support compliance with privacy and security regulations, such as those of the HIPAA, for the security of protected health information (PHI). Our solutions log events, which helps to ensure accountability. Electronic documentation of, for example, response time to nurse calls and on the frequency of checks on patients improves the hospital's position in the event of litigation.

Fast payback

Market forces call for drastically improved uses of technology. But economic realities prevent most hospitals from doing everything in a single big bang. Updating the functions of older systems by adding wireless communications goes a long way. The payback time of the investment usually measures in months.

Because wireless networks can be installed significantly faster than wired networks, they allow exceptional flexibility and responsiveness to organisational needs and changes. Pulling cable inside a building is expensive and disruptive. Wiring a department or a building can take days or weeks. A wireless network can be operational in one or two hours.

Solving the silo syndrome

Fragmentation of workflow and silos of information plague most hospitals, Users must switch between systems, memorising specific interfaces and going in and out of complex screens to find the right information.

On-site wireless communications for quicker response can break down the silos, remove the bottlenecks and enhance the return on the investments in legacy systems, such as HIS, RIS, PACS and LIS.

Quicker response increases productivity

Ascom on-site wireless communications lets everybody involved in a workflow reach each other immediately, wherever they happen to be. Time-critical information goes directly to the person who needs it. And he or she can easily communicate with colleagues, support systems and medical devices.

The real power of wireless communications is in its ability to speed up decision-making and accelerate processes. The most important benefits are more effective use of time, greater patient satisfaction and lower risk.

People, not terminals

1. A fundamental principle of Ascom on-site wireless solutions is that information should reach the right person at the right time and in the right way, not just a terminal. When someone receives information, that person knows it is meant for him or her. There is no doubt who is responsible for taking action.

2. A second principle is that information must reach people in plain English, not in obscure code, and that the person must acknowledge receipt. This minimises misunderstanding and mistakes. Alarms or messages that have not been acknowledged within a fixed amount of seconds are automatically passed on to the next person in a predetermined chain.

3. A third principle is that events, alarms and actions should be logged automatically as they occur. This provides valuable information on which to base continuous improvement of processes and routines. It also improves the hospital's case in the event of complaints or litigation.

Both speech and text

4. A fourth principle is to enable people to communicate both orally and in writing. This makes it easier to cope with difficult situations, and makes it possible to talk with colleagues or superiors. It also saves much walking to find out whether the problem requires immediate attention.

5. A fifth principle is to make it possible to communicate with several people simultaneously, both orally and in writing. Setting up a quick phone conference will often solve unexpected problems and improve the quality of care.

Better use of capabilities

A revolution is under way, not just in the processes of healthcare, but also in the very manner providers treat patients. A computerised framework within which medical care is delivered is taking effect. New technology makes a difference in patients' lives and safety. It reduces the number of steps between the physician placing the order and the patient receiving services, and so reduces the potential for error.

But equally important is making better use of the competencies and capabilities that doctors, nurses and other staff possess – providing them with the opportunity to work together as teams rather than as members of different professions and cultures. Wireless integration can contribute. You will see the results in the form of a more agile organisation, higher productivity and better quality care.

Fifteen value-creating services

Here are just a few examples of wireless communications for hospitals. Most of the functions are already in use. The rest we can quickly create for you.

1. When the hospital director comes to work in the morning the network recognises his wireless communications device. Productivity figures pop up. The number of doctors per patient is up 0.1 to 48.6 on a rolling weekly basis. The length of stay is down from 5.1 to 5.0 days.

2. When the head of the emergency clinic leaves the lunchroom at 1.05 p.m. the figures on inflow to the emergency reach her wireless phone. Since 1 p.m. the day before, 458 patients have been registered of which 91 have been admitted for further care at the wards. That is 25 fewer than the day before. She calls her colleagues to discuss the chances of reallocating resources.

3. A man covered in blood is carried into emergency by three friends. He has several gunshot injuries – one in the region of the heart. The nurse presses the trauma button and the emergency team is there within 30 seconds.

4. Waiting times have started to go down at emergency. The manager of medical technology feels that she has contributed to this progress. It was her idea to integrate cardiac monitoring with messaging. The most important alarms, like cardiac arrest, go directly to the doctor in charge, with clear specification of the alarm priority.

5. A confused man in the emergency psychiatric unit lunges at the nurse and tries to strangle her. He's big and strong. She has no chance of getting free or shouting for help. But she does manage to press the alarm button on her wireless phone and a security guard is soon there.

6. The ward nurse calls the doctor on call. He can't answer, but sees on his display that it's from ward 12. He presses one single button and sends a text message – "Be there in 10 minutes."

7. The phone vibrates in the nurse's pocket and she remembers the time when she was paged by buzzers and flashing lights in the corridor. "It's so much better now with wireless calls and personal responsibility for a reasonable number of patients." On the display she sees that both Mr Richardson and Mrs Smith have called. It's quite a way to Mr Richardson in room 32 and she calls him while she's walking to Mrs Smith in room 4 close by. Mr Richardson just wanted to know the time. "It's five past six. Everything else OK?" She promises to look in on Mr Richardson a bit later.

8. The radiology nurse gets a cancellation from the last patient 20 minutes before she's about to go home. The first patient for the next morning is already in the hospital. She calls the ward and hears that the patient can come straight away. "That'll free up a time for emergency patients tomorrow," she thinks. Half a minute later the porter that's closest to the patient has received and accepted the task of fetching the patient. Fifteen minutes later the X-rays are ready. When the radiologist signs off the examination in the RIS, the nearest porter automatically receives a message to collect the patient.

9. The head of radiology wonders why waiting times are increasing despite investments in PACS technology. How is this possible? Where's the bottleneck? Previously the doctors were

stationed in the radiology room and they approved the X-ray images there. Now they're much more mobile and can approve any examination from any workstation. But how do they know when the images are ready? What if the doctors could be notified automatically when there is a study ready for approval?

10. The radiologist sees that it's the left foot on the X-ray image but it is marked right foot. She doesn't know who is authorised to make a correction in the middle of the night. So she just opens up the wireless correction application in the RIS and makes a note of required corrections. The system sends a message to the authorised person who is walking along a corridor two floors up. He acknowledges the job immediately. Shortly after the radiologist checks the log file for 'broken studies'. It's empty.

11. The nurse sends a wireless message to a group of porters when a time-critical sample is ready to go to the laboratory. The nearest available porter acknowledges and is on her way within five seconds. This shortens turnaround time for critical test results, and frees up the nurse who might otherwise have had to take the sample to the laboratory.

12. Laboratory personnel notify the physician that preliminary results indicate reflex testing might be necessary. The physician immediately gives the laboratory a go-ahead for additional testing.

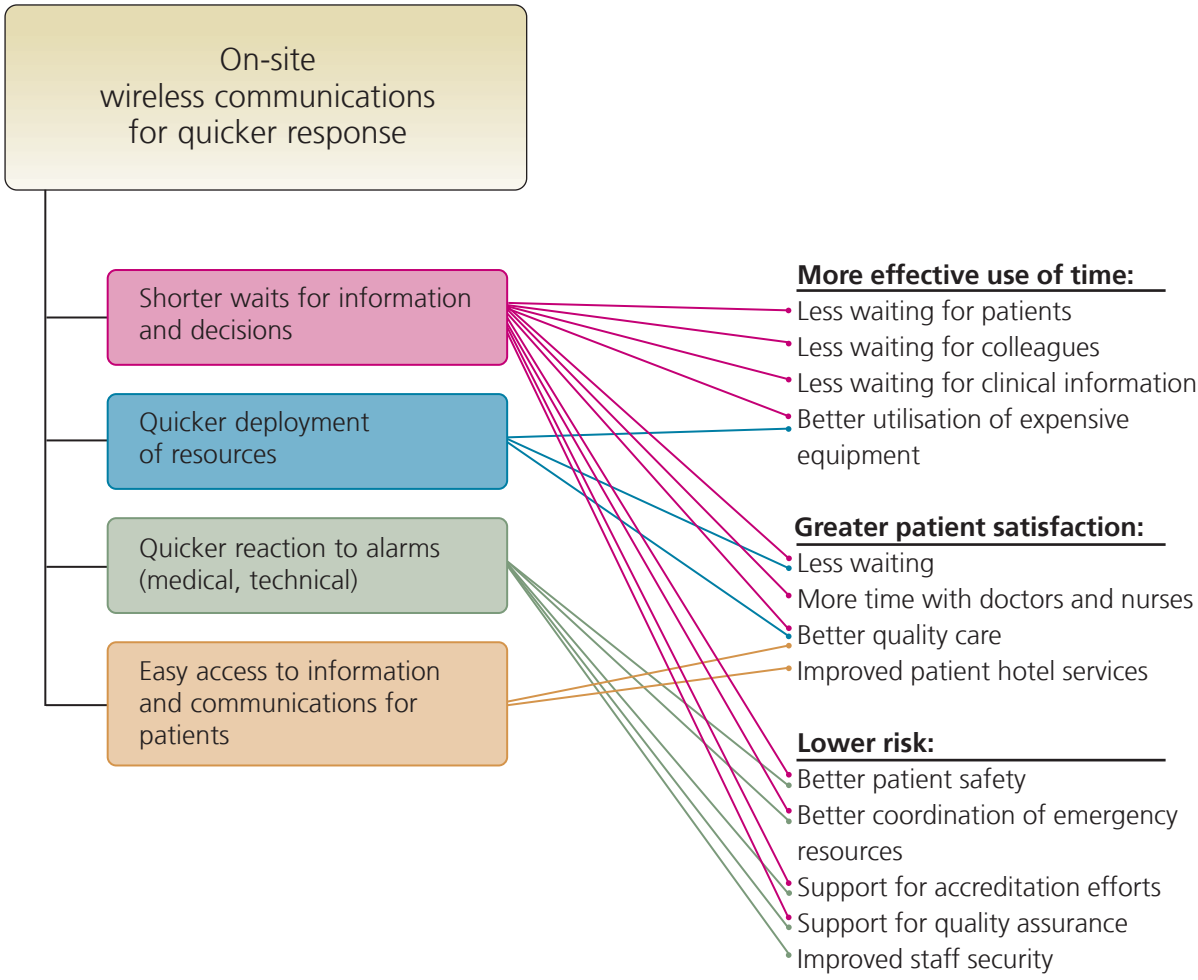
13. In operating theatre number 4, the orthopaedic surgeon has just started to operate when the alert for low air pressure goes. The operating engineer on call is in a culvert under building A and gets the alert on his wireless phone, "No overpressure in OP4, floor 6, building B". The display shows that the pressure sensor set off the alarm, so he requests status on the fan motor. It's working. He guesses it's the fan belt and contacts OP4 while he fetches a new fan belt. Four minutes later the nurse is informed that the fan belt has broken, and five minutes later the overpressure is restored in OP4.

