



Vision

'New screening and diagnostic tests based on developments in genomics and proteomics may enable us to look forward to a day when identifying pre-disposition to certain diseases will ensure that we never get them', says Rob Gossink, manager of the Healthcare Systems programme at Philips Research.

MAINTAINING YOUR POSITION AS ONE OF THE WORLD'S LEADING MEDICAL-IMAGING COMPANIES MEANS KEEPING ABREAST OF THE LATEST TRENDS IN HEALTHCARE AND ANTICIPATING THE CHANGING NEEDS OF THE MARKET. WITH THE DIAGNOSIS AND TREATMENT OF DISEASE ALREADY INVOLVING SEVERAL IMAGING MODALITIES SUCH AS X-RAY, MAGNETIC RESONANCE (MR) AND COMPUTED TOMOGRAPHY (CT), AND WITH HEALTHCARE FACILITIES DEMANDING TOTAL SYSTEM SOLUTIONS, EQUIPMENT SUPPLIERS MUST OFFER A BROAD PORTFOLIO OF PRODUCTS, SUPPORTED BY LEADING-EDGE SOFTWARE SYSTEMS, SERVICE AND SUPPORT. Jacques Souquet (Chief Technology Officer for Philips Medical Systems) and Rob Gossink (manager of the Healthcare Systems programme at Philips Research) explain how an aggressive policy of acquisitions, supported by leading-edge systems knowledge and fundamental research, has positioned Philips Medical Systems as one of the world's top-three medical-imaging companies.



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Multimodal approaches speed up accurate diagnosis
 It is not that long ago that X-ray imaging was the only non-invasive means of examining the internal organs of the human body, and it is an area where Philips has always excelled. It is not surprising then, that in the early 1970s Philips also invested heavily in CT – a combination of X-ray imaging and computer processing that generates 3-D images.

Today, however, X-ray based imaging is one in an arsenal of imaging modalities available to clinicians. CT, MR, ultrasound, and more recent developments such as Positron Emission Tomography (PET) and Single Photon Emission Computed Tomography (SPECT) all play a part in the diagnosis of disease. Some combinations, such as CT and PET scans, allow clinicians to examine

anatomic abnormalities in combination with functional abnormalities – for example, investigating and visualizing the rate of blood sugar metabolism fuelling the growth of a tumour.

For fast and reliable diagnosis, however, multimodal approaches require an accurate superposition of data from different types of scan that can only be achieved by integrated systems. Technical requirements are not the only driver for integrated systems. A consequence of the continued push for cost reduction is that healthcare managers now actively seek out single-source suppliers that can provide total system solutions.

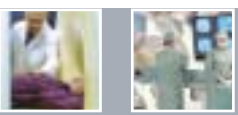
In 1997, Philips Medical Systems started to augment its strong position in X-ray and MR imaging by acquiring companies that specialized in other

imaging modalities. Through the acquisition of ATL Ultrasound (Bothell, USA) and Agilent's Healthcare Solutions Group (Andover, USA) it added ultrasound. By acquiring ADAC Laboratories (Milpitas, USA) it added nuclear imaging (PET and SPECT systems). And by purchasing Marconi Medical Systems (Cleveland, USA) it strengthened MR and nuclear medicine and provided a strong innovative approach to CT imaging. The acquisition of Agilent Healthcare also gave Philips a strong position in cardiac patient monitoring and defibrillators.

Although each of these companies has its own focused research and development group, they are all now backed by the multidisciplinary approach of Philips Research. This not only allows the transfer of technology between modalities. It also allows each

Inside picture

a clear vision for medical imaging and patient monitoring





company to benefit from fundamental research into the underlying physics of imaging and to take advantage of synergy with research activities in areas other than medical.

For example, the amorphous silicon on glass technology originally developed by Philips Research for flat-panel active-matrix LCDs, is now being used to produce solid-state X-ray detectors that are flatter and more sensitive than the bulky image intensifier tubes used in earlier X-ray equipment. The result is faster imaging, reduced X-ray dosage and smaller equipment. Flat detectors based on CMOS semiconductor technology are also being developed for CT scanners, where their high resolution and wide dynamic range provides the contrast ratios needed to create detailed images of soft tissue structures.

