HEALTHCARE IT MANAGEMENT

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LABORATORY INFORMATION SYSTEMS

Security Risks to E-Health

Open Source in Healthcare IT

Electronic Laboratory Notebooks

Arras Hospital Overhauls IT Infrastructure

COUNTRY FOCUS: The Netherlands

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Adopting the Grid

The rapid digital evolution in e-Heath requires efficiency in the IT space like never before. Costs are spiralling with the increasing need to manage vast amounts of patient information and there is growing recognition of the need to consolidate and unify data to enable costs and information to be shared.

In an environment where data retrieval of 5 seconds is considered slow by clinical staff, Healthcare IT managers are faced with the challenge of how to store information efficiently and cost effectively whilst meeting the required response times for accurate retrieval of patient data.

Many in the industry believe that grid based storage technology is the way forward to meeting the needs of today's healthcare environment. Grid computing can adjust resources to meet fluctuating demand, support many different types of devices and offers both reliability and redundancy.

Kodak's CARESTREAM Information Management Solutions (IMS) platform, driven by Kodak's revolutionary VIParchive software, uses a grid IT infrastructure to deliver advanced IT processes to healthcare. It supplies the unique advantages of clinical information lifecycle management used by the banking and insurance industries to solve storage and access issues.

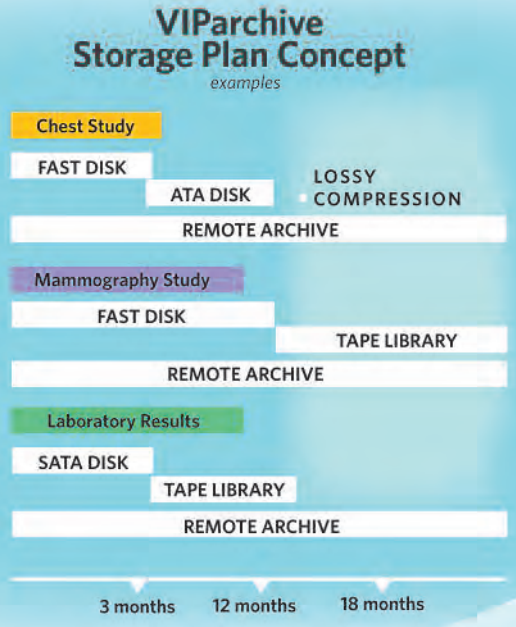
Consolidating all types of data

Virtually all types of multi-media clinical information can be managed including radiology images, laboratory results, video files and other non-DICOM data. Standard interfaces and protocols collect the various files, absorb the data and extract it into a standard open format, which can then be available, to the appropriate users, from a central storage system. All data is consolidated into a patient record, a key approach to efficiently and effectively managing data in massive archives in an escalating environment. A metadata (index) layer allows efficient search and retrieval, including recognition of how many 'objects' are stored for each particular patient.

Intelligent Understanding

Kodak's intelligent storage grid understands the type of data being stored and applies unique "storage plans" for each type of clinical data, automatically applying site and content specific instructions based on user defined business rules. These storage plans can be set up by IT managers on a practical basis to meet a variety of operational or legislative needs. For example, the rules can be set based on the type of exam and the age or other characteristics of the patient. Plans can be set to store data on RAID for a specified time before transfer to deep storage in accordance with national legislation, for example paediatric images stored for 21 years after the exam. This added intelligence allows resources to be fully optimised since access to the data can be tailored to clinical requirements.

Images from Nuclear Medicine can be ingested with laboratory results in PDF format and stored using the same "storage plan", as they relate to the same exam but from different departments. For example, on RAID for 6 months with an immediate copy onto tape for disaster recovery, then another copy made onto slower disk media after 6 months to optimize space usage on the faster fibre channel disks.



The use of IHE XDS (IHE Cross Enterprise Document Sharing) attributes can also be used to define storage plans, to ensure that all patient related documents are stored in the appropriate information lifecycle management process for future reference.

Achieving this level of specification requires intelligent management software that can read the clinical metadata information and then execute the agreed storage lifecycle. Storage plans can be revised at any time to accommodate changes and can be applied retrospectively, a benefit that significantly reduces manual management of data by IT personnel.

Disaster Recovery

This new generation of storage plan solves the problems inherent with previous hierarchical storage management systems, which often required complex IT manipulation in order to recover data. Kodak's solution automatically caters for this scenario by storing multiple duplicate copies of data on a variety of media throughout the enterprise. If the primary archive is inaccessible, the system is queried and data is retrieved seamlessly from another source. Users of the system will simultaneously be unaware of any problem.

Kodak's VIParchive software answers the need for an enterprise-wide archiving tool by which to manage the exponential growth of digital data in Healthcare today. Grid storage technology can also optimise resources while simultaneously automating many IT management functions and also address disaster recovery and business continuity functions mandated by both the EU and HIPAA.

3 Petabytes of Data

Worldwide, Kodak is the market leader in grid based computing for Healthcare, managing over 3 Petabytes of data across Europe alone. During 2006 the Company has announced a number of agreements for European e-Health initiatives where CARESTREAM VIParchive software is driving a powerful solution, including:

— RATU, Finland

The RATU area represents approximately half of Finland and consists of five hospital districts and 69 healthcare centres handling over 700,000 annual studies. Kodak's VIParchive supports the vision of the RATU area to store all medical data to the same repository and to store that data in a patient-centric rather than data-centric way. The integrated solution includes a patient consent layer, unique to Finland, to provide the relevant professional with permission to view examinations beyond the current place of care.

— NSS Scotland

An intrinsic part of the Scotland National PACS Project, Kodak's VIParchive will drive functionality for the National Image Archive for Scotland, connecting over 40 NHS Trusts currently producing 3,100,000 examinations per annum. One of the key issues overcome was the use of a unique patient identifier where the VIParchive platform has to verify that only images with a valid Community Health Index (CHI) are shared throughout Scotland.

— Baltic e-Health Project

As part of the EU funded Baltic e-Health project, Kodak's VIParchive will support archiving, remote access and distribution between within the Baltic Health Network. This is the first cross-border health data network of its kind across the Baltic countries connecting over 200 hospitals and 6,000 general practitioners. The introduction of cross border telemedicine is complex requiring integration and interoperability with different country healthcare systems with different standards and laws. VIParchive 'storage plans' will play an important role in meeting local, regional and national legislation for data storage and disaster recovery.

For further information go to

www.kodak.com/go/carestream

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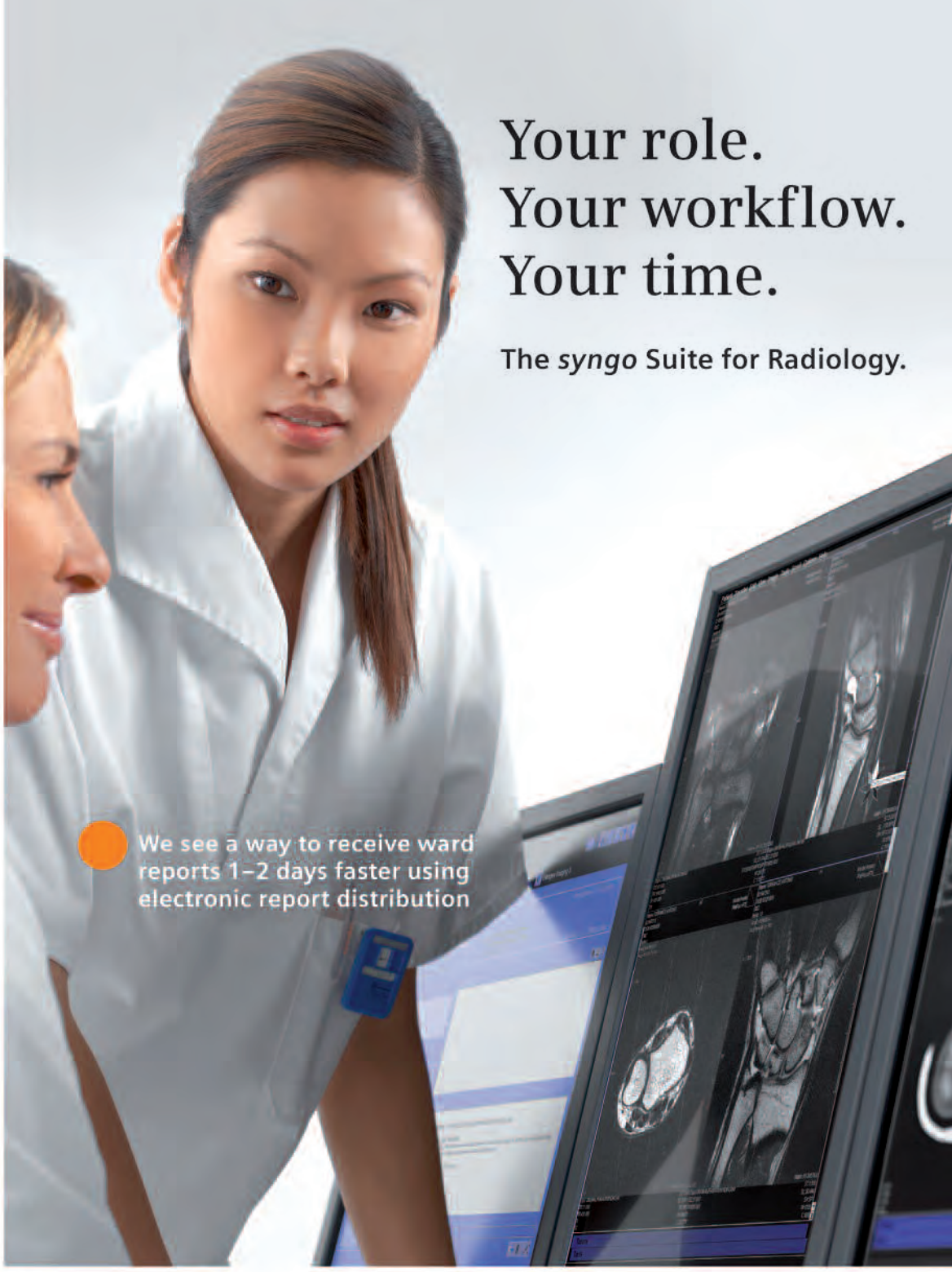

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Letter from the Executive Director, HITM

Dear Reader,

This issue of our journal marks the second year of publication – a significant milestone for many organisations. It also corresponds to the start of a period when healthcare IT moves up Europe's policy agenda. The EU's new Seventh Framework Programme on research highlights healthcare as one of seven key Challenges for the future. Explicit healthcare IT elements are also found in several other Challenges.

The EU move endorses the fact that healthcare IT straddles four revolutions. Their cumulative impact ranges from technology and economics, to ethics, demography and politics.

The first revolution entails a shift in IT design – towards lighter, Web-enabled systems, alongside other developments - wireless transmission, RFID and portable input/access devices. These impact on the modernisation of the wider hospital environment, from the operating room to the hospital lab. Our cover story takes a look at how such forces are shaping new generation laboratory systems.

The second revolution in healthcare IT concerns the dual thrust of biotechnology and nanotechnology. Discoveries in areas like biomarkers will impact on the entire healthcare sector, from pharmaceuticals research through hospital labs to the delivery of personalised healthcare.

The third is about medico-cultural issues, driven by economics and the growing pressure of cost-effectiveness and efficiency. Key themes here include the management of chronic diseases in an aging population, encouraging out-patient healthcare and empowering patients.

The fourth revolution is globalisation. As boundaries between traditionally IT 'silos' erode, so do those between nations. The emergence of India and China as global growth engines and high-technology centres will impact on Europe across the board; healthcare IT is no exception.