14. Power failure and the back-up system doesn't start. Only units supplied by accumulator (UPS) power are working. After intensive communication between the technical staff and with some external help, the back-up system is soon up and running, and vital power is channelled to the operating theatre, intensive care and emergency.

15. Both incoming and outgoing telephone traffic through the main switchboard breaks down due to a circuit board fault. But the on-site wireless communications system is still working, including pre-selected lines for external communication.

No doubt you see several possibilities to accelerate processes, decisions and action in your organisation. And you probably already have a good idea which bottlenecks hinder information flow. Then hand them over to us. We'd like nothing better than to remove them.

Shorter waits for information and decisions
Quicker deployment of resources
Quicker reaction to alarms (medical, technical)
Easy access to information and communications for patients



Smart integration

Most hospitals have invested huge sums in information technology. This often greatly improves the effectiveness of their primary processes. But the benefits of the investments still cannot be used to the full. The problem is bottlenecks in information flows between departments.

Wireless communications for quicker response can remove the bottlenecks and enhance the return on the primary investments. And quicker response requires smart integration with the systems you already use.

Integration with existing systems is our true strength – acquired during fifty years of supplying integrated communications solutions to more than 20,000 hospital installations in Europe and the U.S.

Infrastructure, integration and wireless devices are the main components of our offering. The infrastructure we build integrates with clinical systems, such as HIS, LIS, PACS and RIS; with business and accounting systems; with building management and security systems; with telephone systems and local area networks; and with wireless and wired devices such as pagers (beepers), telephones, smart phones, PDAs, laptop and stationary computers.

Adding on-site wireless communications can make the systems you already have work much harder.

Forward and backward compatible

The wireless infrastructure we build is fully open to the future. You can upgrade and introduce new functions and systems without excessive costs.
There will be no hard-to-penetrate boundaries between different generations of alarm, voice, messaging and data systems. We are still extending systems that we installed twenty years ago. We will be able to keep on extending them twenty years from now.

We can also help create a roadmap for the long-term (but inevitable) journey toward the all-digital, wireless hospital. It is important to remember that no single wireless technology or standard is the "best". Each standard is used for different purposes and in different scenarios. They are complementing, not competing technologies. The trend is towards a mixture of various technologies that interoperate to provide the required services.

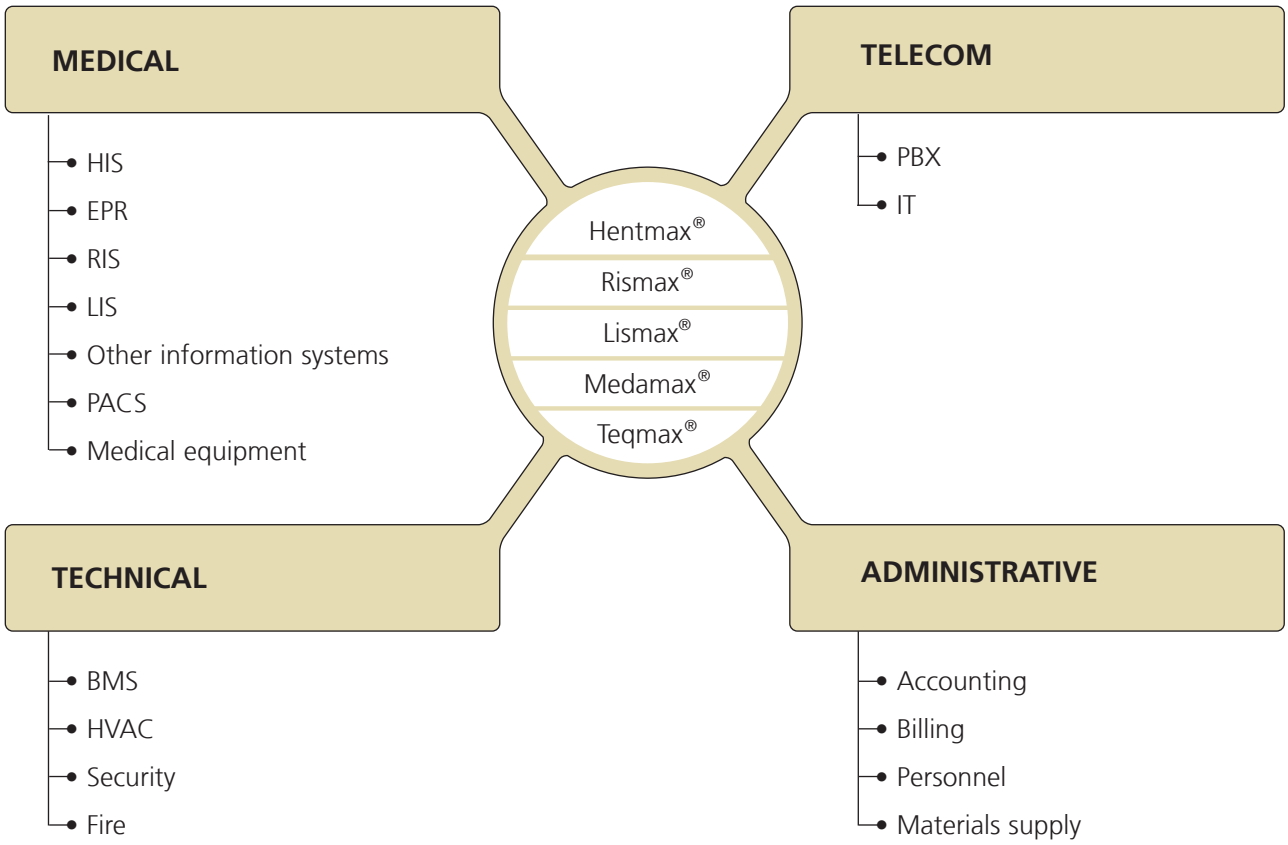
We are not married to any one technology as many other firms are. This allows us to select the most appropriate and cost-effective technology for each individual need. And to integrate the different technologies seamlessly.

Step by step

Ascom's offerings to hospitals comprise five concepts:

- Hentmax® (basic communications platform)
- Rismax® (radiology support)
- Lismax® (laboratory support)
- Medamax® (medical alarm integration)
- Teqmax® (technical alarm integration)

Technical integration with existing systems



Smart integration makes your existing systems work harder. We integrate seamlessly with existing systems, such as EPR, HIS, LIS, PACS and RIS, etc. And with existing IT infrastructures, LAN, PBX, etc. Plus accounting systems, building management systems and security systems.

Hentmax®

Quicker response to service requests

Hentmax is on-site wireless communications for personnel involved in the daily care of patients. Typical users are patients, ward staff, porters and managers.

Hentmax speeds up the response to patients' requests for services – medical services as well as housekeeping services. Equally important, it accelerates nurse-physician communication and eliminates paging delays. It can be used hospital-wide by all departments and staff to coordinate efforts and provide the best patient care leading to faster recovery.

Staff members receive time-critical information right into their pockets – as alarm, text, voice or data and in an interactive form – from colleagues, patients, medical equipment, computers and databases. There is less walking back and forth between patient rooms and nursing units. Overhead paging is virtually eliminated, making the environment quieter and more conducive to healing.

The organisation becomes more responsive and agile. You can plan more effectively, redirect resources faster and eliminate waiting time. Less stress, better patient care, and improved productivity lead to higher job satisfaction among the staff. Because a Hentmax solution logs events, activities and response times, you get valuable documentation in the case of complaints or litigation.

A Hentmax solution can include infrastructure, software, nurse-call system, wireless devices and integration with existing nurse-call and paging systems, HIS, medical equipment, telephone switchboard, security systems, entertainment systems, the internet, intranet, etc. A complete solution comprises installation, commissioning, training of users, maintenance and service.

Examples of functionalities:

- Talk with colleagues – one-on-one or conference calls
- Receive and send text messages
- Alarms – heart, apnoea, etc. – right into pocket telephone
- Wandering control of patients suffering from dementia
- Tagging of mothers and newborns
- Direct contact with the nearest porter or housekeeping staff
- Automatic ordering of patient transport
- Tracing of misplaced equipment
- Inventory control of equipment
- Assault alarm with positioning

Jaap Arts,
Member of the board of directors, BovenIJ ziekenhuis, the Netherlands, and responsible for premises, technology and several medical support departments:
"Patients today demand better hotel services. The new Ascom system contributes importantly to this. It is patient-friendly and easy to operate. It has helped improve our hospital's competitiveness. In addition, the flexible financing solution that Ascom could offer was very important to us."