The changing face of healthcare

The World Health Organization (WHO) recently stated that by the year 2010 over 30% of the world's population will be over the age of 60, an age group that will put very high demands on healthcare providers. This will not only be because of the high incidence of age-related illness, but also because access to information sources such as the Internet will raise people's awareness and expectation about the nature and treatment of their disease.

Faced with increasing patient demand, governments and medical-insurance companies will have to drive down healthcare costs, and one of the best ways of doing this will be to move diagnostic imaging out of the hospital environment and into the community. Provided that community-based medical centres are provided with the right equipment, it will be much better in both human and financial terms to identify and treat disease in its early

stages rather than leaving it to the point where hospitalization and massive intervention are required.

One of the challenges in the deployment of patient monitoring in the community is knowing who is at risk. Up until now, this risk assessment has normally been based on the appearance of a pre-condition in the patient, such as angina. However, the emerging science of genomics promises to make risk assessment much more accurate. With the entire human genome now successfully mapped, it will soon be possible to analyse a patient's DNA in order to identify diseases that an individual is pre-disposed to contracting. Because genes express themselves through the production of specific proteins, monitoring patients for the appearance of related proteins could provide a very early indication of the onset of such diseases, long before the conventional symptoms appear.

It is here that medical imaging could again play a part. Philips Research is working with leading pharmaceutical companies to develop contrast agents that will bind to these proteins, allowing the sites at which they are being produced to be imaged on MR or PET scanners. There are of course diseases that are not directly related to defective genes, but which equally result in biochemical changes within the body. This has prompted the development of low-cost biosensor systems that can monitor parameters such as blood glucose and oxygen levels, or analyze blood for minute quantities of specific organic molecules.

This whole area of research, known as molecular imaging and diagnostics (see article on pp. 10-13), is a new and exciting challenge in diagnostic medicine that Philips is determined to take the lead in.

When speed is essential

While molecular imaging and diagnostics may ultimately identify disease at such an early stage that patients have the time to take low-dose drug treatments or make simple lifestyle changes in order to heal themselves, the fact remains that at least one of today's major killers requires action within minutes or hours rather than days or years. Heart attacks are often sudden and debilitating, and frequently occur when there is no one immediately on hand to render assistance or call the emergency services. In the case of sudden cardiac arrest, the patient has to be defibrillated within minutes if they are to stand a significant chance of survival. For high-risk patients, a wearable sensor that incorporates cardiac monitoring, global positioning and emergency call systems would be a highly effective way of ensuring that help arrives as quickly as possible. It is a concept that fits well with a number of Philips core competencies, not only in medical systems but also in personal care, wearable electronics and wireless communications.

In the longer term, the existence of divisions such as Medical Systems, Consumer Electronics and Domestic Appliances and Personal Care puts Philips in a very strong position to bridge the divide between healthcare and personal care. By leveraging their expertise in cost reduction, user interface and product design we could all look forward to a new generation of everyday domestic appliances that monitor our state of health, relay information back to our central healthcare server and alert us when there are signs that something is wrong. The result will be longer and happier lives. ☑

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- Philips Medical Systems
- Aging (World Health Organization)
- Medical Imaging

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The importance of software

A multimodal approach to disease diagnosis requires that clinicians are able to correlate data from several different sources. In some cases, it may be the superposition of image data from different types of scan. In others it may be a combination of images and biochemical information. Data storage should be centralized so that all a patient's records can be stored together, and the system should be capable of securely transmitting these records to anywhere in the hospital where groups of clinicians deal with the patient.

Presenting diagnostic data in the most meaningful, accessible and easily used way means choosing the right system and software architectures, standards for data interchange and graphical user interfaces. The importance of software in medical imaging is reflected in the fact that Philips Medical Systems currently employs over 1300 software developers, together with the resources Philips Research, including a specialist group focusing on high-level architectural issues.

This group supports development of software architectures for individual imaging equipment, clusters of equipment, and fully heterogeneous network environments where interoperability with other manufacturers' equipment is required. While software determines most of the functionality, the software architectures provide an optimum trade-off between business requirements, technological roadmaps and implementation constraints.

It is of paramount importance that these architectures are able to survive several generations of equipment and changing clinical practices, which is why it is vitally important for Philips Medical Systems and Philips Research to keep their fingers firmly on the pulse of changing trends in healthcare.