These disruptive trends are driving healthcare IT to the frontiers of high-value knowledge work. As new standards, methodologies and operating procedures emerge, and do so in the face of new global paradigms, it is crucial that healthcare IT managers in Europe not only stay abreast of trends, but also influence the shape of their own futures.

Such issues are discussed in considerable depth by experts in this issue of Healthcare IT Management. So too are solutions, such as implementation of an electronic laboratory notebook project and a sweeping IT systems modernisation at France's Arras Hospital. Arras is now primed for the upcoming e-Health wave - one of the clearest success stories of the EU Lisbon Agenda.

Our Country Focus section takes a look at the Netherlands – where 15-month old health insurance reforms are bound to produce new pressures on hospitals in general, and healthcare IT managers in particular.

As part of our resolve to both drill down to details on issues of concern to our readers, and maintain a bird's eye view on the Big Picture, we are pleased to announce the appointment of a new Managing Editor. Ashutosh (Tosh) Sheshabalaya has a decade of experience in the European healthcare industry, with Frost & Sullivan, PriceWaterhouse and the European Federation of Pharmaceutical Industries. More recently, he has earned considerable recognition in Europe, the US and Asia as a writer and speaker on business, technology and globalisation.

Yours faithfully,

Christian Marolt

HEALTHCARE IT MANAGEMENT

Page 10-13
THE FOUR PILLARS AND SEVEN CHALLENGES OF FP7. WHAT'S IN IT FOR HEALTHCARE IT ?

The EU's new Seventh Framework Programme (FP7) is its most ambitious research funding initiative to date. Healthcare IT interfaces with two key undercurrents in EU policy-making – an understanding of the value-accelerating role of IT across the economy, and the challenge of delivering cost-effective and high-quality health-care to an ageing population.

Page 14-19
COVER STORY: THE LABORATORY AT THE CUSP OF TECHNOLOGICAL CHANGE

Exciting times lie ahead for Laboratory Information Systems. Well beyond basic inpatient/ outpatient record keeping and report generation, there are now growing expectations with respect to 'intelligent' information access, improvements in service levels and quality, and above all, connectivity to other IT systems – within the hospital, and with the world outside.

New generation IT technologies have had a major impact on increasing the scope and reliability of automated laboratory analysis systems. Such perspectives were discussed in depth at the annual conference of the Association for Laboratory Automation.

Healthcare IT Management is the official voice of the European Association of Healthcare IT Managers

Managing Editor
Tosh Sheshabalaya - editor@hitm.eu

European Affairs Editor
Darina McGuinness - d@hospital.be

Editors
Catalina Ciolan (CC)
Caroline Hommez (CH)
Dervla Sains (DS)

Editorial Assistant
Christiana Vellianiti (CV)

Correspondent
T. Jones

Guest Authors
T. Bosma, A. Hansske, K. Nikolopoulos, J. Rizzi, S.N. Shah, B. Sutherland, E. Verhulst

Publishing House
EMC Consulting BVBA
28, Rue de la Loi
B-1040 Brussels
Belgium
Tel: +32 2 286 8500
Fax: +32 2 286 8508
Email: office@hitm.eu
Website: www.hitm.eu

Publisher
Christian Marolt - c.m@hitm.eu

Media Contacts
Sean O'Dwyer - s.od@hitm.eu
Stefania Onorati - s.onorati.cd@hitm.eu
Alessia Nicolo - a.n@hitm.eu

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Art Director
Carola Mücke - ca.mue@emcconsulting.eu

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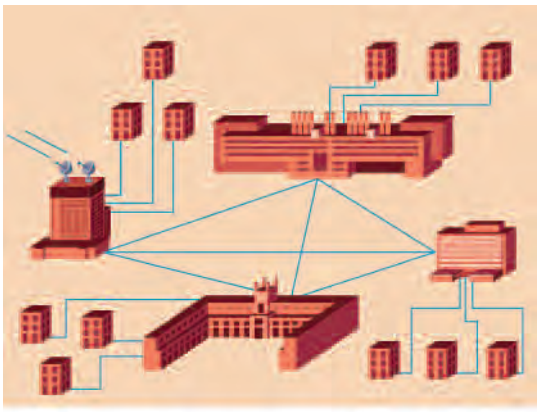


European Association of HEALTHCARE IT MANAGERS

THE EUROPEAN ASSOCIATION OF HEALTHCARE IT MANAGERS

The European Association of Healthcare IT Managers (HITM) is a non-profit pan-European umbrella association of all relevant national healthcare IT associations in Europe.

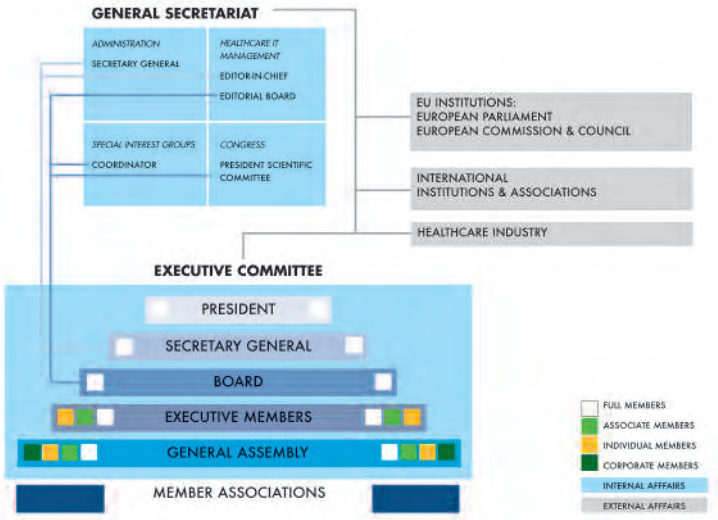
Believing in the fundamental importance of unifying healthcare IT professionals at European and global levels, HITM is committed to increasing the professional authority and responsibility of healthcare IT managers and representing their interests to international institutions and associations.

With membership in HITM steadily growing, the first annual General Assembly is being planned for summer 2007. HITM is strategically based in Brussels, for easy access to the European institutions and associations.

HITM'S MISSION

- To establish common healthcare IT standards, best practices, cross-border collaboration, unifying policies and strategies at EU and international levels
- To increase the visibility, role and importance of IT management in healthcare facilities
- To educate key policy-makers, industry players and the general public about the benefits of healthcare IT
- To promote cross-collaboration in different healthcare sectors
- To promote the efficient, cost-effective use of IT

ORGANISATIONAL STRUCTURE



HITM'S MEMBERSHIP OPPORTUNITIES

- Participate in advocacy groups that impact healthcare IT legislation
- Share knowledge with peers
- Learn about, and contribute to, industry best practices and standards
- Attend the HITM Annual General Assembly and network with colleagues

For more on HITM and information about membership, please contact

Catalina Ciolan, Project Director, at c.c@hitm.eu



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ZORG & ICT @ UTRECHT

This year's Zorg & ICT annual event was held in Jaarbeurs, Utrecht from March 14-16, and was attended by over 110 exhibitors and 6,200 visitors. Cure and care professionals from both large and small health care organisations, hospitals, the government, health insurers and media visited the event. This was an all time record for year-on-year growth in participation, of 25%.

A random selection of the exhibiting companies in 2007 includes AGFA Gevaert, Baas & Rost Advies, iSoft, Oracle, Philips, SAP Netherlands BV, Siemens Nederland, Telezorg BV, Verkerk Service Systemen. Exhibitors showed their appreciation of Zorg & ICT by booking over 80% of space for next year's event.
Visitor interests were as following, and provide a snapshot on issues and perceptions of importance in the health IT sector:

34% Support software
33% Networks, infrastructure, security
32% Document management and workflow
26% Domotica (assisted living/homecare)
26% Management advice and consultancy
22% IT Hardware
21% Storage, administration and outsourcing
14% Nursing call- and alarm systems
10% Medical imaging

Prizes offered at this year's Zorg & ICT include Telemedicine Stimuleringsprijs offered by Netherlands Instituut voor Telemedicine (NITEL) to Rotterdam's The Health Agency for its "Infodoc" Voorlichting op Maat project, an Open Source/HL7-compliant electronic patient dossier.
As Coen Reeser of the Health Management Forum summed up, „I want to see the 'beating heart' of the market and Zorg & ICT is the supermarket of the healthcare sector." (CC)

For more information on Zorg & ICT 2008, please visit www.zorgenict.nl

Photo credit: European Union (EU)

PERSONAL HEALTH SYSTEMS TO EMPOWER CITIZENS

The European Commission's Personal Health Systems (PHS) conference was held at the European Parliament in Brussels on February 12 and 13. The PHS conference focused on finding the best routes to boost the development and deployment of PHS, and the wider field of e-Health systems, in the context of an ageing society. It sought to bring together the viewpoints and perspectives of a wide range of PHS stakeholders: R&D organisations, the medical device industry, healthcare professionals and public administrations of Member States.

Sessions were held for two days and were structured around the following key points:

- Consolidation of the results of more than 10 years of research in the PHS field
- Demonstration of the impact of e-Health on healthcare
- Stimulation of market development and assistance to Member States for the deployment of e-Health systems and services

Participants touched upon the contributions of micro-nano systems towards personalised health-

NEW ORLEANS WELCOMES HIMSS07

The recent HIMSS07 Annual Conference & Exhibition, held February 25 -March 1, 2007 opened its doors to participants from all over the world in New Orleans, US. This year, the conference's theme was "Where ideas become solutions". The number of participants registered by February 18 was 25,000, comfortably exceeding last year's figures.
Steve Lieber, CEO of HIMSS, said that there was about 11% more exhibition space and more than 220 first-time exhibitor companies this year.

In spite of the enthusiasm among participants, the large number of companies attending and the innovative technologies which were showcased, the Conference revealed that the future of health IT in the United States will continue to depend on federal government actions. This was the subject of a Town Hall meeting at HIMSS07, which discussed perspectives on government health IT programs, policies and initiatives.

With respect to new products, electronic medical record systems remained hot items, and representatives from the medical sector said they would be doing some serious comparison shopping while at HIMSS07. Identity management, RFID, biometrics and network security were among other areas of interest.

A HIMSS07 Health IT Venture Fair was held to expose potential investors to young companies seeking $500,000 to $10 million in investments. The Venture Fair was part of new HIMSS platforms. Others included:

- Interoperability Showcase
- Quality Symposium
- Supply Chain Technology Symposium
- Speaking the Language of Healthcare Decision Makers (CC)

For more information on HIMSS07, please visit www.himss07.org

Phot credit: HIMSS

care, the best practices for remote and personalised care, the interoperability between homecare and clinical settings, as well as issues related to the ageing society (organisational, financing and policy issues) and the Ambient Assisted Living Programmes.

PHS can empower citizens to actively participate not only in disease prevention, but also in treatment follow-up, and enable them to enjoy a more interactive and meaningful relationship with healthcare providers.

In order to familiarise participants with current achievements in the field of PHS, a two-day exhibition was organised as part of the conference. Showcasing their solutions and approaches were leading organisations, among them Philips, Ericsson GmbH, Goodit Ltd., Intellect UK, Med-e-Tel, T-Systems, RGB Medical Devices SA and Toumaz Technology Ltd.