BovenIJ ziekenhuis has invested in a Hentmax concept from Ascom.

Centralised communications improves patient service

BovenIJ ziekenhuis is a 300-bed hospital in the Netherlands. With its small scale, highly qualified staff and advanced medical technology it provides high-quality care for the residents of North Amsterdam, across the river IJ.

The nurse-call system was recently installed and integrated with an Ascom wireless paging solution. Events are logged automatically, providing a record of who called and how long it took to respond. Technical alarms are also integrated into the system. To improve its services to patients even further, the hospital recently upgraded its communications and entertainment system. Previously, each patient had a television set and a separate radio system. A telephone was brought in for patients who wanted to make external calls. Mobile phones are banned in the hospital.

The hospital turned to Ascom to integrate all communications and provide more comprehensive services to both patients and hospital staff. Now, each patient has an individual wireless terminal that includes, among other things, nurse call, telephony, radio, television and internet access. Patients get one-on-one contact with a nurse, and nurses save time and energy. In addition, hospital staff will be able to access medical records, order medicines and communicate with colleagues from the patient's bedside.

The new integrated system has helped enhance patient service and satisfaction. It has also lightened the staff's workload as well as reduced the costs for operating several systems.

Rismax®

Quicker response to requests for radiology reports

Rismax is on-site wireless communications designed to support the radiology process within the hospital enterprise. Typical users are radiology department staff and referring physicians.

Rismax integrates with RIS and PACS to speed up communications between radiology departments and clinicians and within radiology departments. Clinicians are notified instantly when an examination is finished and the results are available. Effective study correction increases RIS/PACS uptime, speeds up patient flow. Waiting time is reduced for patients and clinicians, and treatment can start earlier.

Referring physicians automatically receive notification the moment critical reports are ready, without having to look for them. This eliminates the administrative time and expense of conventional report delivery and improves service to both physicians and patients. Faster turnaround of radiology reports is critical for patients in emergency rooms and operating rooms.

A Rismax solution can include infrastructure, software, wireless devices and integration with existing HIS/RIS/PACS, telephone switchboard, etc. A complete solution comprises installation, commissioning, training of users, maintenance and service.

Examples of functionalities:

- Retrieve and send patient data directly from the RIS
- Radiology reports directly into clinician's pocket wireless device
- Automatic notification of study corrections
- Talk with colleagues – one-on-one or conference calls
- Receive and send text messages
- Automatic logging of events
- Automatic ordering of patient transport
- Instant notification to technicians of system errors
- Support for fixed asset tracking and management
- Seamless integration with RIS/PACS and with other Ascom solutions

Dr. Staffan Gustavsson,
Senior Radiologist, Department of Thoracic Radiology, Sahlgrenska University Hospital, Gothenburg, Sweden: "The difficulty of reaching the right persons to notify them of events, questions or orders used to cause much frustration. The messaging tools added to the system allow the staff to concentrate on their work, which also increases quality. We invested heavily in digital technology, but will reach full efficiency only when communication of information that supports workflow is easy. The Ascom wireless solution has proved to be a valuable tool in this project".

Sahlgrenska University Hospital has a Rismax project together with Ascom.

Text-enhanced messaging improves workflow

With 2,700 beds divided among 165 wards, Sahlgrenska University Hospital in Gothenburg, Sweden, is the largest hospital in northern Europe.

Some years ago, the Department of Thoracic Radiology was the first department to introduce digital image management, gradually followed by the other radiology departments. This made it possible to distribute images and reports over the hospital's intranet to be viewed by referring physicians.

It soon became evident that the substantial investment did not speed up processes and increase efficiency as much as intended. The reason was simple – even if images and reports were available online, people lacked tools for communicating additional information needed for an efficient workflow. In addition, end-users did not know when the information was available. They had to search for information online or inquire by phone or email.

Obviously, asking people who needed information to seek for it themselves is not the right approach. Instead, the Department of Thoracic Radiology together with Ascom developed a solution that notifies the right people automatically the moment certain information is available. Actions in the radiology workflow can be set to generate text messages to wireless pagers.

Technologists and nurses can easily communicate with support staff or radiologists, using web-deployed messaging tools.

The system supports messaging of additional X-ray orders from doctor to nurse. The X-ray nurse receives the message in his/her pager and retrieves information on the patient and the type of additional images required.

If extended, the system can support automatic notification to the transport unit when the patient is ready to be moved back to the ward, or a message to the referring physician that an examination has been completed.

Lismax®

Quicker response to requests for laboratory tests

Lismax is on-site wireless communications designed to support laboratory testing processes within the hospital enterprise. Typical users are laboratory personnel, ordering physicians, nurses and porters.

Lismax integrates with LIS and HIS to speed up communications between laboratories (such as clinical chemistry, endocrinology, haematology, immunology and microbiology) and ordering physicians and nurses as well as within laboratory departments. Clinicians can be automatically notified when results are ready. Quicker response and speedy turn-around of laboratory results can mean, for example, that the patient can go home today instead of tomorrow.

The pre-analytical phase is supported with more efficient collection of test tubes. A wireless message can go automatically to porters as soon as a sample is ready to go to the laboratory. Ordering physicians can be notified instantly wherever they are if additional information is required during the reflex process – while the sample is still on the analyser, so that there is no need for a new draw.

A Lismax solution can include infrastructure, software, wireless devices and integration with existing LIS and HIS, analysers, telephone switchboard, etc. A complete solution comprises installation, commissioning, training of users, maintenance and service.

Examples of functionalities:

- Retrieve and send information directly from the LIS
- Test results go directly into clinician's wireless device
- Support for point-of-care testing through wireless LIS access
- Support for monitoring of all quality assurance activities
- Automatic ordering of sample collection
- Talk with colleagues – one-on-one or conference calls
- Receive and send text messages
- Automatic logging of events
- Support for fixed asset tracking and management
- Seamless integration with LIS and with other Ascom solutions

Mr. João Carlos Ferreira,
Managing Director, Eritel Telecomunicações Ltda, Ascom's Brazilian partner:
"We are proud of this solution. In spite of its technical complexity, it is user-friendly and works flawlessly. It has helped the laboratory to upgrade its services to other hospital departments."

The Latin American hospital described in the text has invested in a Lismax concept from Ascom.

Quicker lab samples collection

The Clinical Pathology Department of a 500-bed Latin American hospital had problems with the collection of samples to be tested. When samples were ready for pick-up, nurses had to call the lab over the internal telephone system. Missed calls and delays in samples collection slowed down the processing and often made the ordering physicians wait an unduly long time to begin treatment.

The hospital had previously installed an Ascom wireless paging system. This formed the basis for a new solution to speed up samples collection. Now, when a nurse wants to order pick-up, all she has to do is press a single button on the nearest telephone.

This instantly sends an alphanumeric message to the porter responsible for that particular area, stating where to go to get the samples. The porter accepts the task just by dialling his or her identity number. If there is no answer within a predetermined time, the task is automatically transferred to another porter. If there is still no answer, the supervisor of porters receives an audible alarm and an error message on the PC.

In addition, the system generates statistics of samples collection and displays them graphically, for example, total number of pick-ups in a certain period, average time from notification to pick-up, number of calls per hour, number of cancelled pick-ups. The speed and efficiency of samples collection and the turnaround times for lab results have improved markedly.

Medamax®

Quicker response to medical alarms

Medamax is on-site wireless communications designed to communicate, distribute and notify of medical alarms. Users are nurses, physicians and specialised medical teams (such as cardiac arrest and emergency).

Medamax speeds up response to alarms from medical monitoring equipment to detect abnormal respiratory, cardiac and other conditions. Medamax provides quicker response to emergency situation demands. Nurses and physicians get status reports on request and alarms when conditions deviate from preset values. Information goes right into pocket telephone, freeing staff for other duties than watching monitors.

Treatment can start earlier, which improves outcomes and potentially saves lives. Increased safety for patients and less stress for staff.

Less walking back and forth for nurses, and less noise because of absence of local beeps.

A Medamax solution can include infrastructure, software, nurse-call system, wireless devices and integration with existing nurse-call and paging systems, HIS, medical equipment, telephone switchboard, etc.

Examples of functionalities:

- Remote monitoring of vital signs
- Alarms right into pocket telephone
- Back-up specialists can be called automatically
- Talk with colleagues – one-on-one or conference calls
- Receive and send text messages
- Automatic logging of events
- Support for Medical Information Bus (IEEE P1073) for standardised connections of medical monitoring devices

Ms. Cindy Burger,
Director of Newborn and Critical Care Service, The Children's Medical Center of Dayton, Ohio: "Ascom's wireless solution allows our staff to communicate in a manner that is not disruptive to the care of our patients. It is a very efficient communications method and reduces the noise in the Newborn Intensive Care Unit. The staff was very positive about the introduction of the wireless solution. It has changed the way they operate. They like to be able to communicate with each other immediately. This is truly a time savings."

The Children's Medical Center of Dayton has invested in both a Medamax and Hentmax concept from Ascom.

Newborns get peace and quiet

When the Children's Medical Center of Dayton opened its Newborn Intensive Care Unit, an Ascom on-site wireless communications system replaced conventional intercom and paging systems.

In the old facility, there was a tremendous amount of noise – up to 90 decibels with intercoms often located close to a baby's head. To reduce the noise, the staff wanted to communicate without paging.

Nurses, nurses' assistants and respiratory therapists now carry wireless telephones, integrated with the hospital's business communications network. Vibrating instead of audible signals eliminate abrupt sounds. The parents of the newborns appreciate that they can call the nurse and the nurse can call the parent directly from the newborn's bedside. The charge nurse and the respiratory therapist are always reachable at the same number no matter who is on staff. This allows the staff to get in touch quickly when immediate care is needed.

The hospital reached its goal to provide more peaceful surroundings for newborns and their families. But at the same time, the efficiency of the staff increased noticeably as a result of nurses being able to communicate anywhere instead of walking back and forth to wired telephones.

Teqmax®

Quicker response to technical and utilities alarms

Teqmax is on-site wireless communications for staff involved in facilities management, engineers, caretakers, repair and maintenance personnel.

Teqmax gives quicker response to alarms from indoor climate systems, lifts, doors, windows, lighting and other technical installations. The engineer gets the alarm directly to his or her pocket, can check the status from anywhere in the hospital and reach colleagues with voice and text messages when necessary. He or she can also control devices from a wireless phone – for example, stop a fan or restart a pump.

Teqmax can provide information wirelessly, automatically or on request, about the situation in vital technical installations – energy consumption in the building as a whole, air flow in the ventilation system, water flow in heating and cooling circuits.

You get a quicker response to failures in technical installations and a better grasp of functional safety and energy consumption. Because Teqmax logs events and action taken, you get a good basis for continuous improvement.

The solution includes infrastructure, software, handsets and integration with the BMS (Building Management System) and common information services such as the switchboard, email and security. A complete solution that includes installation, commissioning, training, maintenance and service.

Examples of functionalities:

- Alarms directly in your pocket
- Check status (temperature, doors, fans)
- Control lifts, doors, fans, pumps
- Talk to colleagues – one–on-one or conference calls
- Log events for future analysis
- Faster action when failures occur

Jesper Tanggaard

Manager of Technical Operations, Sydvestjysk Sygehus: "We have been using Ascom on-site wireless solutions for more than ten years. They have become important tools for both the medical staff and the technical staff. They save time and contribute to making our work both simpler and safer."

Sydvestjysk Sygehus has invested in both a Teqmax and Medamax concept from Ascom.

Wireless alarms save lives and money

Sydvestjysk Sygehus is a hospital with 500-plus beds in Esbjerg, Denmark. Ascom wireless telephone and paging systems are used throughout the hospital with many integrated automatic alarm functions.

With the cardiac alarm, for example, nursing staff can alert the resuscitation team directly in life-threatening situations such as cardiac or respiratory arrest. Alarms are activated by pressing call buttons specifically provided for that purpose in all wards.

Two teams are always on duty. When the alarm goes off, members of the first team instantly receive an alphanumeric message on their wireless telephones, telling them to which ward to proceed. If a team member does not acknowledge receipt within 30 seconds, the alarm automatically transfers to a member of the second team, whose members must then go immediately to the designated ward.

Seconds can be critical. The only way to save patients may be by shocking them or with instant pharmaceutical therapy. The wireless solution has made a life or death difference for patients. Because alarms and acknowledgement times are logged automatically, the hospital has a complete record of the events.

Other alarms are important for achieving smooth and cost-effective operation of the hospital's technical facilities. Malfunctions in heating, ventilation, air conditioning, cold storage rooms, lifts and the like, trigger alarms to the maintenance personnel. The alarms indicate the nature of the problems and where they are located. This also applies to disturbances in the supply of medical gases, oxygen, compressed air, etc.

Solutions for rugged hospital environments

Ascom provides you with on-site wireless communications solutions in which every component has been developed for demanding hospital environments. Each solution meets the most stringent formal and practical requirements.

Formal requirements

The formal demands placed on equipment to be used in hospitals vary from country to country. Our solutions meet the requirements laid down by most national and regional authorities. Ascom on-site wireless solutions also make it easier to comply with accreditation requirements for protecting the privacy of patient information, such as those of the HIPAA and equivalents in other countries.

Ascom on-site wireless solutions use low-power, unlicensed radio technology, with little risk of interference with sensitive medical equipment and are field-proven to be safe for use in patient care areas.

You can get robust hand-held units, dust- and water-resistant according to IP64 and shock-resistant according to IEC 68-2-32. Units can be disinfected. You can get a solution that meets the most rigorous safety requirements, such as the German GS standard (Geprüfte Sicherheit – Tested safety).

Practical requirements

Practical requirements vary from hospital to hospital and from one clinic or ward to the next. A common stipulation is secure and complete coverage of specified areas. Another is that people can speak to each other in noisy conditions.

We can design your solution to deliver guaranteed coverage of every nook and cranny of a defined area. It will provide outstanding voice quality throughout your facility with no clicks, fading or dead spots – even in basements and culverts and in radiology areas.

You get telephones that suppress ambient noise. Users can hear – and make themselves heard – even when equipment whirs, beepers beep and people talk loudly all around. Hands-free devices are also available. Should a phone malfunction, simply transfer the SIM card to another device. All personal information, alarms and functions move with the card into the new phone.

Ascom wireless telephones integrate seamlessly with the hospital's existing fixed-line telephone system, regardless of make as well as with any nurse-call system. Seamless call handoff and automatic roaming ensure total reliability as users move around the hospital. Lower power levels than in other wireless communication technologies, such as ordinary mobile phones, substantially reduce interference with sensitive medical equipment.

A solution for every requirement

Healthcare professionals can use varying types of devices, or information appliances, to access wireless services – voice-centric, data-centric and hybrid devices. Typical devices include telephones, personal digital assistants (PDAs), tablet PCs, laptops, wired computers and workstations, or any combination of these that suits the individual worker.

Whatever the demands posed by your environment, we can devise a wireless solution that satisfies the toughest formal and practical requirements. Challenge us with a demanding application. We look forward to showing you what we are capable of.

Primary system functions

User interface for pocket devices:

- Role/responsibility-specific function push-buttons
- Menu structures adapted to specific user requirements
- Text and graphs
- Sound and/or vibrating signals

Medical alarm:

- Alarm to personnel or central systems
- Preference for prioritised alarm
- Alarm receipt notification

Personal alarm:

- Automatic alarm (man down, no movement)
- Manual alarm (push-button, pull cord)

Interactive messaging:

- Traditional paging with message receipt function
- Send or receive text messages
- Request status (vital signs)
- Send control signals (start/stop, open/close)

Voice:

- Person-to-person calls
- Conference calls
- Hands-free
- Loudspeaker

Positioning:

- Precise locating (x-, y- and z-axes)
- Movement, wandering control
- Tracking of people and equipment

Logging:

- Alarm (what, where, when, who)
- Action (who did what)
- Task confirmation (care, procedure performed)

System security:

- Logging of system alarms
- Escalation of important messages and alarms
- ATEX certification

System monitoring:

- Monitor the wireless system
- Monitor to ensure handsets work correctly
- Monitor modules and interface

Total customisation

Some suppliers of wireless communications offer standardised systems that are intended to satisfy all needs. But no two hospitals function the same way, are organised along the same lines, or have identical infrastructures. In addition, people have different values, preferences and priorities. They simply do not work the same way.

At Ascom, we take these differences into consideration. You get a solution made to measure with smart and often unique functions. Commissioning, training, maintenance and service are part of our offering. We go to great lengths to adapt to your specific needs.

Identify and prioritise

Where in the hospital could better communications improve patient satisfaction and boost productivity? Usually, there are several areas in which quicker response and time saving can be achieved quickly and with a limited investment.

Together with key people from your organisation, we identify the most promising areas of improvement and quantify their benefits. What to change? What to change to? How to cause the change? This results in a list of projects, prioritised by their benefit to hospital operations.

Mapping the processes

We map the workflow in each of the prioritised areas. We involve members of the workforce to make them understand what is going on and take advantage of their experience.

Most workflows involve several departments or specialties. But hospitals are often structured, measured and managed in parts rather than as a whole. Making these parts work together as an integrated system is a main objective. To do so, it is necessary to consider the needs of the entire hospital.

The process mapping results in a general view of the organisation, its processes and information flows. It also reveals who needs what information and when – who is getting the right information in a timely manner and who is not.

Finding the bottlenecks

Many bottlenecks occur in services, such as radiology, laboratory, pathology and physiotherapy, which must cope with demand from several sources simultaneously. But most bottlenecks result from inadequate means for communication between people.

Lack of data is not the problem. The problem is a proliferation of different hardware, software and networks that makes it difficult to access data as information. It takes too long to find out whether the relevant information is available. And if it is, it takes too long to access it.

Removing them

Wherever decision-making and processes need to be accelerated, we can define wireless functions that remove bottlenecks. Since processes frequently span departments, this usually involves removing informational barriers between departments.

You lay down the requirements – in terms of, for example, functions, safety, security. We transform your requirements into a solution with infrastructure, software and communications devices. We integrate with your existing systems, such as EPR, HIS, LIS, PACS and RIS, etc. And with existing IT infrastructures, LAN, PBX, etc. Plus accounting systems, security and building management systems.

A complete solution

You get a robust system with high functionality and security. You can count on a complete solution, including installation, commissioning, training, maintenance and service.

During installation and commissioning, we train the system managers and users. System managers get effective tools for discovering, identifying and solving problems. During the system's entire service life, we offer training for users to ensure usability and maximise the business benefits for you.