It has been estimated that the impact of e-Health is going to grow significantly in the coming years. To receive the highest quality of care in the future, it is essential to change the way healthcare is performed and managed. Nonetheless, the question still remains: How can e-Health, Telemedicine or Telehealth improve the delivery of care with a continuously ageing population? (CC)

For more information on PHS 2007, please visit
ec.europa.eu/information_society/events/phs_2007/

COST-BENEFIT OF TELECARDIOLOGY

HITM interview with Mr. Dean Westcott

As discussed elsewhere in this issue, e-Health is becoming a growing priority for the European Union. With several pilots and other projects underway, the European Commission has been seeking to evaluate the cost-benefits of selected e-Health projects.

The Commission's Information Society and Media Directorate General mandated ACCA, the Association of Chartered Certified Accountants, to evaluate an Italian telecardiology service.

HITM interviewed Mr. Dean Westcott, a healthcare finance expert and member of the ACCA Council.

HITM: Please tell us a little bit about ACCA's role in the telecardiology e-Health cost/benefit study that was undertaken on behalf of the European Commission's Information Society and Media Directorate General ?

Westcott: ACCA, as you know, is the world's largest global professional accountancy body, with 260,000 students and 110,000 members (qualified accountants) in 170 countries. ACCA members work worldwide in firms of accountants, commerce, industry and in the public sector.

As a global body, with members working across a full range of sectors, we are particularly well placed to facilitate opportunities for cross-sector and cross-country learning. In the health field, many of our members are in senior positions in health organisations, local authorities and government departments.

This was the third such study undertaken by ACCA in the EU. It focused on a telecardiology project in northern Italy which uses ICT to provide a cardiology monitoring service for patients with chronic heart disease, those waiting for heart transplants and other types of cardiac surgery, as well as a screening service for the identification of the early onset of cardiac disease.

ACCA's role was to provide an economic and financial assessment of this initiative and ascertain the long-term cost benefits of undertaking such investments in healthcare.

HITM: Why was the study undertaken?

Westcott: Healthcare expenditure in Europe is currently averaging 8.5% of GDP and with continuing low birth rates, extended life expectancy and new technological and pharmaceutical developments, is set to grow to three times this figure in the next two decades.

The use of e-Health technologies, as our studies have shown, provides significant opportunities to both reduce costs whilst at the same time offering benefits to patients in the way that services are both accessed and delivered. To put this into context as far as the telecardiology study is concerned, cardiovascular diseases represent 42% of all deaths in the EU at an estimated cost of €169 billion per annum to the economy. Clearly, the scope and need to reduce such costs is enormous.

HITM: What were the results of the study? What impact do such results have on the future of the European healthcare sector?

Westcott: The study identified significant benefits for both patients and healthcare providers in several key areas. These included delivering improved patient services by enabling cardiologists, GPs and nurses to identify changes in conditions and providing a prompt and appropriate medical response, a reduction in cardiology-related GP visits by as much as 90%, a reduction in hospital in-patient admissions of 35% and a reduction in out-patient visits of 12%.

As a result of the use of e-Health technologies the anxiety for both patients and carers is also significantly reduced. Critically, the potential savings identified could amount to as much as €100 million over a 15-year period, directly attributable to the introduction of telecardiology.




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Research of this nature sets out a roadmap for policy makers - based on sound clinical evidence - that there are significant benefits both in terms of patient care and cost effectiveness to be realised from the increased use of e-Health technologies.

HITM: In your opinion, is there a strong impetus from the EU and Member State governmental institutions to promote IT investments in national healthcare systems?

Westcott: The European Commission, through the Information Society and Media Directorate-General, has been instrumental over the past decade in promoting e-Health policies as a route to improving access to healthcare, providing higher quality of healthcare, and alongside, delivering cost benefits which make funds available for re-investment in healthcare.

Whilst there is no doubt that there is an increased awareness at a national level, it is also clear that there is more that can be done. To put this point into context, it is estimated that spending on e-Health worldwide stands at some 2% of healthcare expenditure, yet it has the potential to reduce inefficiencies inherent in the healthcare environment by as much as 25 – 40%. Thus, significant potential exists for the delivery of improved healthcare through co-ordinated ministerial action in the field of e-Health.

HITM: What do you see as the biggest obstacles in raising the profile of healthcare IT investments in Europe?

Westcott: A sustained increase in the level of IT investments requires the co-operation of all stakeholders (health organisations, healthcare professionals, consumers and industry) in following a realistic strategy for the deployment of e-Health technologies. Whilst the challenges to introducing e-Health technologies have been well documented in the past (interoperability of systems, patient confidentiality, standardisation and fragmentation of the e-Health market), these are not insurmountable. The real challenge is the financial commitment from Member States to invest in such technologies.

As our study and others have shown, the introduction of e-Health technologies has the potential to deliver both improved services, increase cost effectiveness and deliver a significant return on investments.

HITM: What are ACCA's recommendations to Member States and the European Commission to ensure the future of e-Health developments and investments in the EU?

Westcott: The message from ACCA is clear: we urge Member States to review their current levels of investment in IT in the health environment, and do so as a matter of urgency. This recommendation is based on strong clinical and economic evidence from a number of studies - most recently, that relating to telecardiology services in northern Italy.

With the costs of modern healthcare escalating rapidly and set to rise further, the evident benefits of e-Health technologies cannot be ignored. ACCA continues to support the European Commission's thrust to promote e-Health policies as a means of improving access to healthcare, improving quality and effectiveness of services and delivering substantial savings for re-investment.

GERMAN PRESIDENCY KICKS OFF IN NEW YEAR

On January 1, 2007, Germany took over the European Union presidency from Finland for six months. To mark the German presidency, Chancellor Angela Merkel launched a "two-phases" programme: the first is focused on reform of the EU's economic and social policies, while the second, directed at celebration of the 50th birthday of the EU, reopens the debate on Europe's future after the rejection of the Constitution in 2005.

In the healthcare sector, the German Presidency has defined health promotion, innovation and access to healthcare as its priorities. Its specific aims are:

- to achieve Lisbon Agenda goals on health issues
- to finalise the health action programme until 2013
- to draw a community framework on health services, patient mobility and cross-border services
- to implement international health regulations
- to co-operate with the European Centre for Disease Prevention and Control
- to work together with the World Health Organization on health promotion strategies
- to work on the Commission White Paper on mental health

One of the first major events in the healthcare area was an Event on "The Social Dimension in the Internal Market – Perspectives on Healthcare in Europe". Held at Postdam on January 15-16, it covered the EU's new health strategy and examined its role in a period when national health services face serious challenges ranging from demographic change to new technologies.

The German Presidency coincides with the launch of the Seventh Framework Programme on Research (FP7), with a considerable amount of new approaches on issues such as first-time funding of security research and its opening up to cooperation with third countries. (CC)

FP7: WHAT'S IN IT FOR HEALTHCARE IT MANAGERS

There are significant opportunities for healthcare IT within the EU's Seventh Framework Programme (FP7), its latest and most ambitious research funding initiative. In a sense, the healthcare IT sector directly meshes into two of the most powerful undercurrents in EU policy-making – an understanding of the central, value-accelerating role of IT in every economic sector, and the over-arching challenge of delivering quality healthcare, cost-effectively, to an ageing population.

FP7 is composed of four specific programmes (see box). In a fluid fashion, these interface into seven key Research Challenges that seek to ensure Europe becomes a world leader in IT. Under the banner 'A Healthcare Revolution', No. 5, is an explicit opportunity for healthcare IT.

The healthcare IT-related implications of the Challenges are briefly discussed below.

1. LAYING TOMORROW'S NETWORKS: Focused on mastering the development of future information infrastructures and makes specific note of delivering the benefits of IT in home healthcare.

2. SMARTER MACHINES, BETTER SERVICES: The aim here is to make machines (ranging all the way to robots) work for us, rather than the other way round. The goal is somewhat poetic – to make an 'intelligent' machine which sees the point in working for its human masters. Here too, explicit mention is made of healthcare applications.

3. THE NUTS AND BOLTS OF TOMORROW'S PRODUCTS: This Challenge, essentially focused on embedded systems, covers a sweeping range of items, including flexible displays and medical devices.

4. DIGITAL CONTENT & LEARNING: Essentially aimed at e-Learning, this Challenge would have relevance in areas such as continuing education for the medical and paramedical professions, as well as networking medical schools.

5. A HEALTHCARE REVOLUTION: This catch-all Challenge notes that healthcare already accounts for about 9% of EU gross domestic product (GDP), and is rising. Meanwhile, given the information-intensive nature of the health sector, it acknowledges the emergence of e-Health as an "important new industry", with e-Health spending forecast at approximately 5% of the total health budget by 2010, up from 1% in 2000 (for the then-15 Member States). The real significance of this otherwise small (0.45%) share of GDP is validated by Goldman Sachs forecasts of the EU's 2010 GDP at almost $13 trillion, which would entail e-Health revenues of about $5.8 billion. Areas earmarked for attention include the quality, availability and effectiveness of healthcare by developing IT to improve everything from healthcare administration to biomedical imaging, from personalised, home-based care to the creation of new medicines.

6. ENVIRONMENT, ENERGY AND TRANSPORT: Some areas of relevance here may involve niches such as medical waste, mobility initiatives for elderly outpatients, 'intelligent' designing of future hospitals etc.

7. ACCESS FOR ALL: The aim of this challenge is social inclusion within the variety of facets in the next, unfolding wave of the IT revolution. One specific trend which is highlighted is the growth of the elderly in European society, with the share of over-65s rising from the current 20% to 28% by 2025. While there are overlaps with Challenge 5, as far as healthcare IT is concerned, the design of medical devices for remote patient monitoring – especially of the elderly and infirm, may be of significant interest to the EU.

Lending support to such a view is the existence of another Commission initiative called i2010 [Editor's Note: to be covered in the Summer Issue of HITM]. Out of four i2010 themes, one is called IT for Independent Living in an Ageing Society, and calls for providing the elderly, with IT tools to support their health, well-being and mobility. In turn, this is expected to have a ripple effect on IT take-up across Europe, not least because of the demographic trend noted by the 'Access for All' Challenge. (TS)

THE FOUR PILLARS OF THE SEVENTH FRAMEWORK PROGRAMME

Cooperation, with a budget of € 32.4 billion, aims at building European leadership in ten key Themes. ICT (Information and Communications Technologies) has the largest single slice, with a budget of € 9.1 billion.

Capacities, with a € 4.1 billion budget, aims to build world-class infrastructure for European researchers. Outlays on the IT element here, in terms of what is known as the e-Infrastructures strand, has a budget of approximately € 600million.

Ideas and People, respectively with budgets of € 7.5 billion and €4.7 billion, aim to but tress the soft side of the European R&D edifice, by funding an autonomous European Research Council to reinforce science and strengthen the human potential of research efforts. Both the Ideas and People Programmes will also fund IT-related research.

FUTURE OF THE EUROPEAN LABORATORY INFORMATION SYSTEMS MARKET

AUTHOR

Konstantinos Nikolopoulos
is a Healthcare IT Industry Analyst with Frost & Sullivan. Frost & Sullivan (www.frost.com) is a global growth consulting company, which has been partnering with clients to support the development of innovative strategies for more than 40 years.

Major forces are reshaping all businesses on a global basis, and healthcare is certainly no exception. The expectation of ready information access, availability of new technologies, the need to improve business processes and workflows and to balance resources, creates a number of challenges for healthcare providers.

In tandem, demands on clinical laboratories are growing each day. Improving service levels to internal and external customers, increasing quality, being able to connect and work in concert with other IT systems, reducing costs, and generating more revenue, are major challenges for laboratories worldwide. Fortunately, many advanced technologies can enable such high levels of functionality. The development of next-generation Laboratory Information Systems (LIS) has led to capabilities far beyond fundamental inpatient/outpatient record keeping and report generation.

Exciting times lie ahead for the European Laboratory Information Systems market and this article takes a closer look at where the industry is today and where it may be headed.

INTRODUCTION TO LIS

A laboratory information system (LIS) can be defined as one or more application packages that support the operational and management needs of a clinical laboratory. Since the spectrum of services required can significantly differ from one laboratory to another, a LIS is a highly configurable application, which is customized to facilitate a wide variety of laboratory workflow models and must be therefore closely tuned to the operating needs of each laboratory and its organisation.

The clinical laboratory produces nearly 80% of the information that physicians use for medical decision making, so it comes as no surprise that when measured by sheer volume of clinical data, laboratory transactions make up as much as 60% to 70% of information that goes into an Electronic Medical Record (EMR). It is clear that the laboratory information system is a critical piece of the spectrum of clinical IT systems and contributes significantly to the overall care given to patients.

CURRENT STATUS

The classic LIS has existed in clinical laboratories for more than three decades, and was designed to support laboratory activities with particular emphasis on work and specimen flow. This has led to high penetration levels for legacy LIS systems (more than 95% in certain geographies), although nowadays they do not provide much flexibility and configurability.

The need for replacing such systems, aided by a change in the mission and goals of modern laboratories (with greater emphasis on activities such as point-of-care testing, outreach

testing and error-free clinical diagnostics) has been a major driving force for new LIS installations.

While initial purchase price, cost of ownership and return-on-investment (ROI) are still major considerations in purchasing decisions, new features that help improve overall laboratory management and workflow are gaining importance, as listed below:

- The emergence of the electronic medical record as the key system for providing clinicians with an integrated view of clinical information in hospitals is one of the biggest factors in encouraging laboratories to replace their LIS. These changes are related to a drive to connect together various hospital departments and departmental software. Clinicians want to be able to enter data into electronic records. They want ancillary systems, such as those of laboratories, to accept orders from the EMR and replicate clinical data to it, as components of an integrated clinical database.
- A growing interest in, and enthusiasm for, the capture, storage, and integration of images— for example, in surgical pathology and cytopathology— into laboratory and pathology reports.
- A growing interest in processes and systems to capture and communicate infectious disease information and epidemiologic data from hospital laboratories to local, regional, and national health authorities.
- Automation of processes that streamline the laboratory workflow, thus reducing levels of human interaction and consequently improving accuracy and quality of tests.

Many advanced technologies have already enabled the high level of functionality demanded from modern LIS solutions. Some examples include more powerful, yet easier-to-use databases; lower cost computers and networks; and higher throughput, automated laboratory systems. As a result, modern laboratory information systems have become increasingly standardised and most of them support tasks such as specimen collection, order entry, results reporting, and interfaces to automated instrumentation and computers.

THE ROAD AHEAD

New demands will be placed on laboratory professionals to shift the range of services that they offer toward clinical consulting, integration of laboratory information from multiple sources, and laboratory information management. These information management and integration tasks can only increase in complexity in the future, as new genomic and proteomic testing modalities are developed and come online in clinical laboratories.

As clinical laboratories start adopting new business models to make themselves more competitive, cost efficient, and responsive, they face a number of information technology challenges that are heavily influencing the development of next-generation LIS solutions.

Radio Frequency Identification (RFID) promises to have a major impact on hospitals and laboratories in the future since it can easily be tied into existing information systems. The use of RFID is currently being driven on the consumer side for automatic tracking and identification throughout distribution systems. In time, RFID technology could be used in the laboratory workflow for everything from patient to specimen tracking.

Wireless networks, which will aid point-of-care decision-making, information access and clinical data entry, are also coming fast. Possible devices that can be used with a LIS include tablet PCs, personal digital assistants (PDAs) and other multimedia-enabled devices such as barcode readers, while the actual technology includes Bluetooth and wireless local area networks (WLAN). These solutions can be used for the acquisition and distribution of laboratory information within a clinical setting, which makes them even more attractive to modern healthcare workers.

Software enhancements will always be a part of the future of LIS. Some of the new features demanded by laboratory professionals include billing and statistical reporting components, the ability to have multiple ways to access and report out operational information, the flexibility to handle data from various instrument manufacturers and the ability to serve outreach markets.

The future, however, will not consist entirely of bright, shiny new toys – everyone agrees that integration of existing laboratory software across the enterprise will be a significant activity over the coming years since hospitals are looking to lower total cost of ownership by standardising platforms and workflows. Such implementations will require more than just new software. Professional services and systems integration expertise will be equally important in helping achieve those changes.

CONCLUSION

Today's laboratory is responsible for more than just generating results from a test. It manages how and when a test is generated, and how clinical results are presented, delivered and stored as electronic data through different interfaces. Clearly over the next few years, with the wider adoption of molecular and genetic testing, data produced in the laboratory will be even more vital to patient care.

In many European countries, stakeholders and decision-makers are beginning to realise the clinical, organisational and financial benefits directly resulting from the implementation of healthcare IT systems. Fortunately, laboratory professionals are no exception. Within such an environment, ready to accept organisational and cultural change, the future of the Laboratory Information Systems market in Europe looks certainly exciting.

PERSPECTIVES ON LAB AUTOMATION: PAST, PRESENT AND FUTURE

AUTHORS

Greg Dummer
is Executive Director of the Association for Laboratory Automation (ALA).

Dr. Sabeth Verpoorte
is Program Chairman of the Scientific Committee at this year's annual ALA conference.

The Association for Laboratory Automation (ALA) is a best-of-breed reference point for everyone concerned with lab automation, across the world. It brings together lab professionals from different application specialties (agro, biopharma and security, universities and industry, vendors and users) to network, exchange views and grow together in a field driven by a sometimes-dizzying pace of technological change.

HITM interviewed Greg Dummer, the Executive Director of the ALA, and Dr. Sabeth Verpoorte, Program Chairman of the Scientific Committee of LabAutomation 2007, this year's session of the annual ALA conference, about their perspectives on lab automation in general, and the role of the ALA in particular.

HITM: Please tell us a little bit about the history and membership composition of the ALA.

Dummer: The Association for Laboratory Automation (ALA) was set up in 1996. The year also saw publication of the first issue of Laboratory Automation News (LAN), which in 1998, was rechristened as the Journal of the Association for Laboratory Automation (JALA).

ALA's aim was to bring together the best, brightest and most motivated lab automation professionals from all walks of life - governments, universities, multinational corporations, and of course, the entrepreneur community –all of who endorsed one of the ALA's principal tenets - that staying a step ahead of today's rapidly changing technology and trends is not just their key to success; it's the key to what unlocks their mind's eye.

That founding spirit continues today - through world-class conferences, a highly regarded scientific journal, formal networking programs, and informal alliances. ALA continues to offer a living, thriving and multifaceted platform for lab automation professionals to compare practical notes, share achievements as well as disappointments, and learn and grow together.

Our members come from all levels (company presidents with Ph.D.s and M.D.s to entry-level lab techs with associate degrees), and from many camps (biopharmaceutical, agricultural, forensic and security sciences, molecular diagnostics, academia, manufacturing, and more).
In 1998, as you know, we introduced the EuroLabAutomation conference, at Keble College in Oxford. That launch session attracted about 150 attendees.

HITM: What would you consider to be ALA's main achievements in 2006, and its priorities/strategic goals for 2007?

Dummer: ALA is in a constant state of change to continually meet the needs of our membership, which is now over 7,250, and growing by some 200 each year. As a multidisciplinary, international forum of scientists and business professionals devoted to education and advancement of technology in the laboratory, we continue to develop programs, priorities and benefits that deliver real value to our members.

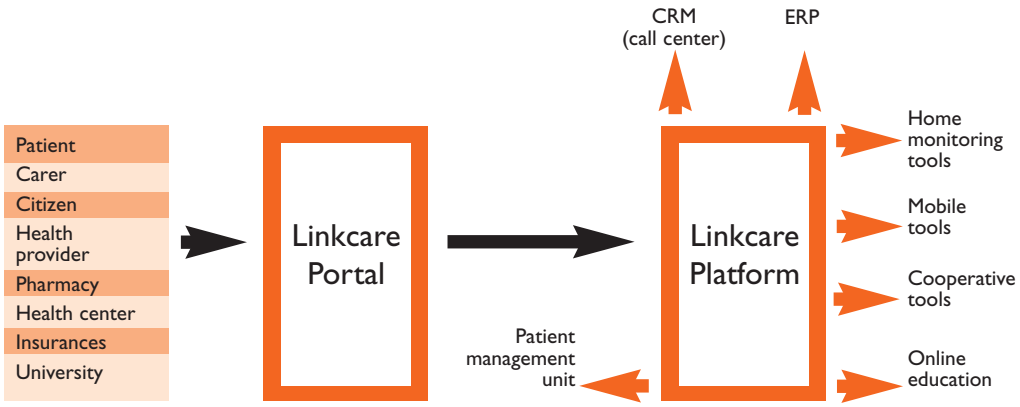
ALA's membership base now comprises three key constituencies: Academia and Government; Technology Users; and Technology Providers.

Each constituency represents the diversity of our field: pharmaceutical, biotechnology, molecular diagnostics, food and agriculture, forensics and security, energy sciences and more. Of course, such a wide range brings many points of change – which is why ALA is constantly evolving.
During the past year, we unveiled a number of new initiatives, including:

- The award-winning e-newsletter LabSnap— A Fast Read on the Latest in Lab Automation
- The scientific knowledge, experiential learnings and dry wit of The Lab Man Forum
- Pod casts of "Ask The Lab Man"

Linkcare

- **Linkcare offers professionals and chronic patients web-based technological solutions featuring management of continuum of care programs**
- **Linkcare overcomes current fragmentation between healthcare and social support facilitating coverage of the demands of elders**
- **Linkcare is a supporting ICT platform for integrated care prepared for extensive deployment of healthcare services. It provides flexible interfacing capabilities with existing corporate information systems**
- **Through the Linkcare Alliance we are promoting synergies among different providers in the areas of services' deployment.**



Join us at the Linkcare Workshop on 22 June 2007 in Barcelona!

ⓘ For further information:

Visit

www.linkcarealliance.org

Or contact

Mirjam Hillenius
Hospital Cl nic de Barcelona
phone: +34 93 2275747
fax: +34 93 2275455
mhillen@clinic.ub.es

i2010 Information Society Innovation & Investment in R&D Inclusion

e-TEN

- Innovation AveNEW, a cost-sensitive program for start-up, entrepreneurial companies in the laboratory automation and technology field
- The ALA New Product Award (NPA) Designation, recognizing outstanding new products in laboratory automation
- A new, member-savvy and interactive ALA Web site

These programs join an already impressive inventory of member offerings.

Topping the list is LabAutomation, the world's leading exhibition for laboratory automation technology, held each January and attended by thousands from across the globe at the Palm Springs Convention Center in the US.

Additionally, we have annually published six peer-reviewed issues of our award-winning scientific journal, the Journal of the Association for Laboratory Automation (JALA), which is also available in an online version.

To ensure our programs meet our members' needs, all initiatives are developed under expert guidance from our member-elected Board of Directors, combined with the expertise of our professional team; this process makes certain our organisation continues on the right path.

The ALA Strategic Plan sets a clear direction for continued growth with regard to fulfilling our educational mission and reaching out to new audiences across multiple disciplines and industries.

ALA is now looking at conducting vital market research and potentially partnering with industry and sister organizations to produce high-quality workshops around the globe.

HITM: What are the most beneficial IT innovations implemented in laboratories during the past 5 years ?