Starting with your needs and requirements, we design customer-specific services for preventive maintenance and remedial service.

You can get maintenance contracts based on preventive maintenance that ensures the availability of the system. You can get service contracts with guaranteed service response times, or telephone support from our local organisation. And at a fixed price so that you have complete control over all costs.

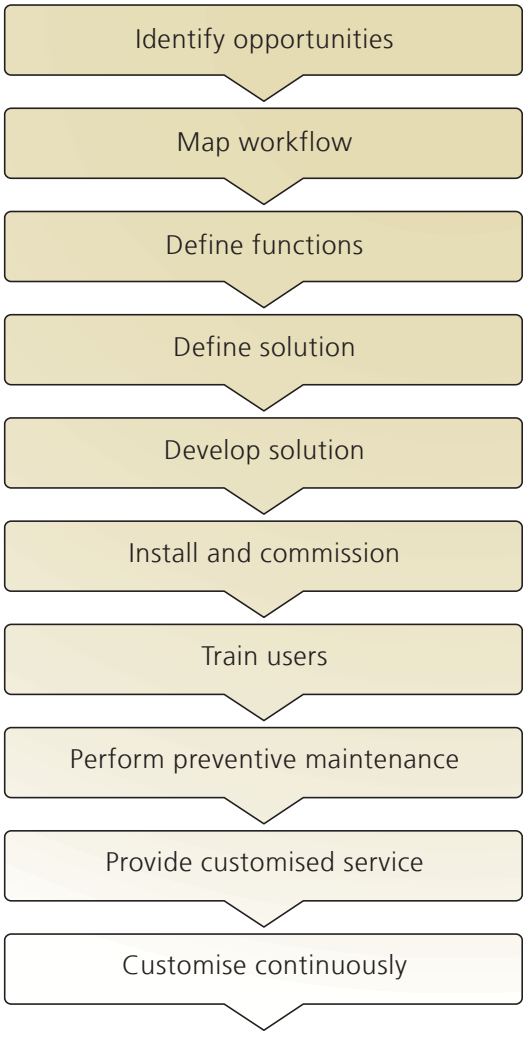
Continuous customisation

Your demands will change over time as you develop your processes. That is why we offer not only a solution made to measure for today's needs. We offer a future-proof solution. We can continuously enhance it to meet your organisation's changing requirements. We transfer expertise to your organisation, so you can develop your own applications.

Most of our systems are in use for ten years or more, and we have more than 20,000 healthcare systems in operation. That has given us solid experience of continuous customisation.

A growing number of hospitals are using on-site wireless communications for quicker response. No other supplier can match Ascom's experience in this area.

Ten steps to quicker response and improved productivity



Which on-site wireless technology is best?

The answer depends on the functions you want. Different functions impose different demands. No single technology can deliver everything. Each one has its own advantages and drawbacks. The technologies you end up choosing can therefore vary from department to department. But they should all be compatible and operate under a common management structure.

Examples of wireless technologies are DECT, PWT, Wi-Fi, on-site paging and Bluetooth (this is only a sample of the technologies that Ascom can handle). The following checklist can help you make wise choices.

Ten things to think about:

1. Coverage – Should your solution cover a department, a ward, a building or multiple facilities? Basements? Culverts? Buildings with thick concrete walls? Do you require both voice and messaging? Guaranteed coverage?
2. Sensitive equipment – Will your wireless communications solution be used in areas where there is a risk of radio interference with medical equipment?
3. Alarm lead times – Can you accept maximum five seconds response time? Do you insist on GS certification (Geprüfte Sicherheit, a German standard that insists on a maximum two-second response time to alarms from lone workers)?
4. Transmission capacity – How 'big' is the information you want to flow through your system? How many Mbit/s do you need? Do you anticipate sending texts? Graphs, diagrams, images and patient waveforms? How many simultaneous calls? How many messages per second, minute, hour?
5. Usability – Will handsets have to work in wet, noisy, dusty conditions? Will they need to be sterilised frequently? How long should a handset work between battery recharges? How long should recharging take? Should users have individual or shared chargers?
6. Remote control – Do you want to remotely control medical equipment or other objects such as valves and fans?
7. Positioning – Do you need to locate physicians, nurses and other healthcare professionals? Or mobile workers such as porters, technicians and security guards? Do you need wandering control of patients suffering from dementia?
8. Tracking – Do you want to track electronically tagged equipment as it moves around the hospital, such as an external defibrillator or a portable ECG recorder?

9. Safety – The choice of technologies has a big impact on the ease – or difficulty – with which a solution can be designed for reliability and availability. The same choice also increases or reduces the requirements for redundancy and preventive maintenance to achieve prescribed safety levels.

10. Security – A main objective must be to protect patients from inappropriate disclosure of information (PHI). Your requirements for security against bugging or intrusions from hackers and viruses will also influence your choice of wireless technologies.

And two more to bear in mind

Most on-site wireless functions require smart integration with existing systems and with different communications devices (usually hand-held or pocket devices). The design of these functions therefore influences the choice of wireless technologies:

1. With existing systems – With which systems will your wireless system communicate? EPR, HIS, LIS, PACS and RIS? Accounting, billing? Switchboard, messaging, fire and gas alarms, security, BMS? Your wishes determine which protocols your wireless system must be capable of handling (TCP/IP, Ethernet, TDMA, for example).

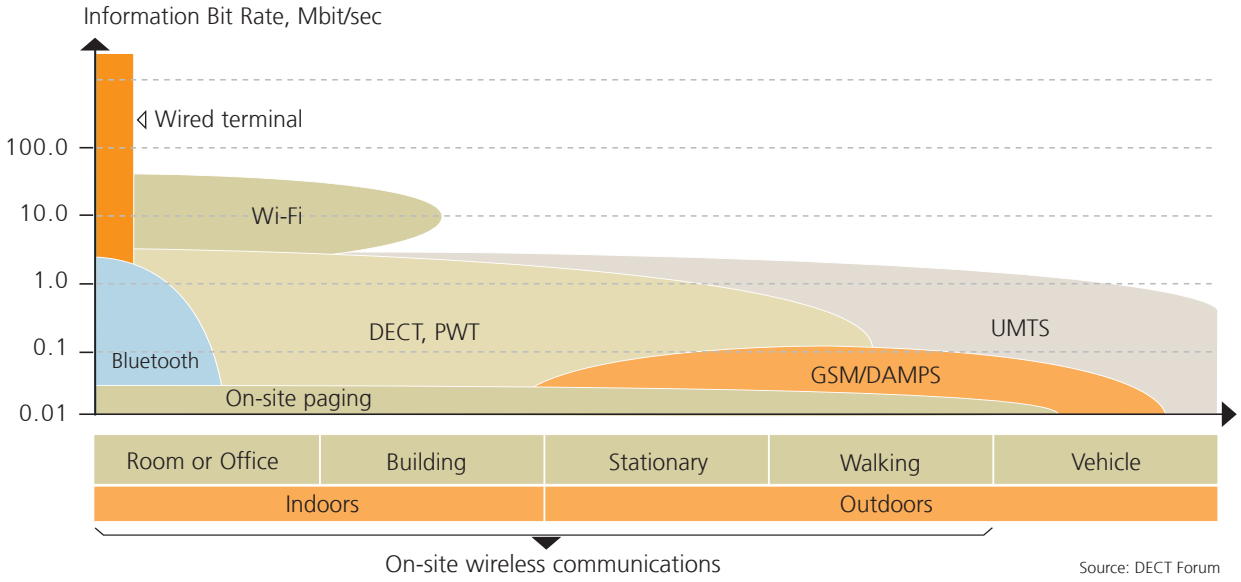
2. With communications devices – Which devices will your wireless system be able to handle? Wireless phones, regular mobile phones, PDAs, pagers?

A solution for tomorrow

Because no single wireless technology is suitable for everything, the trend is towards a mixture of various technologies that must interoperate to provide the required functions. A general architecture of future wireless networks in hospitals is a hybrid of technologies. Ascom can make the different technologies work together seamlessly.

Ascom can help you specify the requirements for your wireless technology so you can achieve a cost-effective solution today, as well as long-term and enterprise-wide integration.

We can realise most wireless functions – at a cost that is reasonable when compared to the business benefits they deliver. The easiest way to get hold of one of our crew of experts is to give us a call or drop us a line. Our contact details are on the back cover.



Source: DECT Forum

Acronyms and terms

802.3. An IEEE standard for Ethernet wired or wireless networking.

802.11. A series of standards issued by the Institute of Electrical and Electronics Engineers (IEEE) for wireless LANs (WLANs). Various specifications cover transmission speeds from one megabit per second (Mbit/s) to 54 Mbit/s. The three main physical-layer standards are 802.11a, 802.11b and 802.11g.

802.11a. An IEEE standard for the physical layer of WLANs operating in the 5-gigahertz (GHz) radio band. It has eight radio channels. The maximum link rate is 54 Mbit/s per channel, but maximum user throughput will be about half this and the throughput is shared by all users of the same radio channel. Data rates fall off as the distance between the user and the radio access point increases. Frequency bands allowed for 802.11a (also called Wi-Fi5) differ in different parts of the world.

802.11b. An IEEE standard for the physical layer of WLANs operating at 2.4GHz. It has three radio channels. The maximum link rate is 11 Mbit/s per channel, but maximum user throughput will be about half this and the throughput is shared by all users of the same radio channel. Data rates for 802.11b fall off as the distance between the user and the radio access point increases.