Verpoorte: I am most familiar with the research lab environment, namely the use of micro- and nanotechnologies for analytical chemistry, pharmaceutical analysis, and cell biology. Certainly in this environment, we have benefited over the last few years from more sophisticated computer programs and systems for the automation of instrument control and data acquisition.

As our ability to generate information has improved, there have been parallel developments in IT technologies for data processing, particularly for bioinformatics applications related to the emerging areas of proteomics and biomarker discovery, metabolomics and systems biology. I think generally IT technologies have had a major impact as far as increasing the level and reliability of automated laboratory analysis systems, and well as on the management of information.

HITM: What laboratory IT innovations and advancements are currently being developed that have the greatest potential to improve safety and the quality of service provided to patients?

Verpoorte: As a researcher in the micro- and nanotechnologies field, the advances in IT that I now encounter most often - and which will impact healthcare generally - are related to the development of a new generation of micro and nano chip-based medical sensors and implants. These devices are designed to generate information about, and for the patient, outside the centralised laboratory, namely directly at the point-of-care in the doctor's office or the patient's home.

The interesting thing about IT is that these technologies are chip-based, and thus can be used to realise both information-generating and information-processing microsystems. This enormously facilitates the integration of both sensing and information handling systems. It becomes possible to produce portable instrumentation for monitoring the health and activities of individuals in their home environment, monitoring various functions in the home itself, and providing information and the possibility to more easily communicate with external healthcare professionals as well as direct family and other potential care givers.

Wireless information transfer certainly will play a large role here as well. Patients will become more informed about their own illnesses or conditions and how to manage these, and be empowered to live more independently. These types of developments are gaining in importance as our populations continue to age.

HITM: What are the biggest challenges facing the laboratories of the future?

Verpoorte: Let's consider clinical labs. With a rapidly growing ability to generate patient data, one of the challenges which will need to be dealt with is how that information is handled, in my view.

Making information easier to generate and process, as well as more accessible to users, carries with it the danger, of course, that patient privacy will be more easily violated. Securing laboratory data systems, particularly those based on wireless technologies, is becoming increasingly important, a fact which is being recognised by developers of such systems. Another challenge with respect to patient monitoring systems is related to the user interface of these systems. Ease of use is paramount, ultimately, to the successful implementation of IT for these applications.

A greater and more general challenge, however, facing today's clinical labs will be their changing role in the healthcare system. As new IT enable increased point-of-care treatment, the clinical laboratory as such will become increasingly decentralised and reduced in size. More flexibility with respect to healthcare management will be required, particularly when it comes to accessing and handling data at home and in a medical environment. IT will certainly provide the necessary technology platforms to make this possible.

HITM: Please give us an overview of the main themes covered at ALA's conference, LabAutomation2007.

Verpoorte: A wide range of scientific topics were on the agenda at LabAutomation2007, offering exceptional insight into the full spectrum of laboratory technologies and tools. The scientific program featured five parallel tracks whose themes are listed below.

Detection and Separation
Detection and separation, two important and frequently related operations in the laboratories of today and tomorrow, were bundled into this track. Session topics included mass spectrometry and other label-free techniques, the latest separation technologies, in conjunction with detection and analytical technologies in pharmaceutical development.

Micro- and Nanotechnologies
This track broadly encompassed new and emerging technologies based on micro- and nanotechnologies. Sessions were devoted to lab-on-a-chip technologies for cell analysis, as well as nanotechnology for drug discovery, and molecular diagnostics.

High-Throughput Technologies
This track focused on the innovative tools, technologies, and techniques that enable high-throughput activities or shorten operational cycle times. Emphasis was placed on new high-throughput technologies and their application to leading-edge automation-assisted research and development. This year's conference featured high-throughput technologies for chemistry and biology.

Informatics
Today's automation solutions often require more informatics than hardware. Whether developing a controller for a new instrument, designing an integrated solution, scheduling a complex assay, tracking samples, or integrating data from multiple systems, success in automation relies on developing hardware and software that work harmoniously. This track offered a platform for showcasing unique, technically innovative applications in the automation arena.

Emerging Areas in Laboratory Automation
This track spotlighted the rising impact of leading-edge automation technologies in leading industries. Featured topics included lab automation and food safety, influenza surveillance, developments in biosensors, and automation for household application formulations.

Laboratory Information Systems

ECRI (formerly the Emergency Care Research Institute) is a nonprofit health services research agency and a Collaborating Centre of the World Health Organization (WHO). Such organisations are appointed to contribute to the WHO's public health mission by providing specialise knowledge, expertise and support in the health field to the WHO and its member nations. ECRI's mission is to improve the safety, quality, and cost-effectiveness of healthcare. It is widely recognised as one of the world's leading independent organisations committed to advancing the quality of healthcare.

ECRI Europe
A NONPROFIT AGENCY

ECRI Europe
Weltech Centre Ridgeway
Welwyn Garden City
Herts AL7 2AA
United Kingdom

Tel: +44 (0)1707 871511
Fax: +44 (0)1707 393138

info@ecri.org.uk
www.ecri.org.uk

ECRI's focus is healthcare technology, healthcare risk and quality management, patient safety improvement and healthcare environmental management. It provides information services and technical assistance to more than 5,000 hospitals, healthcare organisations, ministries of health, government and planning agencies, voluntary sector organisations, associations, and accrediting agencies worldwide. Its more than 30 databases, publications, information services, and technical assistance services set the standard for the healthcare community.

ECRI is pleased to provide readers of Healthcare IT Management with sample information on Laboratory Information Systems (LIS) from its Healthcare Product Comparison System (HPCS) which contains over 280 reports. Publication of all data is not possible. For further information, please contact ECRI.

Note:
This information is provided as a courtesy to readers. Neither ECRI nor Healthcare IT Management assumes any liability for decisions made on this data.

ECRI-RECOMMENDED SPECIFICATIONS	
MODEL	**LABORATORY INFORMATION SYSTEMS**
NUMBER OF USERS SUPPORTED	
SYSTEM CONFIGURATION	
Hardware and software	
Software only	
Hardware platform	No preference
Operating systems	No preference
Program languages	No preference
Database management	No preference
Storage media	Hard drive, optical disk
Peripheral devices	Printer
NETWORKING	
Architecture	Ethernet, TCP/IP
Communications protocols	
ASP CAPABILITIES	Optional
WEB-BASED CAPABILITIES	
MULTIPLE SITES SUPPORTED	
STANDARDS SUPPORTED	
HIS INTERFACES	
NUMBER OF DIFFERENT LAB INSTRUMENT INTERFACES	
SOFTWARE	
• CLINICAL FEATURES	
General lab/ Anatomic pathology	Recquired/Optional
Blood bank	
Transfusion/ donor	Optional
Cytology/ Phlebotomy	Preferred/Recquired
Microbiology/ Telepathology	Preferred/Optional
Specimen tracking	Preferred
Instrument maintenance scheduling	Optional
Ad hoc reporting	Optional
• MANAGEMENT FEATURES	
Bar coding/ Billing	Preferred/Optional
CAP workload/ LMIP	Optional/Not specified
Cumulative QC/ Delta checks	Preferred/Preferred
Inventory control/ Ad hoc reporting	Optional/Optional
Outreach services	
Billing/ Remote ordering	Optional/Optional
Remote results reporting	
Direct printer/ Fax/ Modem	
Number of HIS interfaces	
Order entry/ ADT	Not specified/Recquired
Result reporting	Recquired
DATABASE INTEGRITY	
SYSTEM SECURITY	
TRAINING PROGRAM	Yes
SERVICE PROVIDER	
Hardware	
Software	
OTHER INFORMATION SYSTEMS AVAILABLE	
OTHER SPECIFICATIONS	

FOOTNOTE:
[1] If hardware delivered by 3rd party
[2] currently interfaced with Siemens INVISION, HBOC, Unity, MedSeries 4
[3] procedure/application security

MCS vianova Labor	LabCentre	Laboratory System	MOLIS - Laboratory Information and Management System
1-500	1-500	1,000+	1-500
Yes	Hardware and software	Yes	Yes
No		No	Yes, except OS[1]
IBM, HP, DELL, Compaq, FSC, Sun, Acer	Intel, AMD, X86, Sun Sparc (server)	Compaq/HP, IBM	HP-RISC /ITANIUM, IBM-AIX, SUN-Solaris/Sparc, Intel-LINUX RedHat-SUSE
Windows (LIMS), LINUX, UNIX (Web Frontends)	Client: Windows NT/2000/XP, WTS, Citrix Server: Windows 2000/2003, Linux, HPUX	Servers: UNIX, OpenVMS Instrument Server: LINUX PC Servers: Windows 2000	Application and DB-Server: HP-UX, LINUX, AIX, SUN Solaris; Clients: Win 2000, Professional XP, Server 2003
Visual Basic, C#, Java	Visual Basic, Cache Script	Visual Basic, Standard C/C++, Visual C++, ANSI Standard M and Caché Script, PowerBuilder and Sybase (both CoPathPlus)	Uniface, C
MS SQL server, Oracle Database (Q3/2007)	Cache	InterSystems Caché, Sybase	ORACLE
Hard disk, optical disk, mirrored disk, RAID, tape, DAT	Hard disk, optical disk, 8 mm tape	SCSI, SSA-RAID 0+1&5, optical, high-speed tape	Data: any type of internal hard disk system (RAID 0+1,5,6), SAN, NAS. Backup on tape
Touch screen, bar-code printers/readers, fax modem, mailbox, PCs, LAN workstations, printers, mouse, wireless LAN	Terminology, laser printer, ISDN/fax modem, bar-code reader, LAN	PCs, terminals, character and laser printers, bar-code readers and printers, fax modem	PCs, analyzers, barcode reader and printer, OMR and OCR reader, laser printer, terminal server, fax modem, etc.
Client/server	Client/server	Multi-tier, multi-discipline	Client/Server, Thin-Client, Citrix, Windows Terminal Server
Ethernet, TCP/IP, Token Ring,	TCP/IP	TCP/IP, Ethernet, RS232	TCP/IP
Yes	Not specified	Not specified	Not specified
Yes, Order-Entry, Report-Resulting, Data Mart Analyzing Tool	Not specified	Not specified	ECLAIR module for electronic order entry and result reporting
Yes	Yes	Yes	Yes
ASTM, HL7, ADT, LDT, XML, EDIFACT	ANSI, ASTM, HL7, ODBC	ANSI, ASTM, HL7, CIC, MEDCOM, PMIP	HL7, ASTM, ADT, LDT, XML, Edifact, etc.
SMS, SAP, KIS, GWI, GSD, BOSS	Dataplan, BOSS, SMS Clinicom, SAP, RKD, RZV, ROKD, MGM, GWI	McKesson, Epic, Siemens, Cerner, IDX, Eclypsis, iSoft, others	All interfaces in HL7, SQL-Net-format possible, specific interfaces on request
200+	450+	650+	300+
Yes/Yes	Yes/No	Yes/Yes	Yes/Optional
Yes	Yes	Yes	Yes
Yes with Partner	Yes/Yes	Yes/Yes	Yes/No
No/Not specified	No/Yes	Yes/Yes	Yes/Yes
Yes/No	Yes/No	Yes/No	Yes/No
Yes	Yes	Yes	Yes
No	Yes	Yes	No
Yes	Yes	Yes	Yes
Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Yes/Yes	Yes/Yes	Yes/Yes	No/Optional
Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Yes	Yes	Yes	Yes
Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes	Yes/Yes/Yes
All major suppliers	130+/450+	1,500+/1,500+	All major suppliers
All major suppliers	130+	1,500+	All major suppliers
Multilevel user password, user ID	Multilevel user password, user ID	Multilevel user password, user ID	Multilevel user password, user ID
3 days in-house, 3-10 days on-site	Training and consulting through lab doctors and med tech assistants	Hands-on classroom, on-site programs, Web conferences, user documentation, self-paced online training and user group meetings	Yes, modular training concept, context-sensitive online-help available, user group meetings
HP, IBM, Acer, Sun	iSOFT (optional)	Compaq/HP	Hardware supplier
Not specified; Microsoft Partner	iSOFT (optional)	Mysis	Sysmex
Data warehouse for LIS, order-entry system for LIS, result reporting system for LIS	HIS, RIS, radiology ward communications, patient/diagnosis management, cost performance, performance measure, other	Financial, integration services, consulting services, clinical information system, pharmacy, decision support	Electronic order entry and result reporting system ECLAIR - Lab communication server. Management database for statistical purposes
24/7 service	Meets requirements of German DGTI, Swiss QUALAB, and general standards of communications; other information systems available	Nationwide networking; systems software/hardware support and service; integrated with financial systems, information support systems, others	24/7 support available. Integrated workflow manager. MOLIS database replication system to backup-server under LINUX. Multi-language support. Integrated multi-client system for private, hospital and healthcare networks. Integrated DRG management

	ECRI-RECOMMENDED SPECIFICATIONS	SIEMENS	CERNER
MODEL	**LABORATORY INFORMATION SYSTEMS**	**Siemens NOVIUS Lab**	**PathNet**
NUMBER OF USERS SUPPORTED		1-500	5-600+
SYSTEM CONFIGURATION			
Hardware and software		Yes	Yes
Software only		No	No
Hardware platform	No preference	HP Alpha, IBM pSeries, IBM-compatible Pentiums (clients)	IBM, PCs, HP/Compaq
Operating systems	No preference	UNIX, AIX, Windows XP/2000 (clients)	OpenVMS, AIX, Windows NT
Program languages	No preference	C, C++	COBOL, C++, Visual Basic, C, Java
Database management	No preference	Sybase, ASE 12.5	Oracle
Storage media	Hard drive, optical disk	Hard disk, tape, SAN	Optical disk, hard disk, DAT, tape
Peripheral devices	Printer	Laser printer, bar-code readers, fax modem, pen-based systems, bar-code printer	Laser printer, fax modem, bar-code devices, handheld devices, remote printers
NETWORKING			
Architecture	Ethernet, TCP/IP	Client/server, thin client, 3-tier	Client/server, distributed, Citrix
Communications protocols		TCP/IP	Ethernet, TCP/IP, FDDI, DECnet/LAT
ASP CAPABILITIES	Optional	Not specified	Yes
WEB-BASED CAPABILITIES		Not specified	Yes
MULTIPLE SITES SUPPORTED		Yes	Yes
STANDARDS SUPPORTED		ANSI, ASTM, HL7, NCCLS	ANSI, ASTM, HL7
HIS INTERFACES		Can interface with any HIS[2]	All major HIS suppliers
NUMBER OF DIFFERENT LAB INSTRUMENT INTERFACES		200+	300+
SOFTWARE			
• CLINICAL FEATURES			
General lab/ Anatomic pathology	Recquired/ Optional	Yes/Optional, third party	Yes/Optional
Blood bank		Optional, third party	Optional
Transfusion/ donor	Optional	Optional, third party	Optional/Optional
Cytology/ Phlebotomy	Preferred/ Recquired	Optional, third party/ Yes	Optional/Handheld option
Microbiology/ Telepathology	Preferred/ Optional	Yes/No	Optional/Optional
Specimen tracking	Preferred	Yes	Yes
Instrument maintenance scheduling	Optional	No	No
Ad hoc reporting	Optional	Yes	Yes
• MANAGEMENT FEATURES			
Bar coding/ Billing	Preferred/ Optional	Yes/Optional	Yes/Yes
CAP workload/ LMIP	Optional/ Not specified	No/Yes	Yes/Optional
Cumulative QC/ Delta checks	Preferred/ Preferred	Yes/Yes	Yes/Yes
Inventory control/ Ad hoc reporting	Optional/ Optional	No/Yes	Optional/Optional
Outreach services			
Billing/ Remote ordering	Optional/ Optional	Optional/Optional	Optional/Optional, Web
Remote results reporting		Yes	Yes/Optional, Web
Direct printer/ Fax/ Modem		Yes/Yes/Yes	Yes/Yes/Yes
Number of HIS interfaces			
Order entry/ ADT	Not specified/ Recquired	138/138	500+/600+
Result reporting	Recquired	138	250+
DATABASE INTEGRITY		Full transaction logging	Full transaction logging
SYSTEM SECURITY		Multilevel user password, user ID	Multilevel user security[3]
TRAINING PROGRAM	Yes	2 weeks, included in purchase price	Varies
SERVICE PROVIDER			
Hardware		HP, IBM	IBM, Compaq
Software		Siemens software support	Cerner
OTHER INFORMATION SYSTEMS AVAILABLE		Financials, HIS, pharmacy, radiology, materials management, clinical rules, EMR, imaging, cardiology	Pharmacy, radiology, nursing, surgery, cardiology, patient management, respiratory therapy, oncology, order management, resource planning, access management, others
OTHER SPECIFICATIONS		Client/server architecture; multitasking; open-system architecture; scalability	Multifacility health network architecture; patient-focused decision-support system; computer-based patient record; physician applications; 3-tiered client/server architecture

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A UNIFIED SYSTEMS ENGINEERING METHODOLOGY FOR TRUSTWORTHY SYSTEMS

Formal models help, but the essence is formalised thinking

In our increasingly interconnected world, we also depend to an ever-growing extent on sophisticated technological systems in our everyday environment. While it used to be enough to be a skilled and experienced practitioner, today our work is determined more and more by using sophisticated systems as tools to provide us with instant information and allow us to achieve results that were beyond reach just a few decades ago. While our skills are still important, such systems are no longer just tools but an integral facet of our lives and working environment. We depend on it every second and such systems must not only work as advertised; they must be robust, safe and secure as well. Not only are lives at stake; liability claims loom around the corner as well.

Are engineers ready for the task?

AUTHOR
Eric Verhulst
is director of the Open License Society.
More information at www.OpenLicenseSociety.org

Why projects fail

As our systems grow in complexity, so does the software content. And software engineering as such is not yet a fully mastered discipline. According to the now-famous CHAOS studies of The Standish group, about half of all IT development projects still have serious problems although the success rate has been improving over the last decade.

Today, 15% still fail completely while 35% are over time, over budget or lack critical features and requirements. The reasons remain the same: not enough effort is spent on analysing the stakeholder's requirements and formalising them in implementable specifications. This is the human factor becoming apparent. In software intensive systems, the issue is state space explosion and the ensuing application of Murphy's Law - when things can go wrong, they will. It is just a matter of time. No testing will ever reveal all errors, as testing itself could take longer than the lifetime of the system.

Small is beautiful

When things get too complicated, it is time to apply the principle of Occam's Razor – named after the 14th-century English Franciscan friar and logician, William of Ockham: cut away all ballast. From an architectural point of view, this also means that we work with smaller units as trustworthy components. There is then no need to export the full internal state space to the whole system if each component can be accessed with a simple protocol. This should also be reflected in the project planning. Rather than trying to develop it all at once, the project manager should introduce small tasks with short-term milestones and work in iterations by introducing well defined and clean interfaces between the components. This is also what the Standish Group found. The total failure rate went down from 30% in 1994 to 15% today, because projects were split into smaller sub-groups and tasks, while the classical waterfall method was replaced by an evolutionary approach.

Prevention, rather than testing and correction

Another major difference between software engineering and most other engineering disciplines is that software is still largely a craft. This is reflected for example in the fact that mathematical tools, called formal methods in this domain, are barely used unless safety is a critical issue (e.g. for the development of an airplane or medical device). This is a bit astonishing as software can be made perfect if it is running on an error-less

piece of hardware. Hardware has bugs that are even visible under a microscope. When software fails, it is either a hardware bug or a software design error. A methodological process can prevent such errors or at least reduce them to a fraction of what is common practice (a few errors for each 1,000 lines of code). Testing is now too often used in the hope of finding such software design errors (erroneously called bugs), while it is mathematically sure that testing will never find all these errors. Testing should be reduced to confidence testing only - just like construction engineers, who do not use testing to find their design errors.
How can this be achieved?

A unified systems engineering process

The key to a successful systems engineering process can be summarised in a single word: consistency. What it means is that is that we must take into account that developing a system is an activity carried out by human beings for human beings, with all their differences and limitations. The major limitation is that we are all individuals speaking our own "language". Often this means that we all use different terms for the same thing, because in each domain the terms have their specific context. This can only be overcome by intensive communication and by defining a unifying "systems grammar". In other words: teamwork by people of complementary skills and defining a common vocabulary for all activities in the systems engineering process. It starts by collecting requirements from all stakeholders. Next comes an activity whereby these requirements are translated in measurable specifications and system components. Today, this also means simulation and modelling to verify that all selected requirements are consistent and complete. Actually when developing a system, we have to consider the 'operators' as well as the 'environment' as part of the system under development. Simulation can also help to validate the feasibility. Formal modelling helps in proving that the used algorithms are correct but also that the architecture is right. And finally, when all these design activities are complete (this means after a number of iterations), then we need a runtime environment that speaks the same language. At Open License Society we believe that all systems can be expressed as a set of "interacting entities"; hence we need a runtime environment that supports it. The result is a process oriented programming model. In the ideal case, the source code is generated, not written.

Our test case: developing a network centric real-time operating system

In order to test this model, Open License Society used it own approach to develop its own supporting toolset. First, a systems grammar was defined and a Web-based supporting tool for collecting requirements, specifications and architectural elements. This environment was applied first to the development of OpenComRTOS (OpenCom Real-Time Operating System) as the future runtime layer. Before any line of code was written, its design was carried out from a blank slate while applying the Leslie Lamport TLA/TLC formal model checker (Temporal Logic of Actions/Temporal Logic Checker). For months, a team composed of a systems architect, a software engineer and a formal modelling engineer worked closely together. Starting from a very abstract and incomplete model, several tens of successive modelling stages resulted in a code that was written and running in a first version in just two weeks.

Several lessons were learned along the way. The first is that formal techniques do not really prove that a software works correctly and is wholly error-free. It can prove that the formal models are correct, and hence a matter of correctly mapping the architecture into source code and using a trusted compilation and execution environment. The major lesson, however, was that the approach also results in much more efficient and robust architectures (e.g. the resulting code could be reduced to less than 1 Kbyte for single processor nodes and less than 2Kbytes for multiprocessor nodes). This is an improvement of a factor 10 to 20 versus a similar RTOS (Real-Time Operating System) that was developed by the same architect ten years ago. In addition, the resulting design has several important improvements for security and safety (e.g. buffers free from overflow) and for predictive real-time behaviour.

What are the lessons and benefits?

On the engineering level, the lessons are a bit counter-intuitive. All engineers have been educated as specialists with a single goal - to produce better and cheaper products. However, this has been proven to be just an extension of craftsmanship. It is valid when the domain remains very well confined and when new designs are gradual improvements of existing designs. Our mind is good at this because it requires heuristic experience and it provides us with a road of lesser effort.

Today however things change too fast and systems are increasingly complex and have multiple subsystems coming from different domains. To still achieve the goal of efficiency, this requires more than reuse, it requires re-evaluating existing solutions and rethinking them anew, looking from a different perspective. This was, for example, the case of OpenComRTOS - resulting in a dramatic improvement, even in a well-established domain. Formal modelling helped precisely because it allows to reason at a much more abstract level, without reference to the implementation domain. Hence, generalisation is the key. The project also clearly showed the limits of the human brain, at least for systems engineering. It was almost shocking to discover how much our thinking can be biased by what we know and how hard it was to make the switch to more abstract thinking. This is certainly an area that deserves more research.