802.11g. An IEEE physical-layer standard for WLANs operating at 2.4GHz. It provides three available radio channels with a maximum link rate of up to 54 Mbit/s per channel. Support for complementary-code-keying modulation makes 802.11g backwardly compatible with 802.11b. The addition of other modulation schemes into the draft standard achieves higher link rates.

802.11i. A security upgrade for the 802.11 standard. Includes two main developments: Wi-Fi Protected Access (WPA) and Robust Security Network (RSN). WPA will improve security of legacy devices to a minimally acceptable level, but RSN is the future of over-the-air security for 802.11.

802.15. An IEEE standard for wireless networking in the 2.4 GHz ISM band. IEEE 802.15 and the Bluetooth standard are synonymous.

ACR/NEMA. The American College of Radiology and the National Electrical Manufacturers Association (ACR/NEMA) have joined together to establish the DICOM standard for transfer of images between disparate computer systems, especially different PACS.

Ad hoc network. A set of wireless terminals communicating directly with one another without using an AP or any connection to a wired network. With an ad hoc network, also known as a peer-to-peer network or independent basic service set (IBSS), you can set up a wireless network in which a wireless infrastructure does not exist or is not required for services. See also Piconet.

Alert. A written or acoustic signal to announce the arrival of messages and results, and to avoid contradictions, conflicts, erroneous entry, tasks that are not performed in time or exceptional results. A passive alert will appear on a screen in the form of a message. An active alert calls for immediate attention, and the appropriate person is immediately notified, e.g., by beeper.

Ancillary services. Support service in a hospital or healthcare facility that is not direct patient care delivery, for example, laundry, portage, catering, cleaning, stores. Ancillary services information systems support the management, monitoring, planning, scheduling and request processing of ancillary service functions.

AP (Access Point). Wirelessly networked devices usually connect to a wired network through a hardware device called an access point. Multiple access points, set up in various locations around an office, let users roam freely while staying connected.

Bearer service. A network technology that provides wireless transmission. Examples are DECT, Mobitex, Radio Data Link Access Protocol (RDLAP), Reflex, cellular

digital packet data (CDPD), Global System for Mobile Communications (GSM) and digital cellular/personal communications services (PCS) packet services, including general packet radio service (GPRS), enhanced data rates for GSM environments (EDGE) and Wideband Code Division Multiple Access (W-CDMA).

Bluetooth. A low-bandwidth, short-range wireless networking technology for communication between small personal computing and communication devices, such as desktop computers, laptops, PDAs and cell phones. Data can be exchanged at a rate of 1 Mbit/s, and up to 2 Mbit/s in the second generation of the technology. Bluetooth transmits both voice and data on the 2.4 GHz ISM band. It uses FHSS (1600 hops per second) to increase the reliability of the communication channel. Built-in encryption and verification is provided. As with 802.11 devices, Bluetooth devices have sleep modes and only transmit when there is a need, so most of the time the transmitter is inactive. Bluetooth and IEEE 802.11-based wireless LANs are complementary, rather than competing, technologies.

CAD (Computer Aided Diagnosis). The use of special computer programs, usually with some artificial intelligence base, to scan images and flag areas that look suspicious. Modern data analysis techniques are used to carry out some portion of the decision-making process previously provided by the physician or other healthcare professionals.

CAT (Computed Axial Tomography). "CAT Scan". An advanced, non-invasive method of radiological diagnosis that creates cross-section images of the body in a computerised display equipment.

CEN (Comité Européen de Normalisation). The European Committee for Standardisation.

CEN/TC 251. Technical Committee of the European Standardisation Committee (CEN), which is concerned with the establishment of European Medical Informatics standards.

CMV (Controlled Medical Vocabulary). An approved list of terms coded in a fashion that facilitates the use of computer-controlled vocabularies is essential if clinical applications are to function as intended. Widely used systems in the U.S. include the American College of Radiology (ACR) Code, Current Procedural Terminology (CPT), Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) and the International Classification of Diseases, Ninth Revision (ICD-9).

CPOE (Computerised Physician Order Entry). An electronic prescribing system that intercepts errors when they most commonly occur – when medications are ordered. Orders are integrated with patient information, including laboratory and prescription data. The order is then automatically checked for potential errors or problems.

DECT (Digital Enhanced Cordless Telecommunications). An interface specification for European digital mobile telephony. DECT employs 10 carrier frequencies between 1.88 GHz and 1.9 GHz with 24 time slots each leading to a capacity of 120 simultaneous calls. It is typically used for short-range communications and wireless-local-loop applications. Advanced radio technology ensures effective use of the radio spectrum, low risk of radio interference, low power consumption and excellent security.

DICOM (Digital Imaging and Communications in Medicine). A communications standard developed by the American College of Radiology/National Electrical Manufacturers Association and used in digital radiology systems (e.g., computed-radiography, computed tomography and magnetic resonance imaging systems).

DPRS (DECT Packet Radio Service). A wireless technology that can transmit and receive data based on DECT technology. DPRS allows the user to send and receive emails on a laptop PC wirelessly. The range is 50–300 metres, and the speed up to 552 kbit/s.

DRG (Diagnosis Related Group). A patient classification scheme that provides a clinically meaningful way of relating the number and types of patients treated in a hospital to the resources required by the hospital.

DSSS (Direct-sequence spread-spectrum). One of two types of spread-spectrum radio technology used in wireless LAN (WLAN) transmissions. To increase a data signal's resistance to interference, the signal at the sending station is combined with a higher-rate bit sequence that spreads the user data in frequency by a factor equal to the spreading ratio. Compare FHSS.

EDI (Electronic Data Interchange). The computer-to-computer exchange of business documents in a standard electronic format. Sending, transmission, reception and interchange of information and data relating to business transactions (typically an order or an invoice) by electronic means.

EDIFACT (Electronic Data Interchange for Administration, Commerce and Transport). A set of syntax rules for EDI evolved by ISO on the basis of experience by users.

EMR (Electronic Medical Record). Used to compile computerised patient healthcare information, an EMR generally deals with information only in the form of document images or text formatted for output to a printer or for video display. It does not ordinarily handle discrete data such as is usually stored in a database management system.

ESPA 4.4.4. A standard protocol for exchanging messages with paging equipment. Adopted by the European Selective Paging Manufacturers Association.

Ethernet. The most widely installed local area network (LAN) technology, specified in the IEEE 802.3 standard. Ethernet is also used in wireless LANs (WLANs). The most common Ethernet systems are called 10BASE-T and provide transmission speeds up to 10 Mbit/s. Devices compete for access using the CSMA/CD protocol. Fast Ethernet, or 100BASE-T, provides transmission speeds up to 100 megabits per second. Gigabit Ethernet provides an even higher speed at 1000 megabits per second (1 gigabit or 1 billion bits per second). 10-Gigabit Ethernet provides up to 10 billion bits per second.

ETSI (European Telecommunications Standards Institute). A non-profit organisation that establishes telecommunications standards for Europe. ETSI guidelines are voluntary and almost always comply with standards produced by international bodies.

Evidence-based medicine. The conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research. Evidence-based healthcare extends the application of these principles to all professions associated with healthcare, including management and purchasing.

FHSS (Frequency-hopping spread-spectrum). One of two types of spread-spectrum radio technology used in WLAN transmissions. FHSS modulates the data signal with a narrowband carrier signal that "hops" in a predictable sequence from frequency to frequency as a function of time over a wide band of frequencies. Interference is reduced, because a narrowband interferer affects the spread-spectrum signal only if both are transmitting at the same frequency at the same time. The transmission frequencies are determined by a spreading (hopping) code. The receiver must be set to the same hopping code and must listen to the incoming signal at the proper time and frequency to receive the signal. Compare DSSS.

Frequency hopping. A type of spread spectrum technology commonly used in the ISM band. Originally designed for the military, frequency-hopping radios change frequency at regular intervals to resist jamming.

Genomics. The area of scientific study that aims to decipher and understand the genetic information contained within living organisms. A genome is the complete set of DNA (deoxyribonucleic acid) contained within all cells of an organism – including its genes (the areas of DNA responsible for production of proteins). Mapping the human genome is the biggest genomics project undertaken to date. The human genome has approximately 3 billion pairs of bases and 30,000 genes.

GPRS (General Packet Radio Service). A packet-oriented overlay to GSM networks supporting connection- and connectionless-oriented services and diverse quality-of-service mechanisms. The theoretical maximum speed can be as high as 171.2 kbit/s using all eight time slots and CS 4 channel speeds. Real-life user throughput is expected to be much lower – less than or equal to 56 kbit/s.

HIMSS (Health Information and Management Systems Society). An American industry association that offers a variety of publications, educational programs and services related to healthcare information systems. Its members contribute to the development of such technologies as telemedicine, computer-based patient records, community health information networks and portable/wireless healthcare computing.

HIPAA (Health Insurance Portability and Accountability Act). The HIPAA, passed by the U.S. congress in August 1996, calls for the use of electronic data interchange (EDI) in healthcare transactions, and for protecting the privacy of patient healthcare information. Healthcare organisations (HCOs) face fines and imprisonment for wrongfully disclosing patient information. The HIPAA directives – for EDI in particular – have major IT implications for HCOs, many of which are devoting considerable time and resources to system compliance.

HIPERLAN (High-Performance Radio LAN). A wireless-LAN standard from the European Telecommunications Standards Institute (ETSI). Designed to provide high-speed communications between portable devices broadcasting in the 5-gigahertz radio band, it allows flexible data networks to be created without the need for a wired infrastructure. It can also serve as an extension of a wired LAN. HIPERLAN/1 provides speeds up to 20 Mbit/s. HIPELAN/2 provides speeds up to 54 Mbit/s and competes with IEEE's 802.11a standard, which also operates at 5 gigahertz.