Finally, the benefits are evident but must be measured in the long term. They come down to having more trustworthy components to build new systems from, but with higher quality (robustness, safety, security). This approach also has the benefit of reducing the development cycle, reducing the failure rates and redesign costs. In the end, the benefits are financial. Less money will buy us more if we not only correctly develop the right stuff, but also if we develop the right system - which is where it all started anyway.

IT PROJECTS

Less Chaotic But Pitfalls Remain

The Standish Group's latest CHAOS study shows a considerable improvement in the success rates of IT projects, compared to its first study 12 years ago. That study, in 1994, became a well-known warning to IT managers, to brace themselves for a hard landing with more than eight out of 10 large-scale projects.

The new survey finds that 35 percent of software projects begun in 2006 were "successful" - completed on time and within budget, and in conformity with user requirements. This is more than double the success rates from the 1994 Standish investigation, when the corresponding figure was just 16.2 percent.

In parallel, the 2006 study shows that outright failures dropped to 19 percent, compared with 31.1 percent in 1994. Meanwhile, so-called 'challenged' projects – which had cost/time overruns or failed to fully meet user requirements, declined from 52.7 percent in 1994 to 46 percent.

The reasons cited by The Standish Group for this turnaround are better project management, iterative development and the emerging Web infrastructure.

The Standish SURF database, which is the source for its CHAOS statistics, holds data on more than 50,000 projects from around the world.

Although widely cited, the findings of The Standish Group have drawn criticism from some quarters. One of the most outspoken is Robert Glass, an author involved in IT industry and academia for more than 45 years.
Glass does not subscribe to what he dismisses as current 'software crisis' thinking, and has pointed out that researchers seeking to clarify findings from The Standish Group (in terms of the methodologies used) have been routinely rebuffed. Above all, Glass takes serious issue with the value of using old data.

Another study, from Simula Research - 'How Large Are Software Cost Overruns?' - compared CHAOS with other sources, and found that the outcomes differed greatly from the former. The Simula team also drew attention to a sentence in the Standish 1994 report which suggested that the findings might have been biased from the outset toward failure.

Glass will, no doubt, be heartened by the latest study.
However, it is still too early for healthcare IT managers to put their terminals on standby and take a much-needed break. One of the most ambitious IT projects in the world, a GBP 12 billion programme to overhaul the British National Health Service, is reported to be in considerable difficulty. In February, Andrew Rollerson, a senior IT consultant involved with the programme, said it "wasn't working" and was in danger of delivering a "camel rather than a racehorse". The key reason: small-scale project management techniques were clearly inadequate, in the face of the demands from the programme. (TS)

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SNOMED CT®

Enabling Semantic Interoperability Through Clinical Terminology

AUTHOR

Theo Bosma
is Vice President of Global Sales at Health Language, Inc., which services the worldwide healthcare industry through innovative software infrastructure technology and expertise.

For cited references, please contact office@hitm.eu

Semantic interoperability is the latest buzzword in the worldwide healthcare information realm. As a way to standardise clinical terminology, it seeks to ensure interoperability in an Electronic Health Record (EHR) by reducing variability in the way data is captured, encoded and used in patient care and medical research – a situation with special significance for cross-border, multilingual environments like the European Union.

Some countries believe that semantic interoperability is a strategic imperative for the coming years, whereas others are still trying to discern what semantic interoperability truly represents and whether it is necessary – either now or in the future. This article delves into the various meanings ascribed to semantic interoperability and details scenarios on how one can achieve it through clinical terminologies.

What is semantic interoperability?

Selvage, Wolfson, Zurek and Kahan (2006) tell us that semantic interoperability indicates that the meaning of data can be comprehended unambiguously by both humans and computer programs, and that the information can be processed in a meaningful way. Aguilar (2006) informs us that semantic interoperability defines the ability of information that is shared by systems to be understood at the level of formally defined domain concepts, so that the information can be processed by the receiving computerised systems. It is essential for the development of automatic computer processing for healthcare applications and decision support systems. Mead (2006) states that semantic interoperability guarantees that the meaning of a structure is unambiguously exchanged between humans. Documents such as progress notes, referrals, consults and others rely on the specificity of medical vocabularies and common practice to guarantee semantic interoperability at a clinician-to-clinician level.

So, why is semantic interoperability important? In today's world, global business is booming and, thus, sending people to live and work in multiple countries is becoming a common business practice.

These people are confronted, on a day-to-day basis, with different languages, cultures and healthcare practices. Suppose that Mr. Smith, who lives in the UK, is assigned to a project in Spain for two years. Mr. Smith's patient record is located on a computer somewhere in a hospital in the UK in the English language. Mr. Smith, who now lives in Spain, is involved in an accident and breaks his right leg. Mr. Smith is hurried to the nearest hospital. Today, the Spanish hospital would probably not be interoperable at any level with Mr. Smith's UK hospital. In other words, there is no possibility of retrieving Mr. Smith's patient history. Conversely, if these hospitals were interoperable in a semantic fashion, they would be able to retrieve Mr. Smith's patient history in Spanish with standard clinical terms.

Mead states that data is not semantically interoperable from a computational perspective unless all systems are informed of the semantics of the specific tag set before receiving the data. According to Mead, any set of locally defined XML tags, such as metadata, can be easily transmitted between machines and rendered in virtually any operating environment through the use of Web browsers, thus providing an apparent demonstration of semantic interoperability. However, if the tag set was initially locally defined, its semantics most likely will be either unknown or in conflict with other locally defined tags on a receiving machine. For Mead, semantics is meaning (versus syntax, which is structure). He illustrates the difference between the two concepts by setting forth the following sentences as an example: "The patient was given pain medication" vs. "The patient was given medication for pain." The two sentences obviously do not have the same syntax. Depending on your level of clinical experience, they may or may not have the same meaning. The example illustrates that syntax alone is often not a reliable determinant of semantics.

> "The patient was given pain medication" vs. "The patient was given medication for pain." ... Depending on your level of clinical experience, they may or may not have the same meaning.

Currently, several countries are looking at SNOMED CT® (Systematized Nomenclature of Medical Clinical Terms) for a specific tag set as a foundation to semantic interoperability. Van Beek (2006) informs us that SNOMED CT® enables

interoperability, i.e. it allows data to be exchanged between systems and to be interpreted automatically according the meaning of the encoded clinical data, regardless of the technology used. Without standardisation, custom interfaces and other workarounds become necessary. An even greater barrier occurs when the clinical information remains locked within textual statements that cannot be fully interpreted by a computer. This makes sharing, comparing, and retrieving patient or population-based data within and among different settings and information systems difficult at best and error prone at worst (Van Beek). In Mr. Smith's scenario, the SNOMED code for a broken leg is the same in both the English and Spanish versions of SNOMED. However, in the clinical information system, the clinician in the UK would see "broken leg" and the clinician in Spain would see "pierna rota."

Standardised clinical terminology is the key component to ensuring interoperability in an Electronic Health Record (EHR).

The evolution of clinical information systems has progressed rapidly. The first stage was to convert from paper-based information systems to computerised clinical information systems. Many major hospitals are taking that one step further with the implementation of next generation Electronic Health Records (EHRs).

On a broader scale, governments and organisations like the European Commission are evaluating clinical terminologies to yield semantic interoperability in a region, country or cluster of countries. In fact, the National Programme for IT in the UK stated that the use of SNOMED CT® would be a mandatory element of their interoperability efforts. To achieve that objective, Health Language, Inc. was asked to supply the tools and content to achieve the desired semantic integration with the clinical systems suppliers.

Schwend, President and CEO of Health Language, Inc., stated (2006) that the UK has established the most comprehensive healthcare IT (HIT) system under development. This system includes an integrated care record service, an electronic appointment system and an electronic prescription transmission service that will be accessible to all major healthcare providers by 2014. Schwend added that Australia, Canada, Germany, Norway and the UK all began their HIT with fragmented and incremental processes that lacked interoperability. They realised the need for a national standard and mandates to move forward. Governments are also now using public funds as incentives to encourage providers to rapidly deploy HIT. In the U.S., President Bush is trying to motivate the industry to move in the right direction, while several European countries have already received their marching orders.

It is now up to the hospital information systems suppliers to make their systems compatible with clinical terminologies like SNOMED CT® . One option for healthcare organizations in their goal to attain semantic interoperability functionality is to evaluate Health Language, Inc., the world's leading manufacturer and marketer of language engine technology, which is designed to automate the incorporation of controlled medical vocabulary and coding standards into healthcare IT applications.

The flagship product, Language Engine (LE), provides all of the terminology needed to practice, communicate, document, and analyse in the modern world of electronic healthcare. LE is a database of medical terms that functions beneath an existing electronic medical records system to integrate patient medical data on an enterprise-wide basis. It creates a "master-catalogue" of common terms for medical professionals and researchers throughout the healthcare industry. On the clinical side, LE helps to eliminate errors, confusion and ambiguity that arise in clinical documentation, as well as address risk management issues by bringing consistency to patient care. In today's world of national e-Health initiatives, there is an ongoing need for applications to access standardised vocabularies for administrative and specialty systems. LE's aligned data model allows one to logically incorporate all of the terminologies in an enterprise, while providing tools that facilitate mapping of proprietary, local content. Such custom modelling allows users to continue to use the terms and codes they prefer, while aligning the data captured to a reference standard. Given the disparate information systems utilised by healthcare providers, interoperability through standardisation is essential for any exchange of information.

In conclusion, standardised clinical terminology is the key component to ensuring interoperability in an Electronic Health Record (EHR) by reducing the variability in the way data is captured, encoded and used in patient care and medical research. At this time, we cannot yet close the door and throw away the key. There are still barriers that prevent widespread adoption of this critical technology that engenders systems interoperability and the sharing of data to facilitate effective communication within and across healthcare settings. These barriers include:

+ Many healthcare facilities have limitations on which aspects of information they can electronically exchange within their facility or with other facilities.
+ There is a lack of electronic patient record information, which impedes the deliverance of quality patient care.

Nonetheless, we are making progress in many areas. An increasing number of governments, hospital information systems suppliers and hospitals have declared semantic interoperability as one of their strategic imperatives for 2007.

A growing number of countries are now also organising awareness programs around clinical terminologies and semantic interoperability. Hospital universities are inviting subject matter experts to share their knowledge and experience so that future clinicians are not new to the subject when they begin their work in the field. These combined efforts will result in the realisation of improved patient care on a global basis.

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HIN TRAILBLAZER

Israel's OFEK Network

For medical practitioners, missing clinical information is as much an everyday nuisance as hard reality. Current efforts to create health information networks (HIN) seek to directly tackle this problem. However, with a handful of exceptions, progress has been uneven. It may be several years before technically integrated, seamless and comprehensive networks emerge on a meaningful, global scale.

Today, Israel hosts what, by several measures, is one of the world's first integrated HINs.

Known as the Ofek Network, it extends to a total of 5 million people at 16 hospitals (8,100 beds) and 1,300 clinics with over 9,000 users. The figures are impressive: every year, users consult about a million patient records (corresponding to over 15 million pages of information) with average response time of below 10 seconds. Ofek is growing and is likely to provide comprehensive national coverage across Israel in the near future.