HIS (Hospital Information System or Healthcare Information System). The IT applications used to manage hospital operations. An integrated, computer-assisted system designed to store, manipulate and retrieve information concerned with the administrative and clinical aspects of providing services within the hospital.

HL7 (Health Level Seven). A set of standards designed to facilitate the transfer of health data resident on different and disparate computer systems in healthcare. HL7 facilitates the transfer of laboratory results, pharmacy data and other information between different computer systems. HL7 covers clinical and administrative data. It does not support the transfer of the entire patient record nor the transfer of image data (such as from a PACS). Level Seven refers to the highest level, the application level, of the International Standards Organisation's (ISO) model for Open Systems Interconnection, OSI.

IEEE (Institute of Electrical and Electronics Engineers). An American organisation that, as one of its functions, acts as a standards body to define uniform ways for electronics and computers to communicate.

IGRT (Image Guided RadioTherapy). Radiotherapy using imaging systems integrated into treatment systems.

IHE (Integrating the Healthcare Enterprise). An initiative started in November 1998 by the Radiological Society of North America (RSNA) in conjunction with the Hospital Information and Management Systems Society (HIMSS). The aim is to devise a technically viable specification for improving communications between the various healthcare systems and devices.

IMRT (Intensity Modulated RadioTherapy). Radiation treatment using beams that wrap precisely around tumours, avoiding contact with healthy tissue. Dosage levels can be determined according to the tissue type to deliver selective radiation

Interactive messaging. A service that allows users to send alphanumeric messages from their wireless handset to other wireless handsets or to email addresses. Interactive Messaging also allows the user to receive emails and web messages from the internet.

ISM (Industrial, Scientific and Medical) band. A frequency spectrum that is freely available worldwide with only a few basic equipment characteristics regulated (i.e., spread spectrum and low power). The major disadvantage is the great number of incompatible device types that share it. These include cordless phones, microwave ovens, garage door openers, low cost wireless video surveillance systems, and numerous WLAN technologies. This means that the ISM band is likely to be fairly noisy and will thus impact data communications performance. Industrial, scientific and medical stands for the non-commercial uses for which the 2.4GHz band and other frequencies were once reserved.

Laboratory accreditation. Formal recognition that a testing laboratory is competent to carry out specific types of test.

LIMS (Laboratory Information Management System). A LIMS connects the analytical instruments in the lab to wired or wireless terminals used by doctors, nurses and other caregivers. A full-featured LIMS will forward data from lab instruments to a terminal, organise it into meaningful information, and arrange it in required report formats.

LIS (Laboratory Information System). A system that supports the information-processing and business requirements of clinical laboratories.

LOS (Length of Stay). The number of days a patient spends in the hospital. LOS can indicate the efficiency of hospital care, as well as be an indicator of effective planning for discharge.

MDD (Medical Devices Directive). Covers the regulatory requirements of the European Union for Medical Devices (93/42/EC). Compliance with the requirements is declared by placing the CE marking on the product, and supplying the device with a Declaration of Conformity.

MIB (Medical Information Bus). A hardware and software standard (IEEE P1073) that enables standardised connections between medical monitoring devices and clinical information systems.

Mobile terminal. Any mobile device that can connect to a wireless network. Data-centric examples include wireless personal digital assistants (PDAs). Voice-centric examples include basic and enhanced mobile phones.

Modality. In radiology, modality refers to the type of equipment that produces an image.

MRI (Magnetic Resonance Imaging). A non-invasive, diagnostic service providing visualisation of images of body tissue. The patient is exposed to short bursts of powerful magnetic fields and radio waves. The bursts stimulate protons (hydrogen nuclei) to emit radio signals, which are detected and analysed by computer to create an image of a slice of the patient's body. Three-dimensional reconstruction techniques can be used.

NMR (Nuclear Magnetic Resonance spectroscopy). An imaging technique closely related to MRI (Magnetic Resonance Imaging). Both techniques use the magnetic properties of atomic nuclei to get information about a sample. MRI measures the amount of a given nucleus at a given place (spatial distribution). NMR measures the amount of the nucleus in each chemical environment. The distribution is called a spectrum.

Both techniques use almost the same equipment, so they are often combined for a more comprehensive study of a sample.

Nuclear medicine. A field of medicine that uses very small amounts of radioactive materials to diagnose and treat disease. These materials are attracted to specific organs, bones or tissues. They emit gamma rays that can be detected externally by special cameras, gamma or PET cameras. These cameras work in conjunction with computers to form images that provide information about the area of body being imaged. Nuclear imaging often identifies abnormalities very early in the progression of a disease, long before some medical problems are apparent with other diagnostic tests. This early detection allows a disease to be treated early when there may be a more successful prognosis.

ODAP (Open Data Access Profile). A platform for interoperability in DECT systems, making it possible to integrate sensors, detectors, actuators and control devices into wireless applications.

OFDM (Orthogonal Frequency Division Multiplexing). A technique that splits a wide frequency band into a number of narrow frequency bands and sends data across the subchannels. The wireless networking standards 802.11a and 802.11g are based on OFDM.

OSI (Open Systems Interconnection). A standard description or reference model for how messages should be transmitted between any two points in a telecommunications network. OSI was officially adopted as an international standard by ISO. OSI divides telecommunication into seven layers. The upper four layers are used whenever a message passes from or to a user. The lower three layers are used when any message passes through the host computer.

PAN (Personal Area Network). A small network, often ad hoc, consisting of devices that connect to each other, but not to a larger network. See also Piconet.

PCT (Patient-Centric Terminal). An acronym used by Ascom.

PCT (Private Communication Technology). A protocol developed by Microsoft and Visa International for secure communication on the internet. It is a counterpart to Netscape's SSL protocol and a companion to the STT protocol. Like SSL, PCT is intended for internet standardisation.

PDA (Personal Digital Assistant). A handheld computer that serves as an organiser, electronic book or note taker. It typically uses a stylus or pen-shaped device for data entry and navigation.

PET (Positron Emission Tomography). An imaging technique that uses radioactivity to help in the diagnosis of disease. It tracks metabolism and responses to therapy in oncology, neurology and cardiology. It is especially effective in evaluating brain and nervous system disorders. The patient is surrounded by an array of detectors linked to a computer. After a small amount of radioactive isotopes, tracers, have been introduced into the body, the emission of positrons can be computed and a three-dimensional colour image produced to reflect the metabolic and chemical activity of the tissues being studied. A positron is an anti-matter electron. It is identical to the electron in mass, but has an opposite charge of +1. The electron is defined to have a charge of -1.

PHI (Protected Health Information). Any information that might directly or indirectly identify an individual, including physical or mental health information; past, present or future information; information collected, created or received, information in any medium – electronic, paper, oral. The intention is to protect patients from inappropriate disclosures of information that can cause harm to a person's insurability, employability, etc. See HIPAA.

Piconet. A collection of devices connected via Bluetooth technology in an ad hoc network. A piconet starts with

two connected devices, such as a portable PC and cellular phone and may grow to eight connected devices. One unit will act as a master and the others as slaves for the duration of the connection.

PIS (Pharmacy Information System). A system that deals with all or some of the pharmacy processes. Such systems can be linked (or be integral with) prescribing systems for electronic processing of requests for medication, toxic drug dosage validations and can provide inventory control for departmental stocks.

PKI (Public Key Infrastructure). A method that enables users of a basically unsecure public network such as the Internet to securely and privately exchange data and money through the use of a public and a private cryptographic key pair that is obtained and shared through a trusted authority.

PLMR (Private Land Mobile Radio). A broadcast band for radios that operate in the 450 – 470 MHz band with 6.25 kHz channel spacing. Some traditional telemetry systems operate in this band. Previously, PLMR operated on 25 kHz channel spacing. With the change of this band to 6.25 kHz, there could be interference to medical telemetry equipment, possibly making it to be unusable at times.

POC testing (Point-of-care Testing). Also called bedside, near-patient testing. Laboratory analytical tests performed by various operators outside a central laboratory, at the point of patient care.

PWT (Personal Wireless Telecommunications). A derivative of the DECT standard for use in North America. PWT provides the same services as DECT, but uses a different modulation scheme and frequency to comply with U.S. rules. PWT is a standard under document number TIA/EIA-662.

QA (Quality Assurance). The formal and systematic exercise of identifying problems in medical care delivery, designing activities to overcome the problems, and carrying out follow-up steps to ensure that no new problems have been introduced and that corrective actions have been effective. The ultimate objective is to improve the outcome of all health care in terms of health, functional ability, patient well-being and consumer satisfaction. Quality assurance issues are contained in the ISO 9000 series of standards.

Reflex testing. Follow-up testing automatically initiated when certain test results are observed in the laboratory; used to clarify or elaborate on primary test results. In reflex testing, the next test is determined by the results of the previous tests. The physician's knowledge is put in a software algorithm that controls the sequence of tests depending on previous results. Reflex testing reduces the number of tests, but may require quick decision-making for the next set of testing if the patient's data are not completely clear.

RF (Radio Frequency). The range of frequencies, between about 3 kHz and 300 GHz, over which electromagnetic radiation is used in radio broadcasts. It is subdivided into multiple bands, each whose maximum frequency is 10 times its lowest frequency: very low frequency (VLF, 3 kHz – 30 kHz), low frequency (LF, 30 kHz – 300 kHz), medium frequency (MF, 300 kHz – 3 MHz), high frequency (HF, 3 MHz – 30 MHz), very high frequency (VHF, 30 MHz – 300 MHz), ultra high frequency (UHF, 300 MHz – 3 GHz), super high frequency (SHF, 3 GHz – 30 GHz), and extremely high frequency (EHF, 30 GHz – 300 GHz).

RFID (Radio Frequency Identification). A form of contactless automatic identification and data capture. It can be used to identify and log just about anything, including people, instruments, pharmaceuticals, vehicles, documents and components. Carrier frequency bands used to transfer information between the tag and antenna are either in the very low (50 to 500 kHz), medium (13.56MHz) or microwave (0.9 to 2.5 GHz) range.

RIM (Reference Information Model). A comprehensive object-oriented information model for clinical healthcare that serves as a semantic point of reference for all the standards development efforts of Health Level Seven (HL7).

Roaming. The ability of a user to maintain network access when moving between access points.

RSN (Robust Security Network). A secure wireless LAN (WLAN) based on the developing IEEE 802.11i standard.

Service consumer. Authorised healthcare party who uses service providers' services in clinical work.

Service provider. Authorised healthcare party qualified to perform, for example laboratory or radiology services, and to validate the resulting service report.

SIM (Subscriber Identity Module). The smart card inside a wireless phone or other wireless device that identifies the user to the network, handles authentication and provides data storage for user data such as phone numbers and network information. It may contain applications that run on the phone.

SMS (Short Message Service). A bidirectional paging function that is built into Global System for Telecommunications (GSM) systems. Each message can be up to 160 ASCII characters long. The network stores messages for up to several days (typically a maximum of 72 hours) and attempts to deliver the messages whenever the portable phone is switched on. Confirmation of receipt is available as an option in some networks.

SNOMED (Systematised Nomenclature of Medicine). A nomenclature created by the College of American Pathologists (CAP) for use in pathology. It has gradually been extended to cover other domains of medicine. Its over 150,000 items cover numerous medical specialties. CAP is also developing SNOMED RT for reference terminology and SNOMED CT for combined terminology.

SPECT (Single Photon Emission Computed Tomography). A specialised form of radionuclide scanning that uses a principle similar to CT scanning to produce cross-sectional images (slices) constructed by a computer from radiation detected by a sensor that rotates around the body.

Spread spectrum. A method by which a normally narrowband radio signal is spread out to a much wider bandwidth before transmission takes place. Upon reception of the signal, the receiver recovers the original narrowband signal through the reverse process, referred to as despreading. Spreading and despreading are usually done using one of two techniques, direct sequence (DSSS) and frequency hopping (FHSS). In direct sequence, the radio signal is multiplied by a pseudo-random sequence (PRBS) whose bandwidth is much greater than that of the signal itself, thereby spreading its bandwidth. In frequency hopping, the pseudo-random sequence moves the radio signal about, in a random fashion, across a broad frequency band. Regardless of the spreading technique used, the purpose for doing so is to exploit one or more of the many benefits of spread spectrum: Interference rejection, signal hiding, frequency band sharing, anti-jam properties, and license-free operation of up to 1 watt.

SQL (Structured Query Language). A standard interactive and programming language for getting information from and updating a database.

Tagging. Methods for uniquely identifying, tracking and tracing a person or an item.

TAP (Telocator Alphanumeric Protocol). A protocol for submitting requests to a pager service. The current version is TAP 1.8. Adopted as standard by the Personal Communications Industry Association (PCIA). TAP is also known as iXO or PET (Personal Entry Terminal).

TCO (Total Cost of Ownership). Quantifying every aspect of cost, starting with the cost of buying infrastructure, devices and software, then adding the cost of service

support and breakdowns, then subtracting the gains from quicker response, more work performed, shorter service cycles and demonstrated ability to extend equipment life.

TCP/IP (Transmission Control Protocol/Internet Protocol). A set of protocols for Layers 3 (Network) and 4 (Transfer) of the OSI network model. TCP/IP is a de facto standard, particularly as higher-level layers over Ethernet. Although it builds upon the OSI model, TCP/IP is not OSI-compliant.

TDMA (Time Division Multiple Access). A technology used in digital cellular telephone communication that divides each cellular channel into three time slots to increase the amount of data that can be carried. TDMA is also used for DECT.

Telemetry. Transmitting measurements of physical phenomena, for example patient monitoring data, to a distant recorder or observer.

TETRA (Terrestrial Trunked Radio). An ETSI standard for the digital private mobile radio (PMR) and public access mobile radio (PAMR) technology for police, ambulance and fire services, security services, utilities, the military, public access services, fleet management, transport services, closed-user groups, factory site services, mining and other uses. TETRA uses TDMA technology with four user channels on one radio carrier and 25kHz spacing between carriers.

TKIP (Temporal Key Integrity Protocol). A wireless encryption protocol that fixes the known problems in the Wired-Equivalent Privacy (WEP) protocol for existing 802.11b products. Like WEP, TKIP uses RC4 ciphering, but adds functions such as a 128-bit encryption key, a 48-bit initialisation vector, a new message integrity code (MIC), and initialisation vector (IV) sequencing rules to provide better protection.

UMLS (Unified Medical Language System). A project sponsored by the United States National Library of Medicine (NLM) to link various medical nomenclatures including the MeSH headings, ICD-9-CM, SNOMED and the terminologies of DXPlain and QMR. A main result of the project is the Meta-1 Metathesaurus. UMLS has three components: an Information Sources Directory, a Metathesaurus and a Semantic Net.

UMTS (Universal Mobile Telecommunications System). The first of the third-generation (3G) cellular networks, UMTS is being designed to offer speeds of at least 144 kbit/s to fast-moving (e.g., vehicle-based) mobile devices, and offer an initial 2 Mbit/s to campus sites. Designers expect to increase this to 10 Mbit/s by 2005.

Vital signs. Measurements of the body's most basic functions. The four main vital signs routinely monitored include, body temperature, pulse rate, respiration rate and blood pressure. (Blood pressure is not considered a vital sign, but is often measured along with the vital signs.)

VoIP (Voice over IP). The ability of an IP network to carry telephone voice signals as IP packets in compliance with International Telecommunications Union Telecommunication Standardisation Sector (ITU-T) specification H.323. VoIP enables a router to transmit telephone calls and faxes over the internet with no loss in functionality, reliability or voice quality.

WAG (Wireless Application Gateway). A server-based gateway that provides wireless access to enterprise applications. WAGs provide secure access to any data source and the ability to render the data to any device (e.g., PDA, wireless telephone, pager or desktop).

WDCT (Worldwide Digital Cordless Telecommunications). A Siemens proprietary digital cordless standard for products marketed in the USA, a derivative of the DECT standard, augmented to operate in the ISM band (2.4 GHz) and to comply with FCC rules.

WEP (Wired-Equivalent Privacy protocol). A security protocol, specified in the IEEE 802.11 standard, that attempts to provide a wireless LAN (WLAN) with a minimal level of security and privacy comparable to a typical wired LAN. WEP is weak and fundamentally flawed.

Wi-Fi (Wireless Fidelity). The Wireless Ethernet Compatibility Alliance's (WECA's) name for the IEEE's 802.11b standard for wireless LANs operating at 2.4 gigahertz (GHz). WECA promotes the standard's use for wireless products, and performs interoperability certification on products submitted by member companies for testing. More than 40 wireless technology vendors support the Wi-Fi standard.

WLAN (Wireless LAN). A LAN technology in which radio, microwave or infrared links take the place of physical cables. Three physical media types of WLAN are available. The first two – direct-sequence spread spectrum (DSSS) and frequency-hopping spread spectrum (FHSS) – are based on radio technologies that are not interoperable. The third is infrared, a non-radio technology based on lightwaves. Infrared can coexist with radio-based systems in one enterprise network. WLAN standards include IEEE 802.11 and HIPERLAN. Although WLANs can be found in a corporate environment, service providers are offering commercial services in "hot spots", such as airline lounges and coffee bars.

WML (Wireless Markup Language). A language that allows the text portions of web pages to be presented on the small screens of mobile devices, such as telephones and PDAs via wireless access. WML is part of the Wireless Application Protocol (WAP), which works on top of standard data link protocols, such as GSM and TDMA.

WMTS (Wireless Medical Telemetry Service). Radio frequencies of: 608 to 614 MHz, 1395 to 1400 MHz, and 1429 to 1432 MHz, set aside for primary or co-primary use in wireless medical telemetry. Allows bidirectional transmission, but neither video nor voice transmission.

WPA (Wi-Fi Protected Access). An intermediate WLAN security solution that can be applied to existing client hardware. This specification of standards-based, interoperable security enhancements increases the level of data protection and access control for existing and future wireless LAN systems. Wi-Fi Protected Access is derived from, and will be forward compatible with, the upcoming IEEE 802.11i standard.

Wrapping it all up

Greater patient satisfaction. More effective use of time. Lower risk. These are the benefits you get if your organisation can respond quicker to the need for critical information.

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Ascom wireless communications integrates with clinical systems, such as HIS, LIS, PACS and RIS; with business and accounting systems; with building management and security systems; with telephone systems and local area networks; and with wireless and wired devices such as pagers, telephones, smart phones, PDAs, laptops and stationary computers.

Integration with existing systems is our true strength – acquired during fifty years of supplying integrated communications to more than 20,000 hospital installations in Europe and the U.S.

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