Ofek's roots date back to 1999, when Clalit Health Service, Israel's largest HMO (with 14 hospitals and 3.8 million customers) began development of a Regional Health Information Organization (RHIO).

Clalit's challenge was a familiar one for healthcare IT managers across the world. Its patient data and medical information systems were disparate and heterogeneous. It had no fewer than 25 separate legacy systems for different facilities (lab, operating theatre, radiology, pathology, document management etc.).

Clalit began with a set of key objectives: a robust, user-friendly system providing access to a completely integrated medical record at point of care, in real-time, with strict security and privacy. On the technical side, it sought to define a minimal dataset to support sharing a patient's available medical information, a drill-down capability to the data - alongside a decentralised structure which maintained data in originating systems. The latter factor in particular addressed a major concern of IT managers everywhere – to avoid replacing existing systems. A further requirement was future-proofing: the RHIO would be upfront designed for scalability and flexibility to enable growth.

Clalit's RHIO objectives were buttressed by a clinical data integration pilot project at an affiliated facility, the Soroka Medical Center. Soroka shared the same strategic approach but had already implemented technology from Israeli medical informatics provider dbMotion to achieve its goals.

dbMotion's electronic health record (EHR) solution consisted of a Web-based product with no central database, no requirement to replace existing information systems, and no disruption to workflow during implementation. In essence, what it created was an EHR comprised of virtual patient objects, which aggregated information from disparate systems in different locations in an on-demand basis. The solution also featured additional functionalities such as patient-centric messaging, alerts, notifications, tracking logs, and auditing.

The dbMotion architecture was also proofed against any single point of failure in the network - allowing the system to function if a facility went offline (while indicating this clearly to a user/caregiver), and accommodated Clalit's privacy, security and performance requirements (turnarounds to queries in less than 10 seconds).

Crucially, implementation turned out to be transparent, straightforward and rapid (less than 12 months), with minimal training due to its Microsoft Windows functionality.

The Soroka pilot was extended across the entire Clalit HMO to create the Ofek network. In turn, Ofek's success has snowballed, to include two large government-owned facilities, Sheba Medical Centre and Rambam Medical Centre. This was accomplished in both cases in 3-4 months.

While the dbMotion solution is under implementation in the US and Europe, the Ofek network's success has led the Israeli government to consider creation of a national health information record to cover all its citizens, based on an RFI which uses Ofek as a template.

A COMPLEX CHALLENGE

The HIN challenge has both hard and soft facets.

The former consist of technology issues. These pertain principally to the integration of disparate IT systems, set up and developed over different time frames – usually on an ad-hoc (and often undocumented) basis. They are incapable of not only communicating with the world outside, but frequently also between different departments of the same hospital.

The second facet of the challenge concerns sensitive, complex questions about security, ethics and privacy, strongly embedded in local cultural contexts.

REDUCING SECURITY RISKS TO E-HEALTH

AUTHOR
Blake Suthherland
is vice president of product management at Third Brigade.

Excitement about the promises of e-Health is tempered by growing apprehensions about security. A hospital typically contains a vast panoply of computer systems and hundreds of software applications. Together, they are core to the provision of healthcare in the modern age. So far, however, much of this IT infrastructure has been confined within the physical limits of the hospital, and the electronic exchange of patient and other data with the world outside has been maintained within dedicated networks. e-Health necessitates both a sharp rise in such exchanges and a breaking down of the walls, in order to permit remote access. Will this result in an increase in unwelcome intrusions?

In Europe, the EU-supported e-Business Survey 2006 found that security was viewed as the key hurdle to e-business applications in hospitals, far higher than in other sectors.

The New Threat

Until recently, attention-seeking hackers were the main IT security threat to businesses, including healthcare organisations. These types of mass attacks often had no particular target in mind; they would simply seek out vulnerabilities in one system, exploit them – and move on to the next.

Today's attackers, however, increasingly target specific organisations. Motivated by profit, revenge, and perhaps terror, they have the potential to seriously disrupt operations. While some attackers may be faraway, faceless strangers, others may lurk in your midst. There is a significant risk from insiders—employees, contractors, and consultants—who easily bypass perimeter security and other traditional solutions. Just a few years ago, healthcare facilities were rarely objects of attacks, but have recently become prime targets. Hospitals, clinics, and medical group practices all contain large amounts of valuable data—not just confidential patient information but also financial and personal data about employees, insurance companies, suppliers, and partners—making them appealing to attackers interested in financial gain. A new form of fraud called medical identity theft is on the rise, with 250,000-500,000 victims in the US alone, according to a November 2006 Readers Digest report.

Now that most healthcare organisations have strong perimeter defenses, including network firewalls, user authentication, configuration management and data encryption, attackers have set their sights on the next most vulnerable part of the system: software applications.

Applications — At the Core of Modern Healthcare

Healthcare organisations increasingly rely on computerised e-Health systems and software applications. Large hospitals often have tens of thousands of such systems, ranging from X-Ray and magnetic resonance imaging (MRI) machines to portable bedside monitors, wireless/telemetry monitors, clinical systems, wireless PCs, and enterprise servers.

Each system contains custom software applications, which in turn rely on common commercial off-the-shelf (COTS) operating systems and applications.

Without these systems, healthcare facilities cannot reliably provide the high-quality services they and their patients have come to expect. And yet it is also important to recognise the risks they introduce.

Why Are Applications Vulnerable?

When dealing with applications of any complexity, it's all but impossible to write perfect code. Electronic health or medical records (EHRs/EMRs), for example, are complex systems that typically consist of an operating system, a database, a Web server, an application server, and the EHR/EMR application itself.

All told, there can be a hundred million lines of code and as many as 150,000 defects open to exploitation by an attacker. While not all will be critical vulnerabilities in environments employing sound security practices and procedures, the final count of numbers can still be staggering.

Another reason for the vulnerability of applications is that they are increasingly designed to be remotely accessed by system administrators, medical professionals, healthcare partners, and patients via the Web. While Web-based applications offer convenience, efficiency, better service, and savings, they also fundamentally increase the risk because of their accessibility.

The Consequences of an Attack

An attacker who successfully exploits a vulnerability in an application can quickly and significantly affect a healthcare facility in various ways, including disrupting critical services (such as, for example, an operating room), stealing data

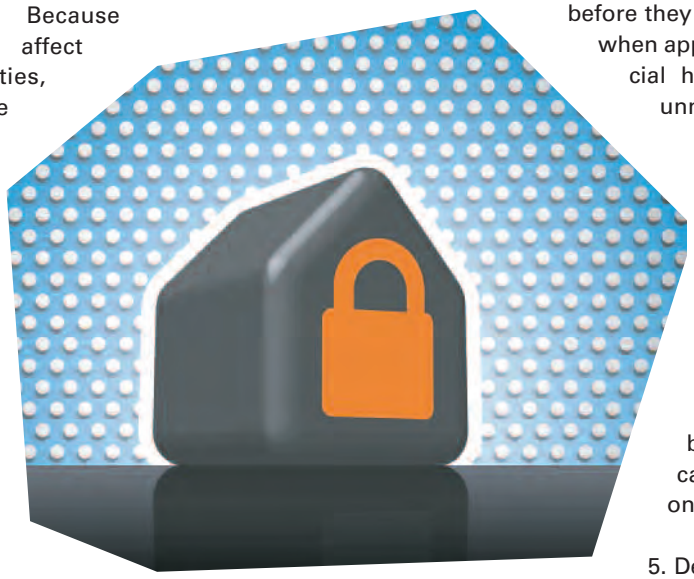
and identities and using them for illicit purposes. The fallout from these attacks could be devastating, in terms of quality of care, financial losses and legal consequences – above all, in terms of compliance and notification.

Current Security Approaches Are Not Adequate

Although healthcare organisations have done much to strengthen their security with numerous perimeter defences, many such measures do not provide adequate protection because application vulnerabilities allow them to be readily bypassed. Attackers have set their sights on applications (or vulnerabilities within the applications) and have repeatedly proven that they are an effective way of compromising a system.

While patching software vulnerabilities remains a key security priority, it's a race that can't be won. Beyond perimeter defences, many healthcare organisations rely on patches—fixes provided by software vendors that address specific vulnerabilities. However, the time between publication of a vulnerability and the malicious code that exploits it has narrowed sharply—from months and weeks to days. In some cases, attacks occur before the vulnerability is even discovered or announced (so-called zero-day attacks).

Meanwhile, the time to create patches and distribute them remains relatively fixed and dangerously long because they need to be tested, installed, and scheduled to minimise disruption. Because deploying patches can affect manufacturer warranties, many medical devices are left unpatched for long periods of time.



It Is All About Risk Management

Unfortunately, it is not possible to eliminate all sources of risk. The key is to determine what level of risk is acceptable and then manage the risks through cost-effectively implementing security processes and technology. With respect to risks posed by software vulnerabilities in e-Health systems, organisations should ensure they incorporate the following into their risk management strategy:

1. Application Vulnerability Assessments

An application vulnerability assessment helps determine system vulnerabilities. It can require as little as a day using special software to systematically test for thousands of known vulnerabilities - or up to several weeks involving a qualified security tester. Findings are categorised and prioritised by degree of severity and assessments repeated periodically to look for new vulnerabilities.

Steps in Risk Management

Perform Application Vulnerability Assessments
Demand Better Accountability From Your System Vendors
Harden your Systems
Deploy Security Patches
Implement a Defence-in-Depth Strategy

2. Better Accountability From System Vendors

Reporting results of the above assessments and asking vendors to disclose vulnerability information provides information to better protect assets; it also causes vendors to acknowledge awareness of potential flaws and compels them to take more care to reduce vulnerabilities in their products.

Healthcare IT managers should consider participating in initiatives like the e-Health Vulnerability Reporting Program (www.ehvrp.org), which strive to ensure greater security of e-Health systems.

3. Hardening Systems

Ask software and system vendors to provide application hardening recommendations and take steps to implement them. This could be as simple as changing the default configuration on "black-box" systems before they are deployed or be more involved when applications are installed on commercial hardware, to identify and disable unnecessary services.

4. Security Patches

Since attackers regularly attempt to exploit known vulnerabilities, ensure the deployment of vendor-approved security patches in a timely manner. Also ensure your software and system vendors provide appropriate vulnerability/patch information so that you can make informed decisions based on risk.

5. Defence-in-Depth Strategy

Defence-in-depth is a common security strategy that promotes the use of multiple protection techniques to mitigate the risk of one component being compromised or rendered ineffective. When vulnerabilities exist and patching is not an immediate option, utilising security control technology, such as Host-based intrusion prevention, will shield the application until it is patched.

While the complexity of e-Health systems, software, and applications will continue to present a daunting security challenge for many, following these security guidelines will help healthcare providers significantly reduce the risk of an attack, enabling hospitals and medical centres to deliver on the promise of lower costs and higher quality care.

BENEFITS OF OPEN SOURCE IN HEALTHCARE

Open source software has been on the rise for more than 15 years now in the general software space but it hasn't really taken off the same way in healthcare. Healthcare software, which is very specialised and generally considered a small market, has remained primarily proprietary and closed source but there are many benefits for health IT vendors to opening up the source code in their software.

AUTHOR

Shahid N. Shah
is CEO of Netspective Communications, a software consultancy specialised in delivering custom healthcare software solutions.

The Benefits of Open Source

Visibility: If a vendor open sources its software, its visibility will be increased because it's not proprietary and the press, competitors, partners, etc will all talk about it without thinking they are promoting a specific company.

Ubiquity & Ecosystem: Open sourcing can create almost unstoppable power as it picks up rapid momentum, and establishes a real self-sustaining ecosystem. Mindshare is paramount and publicity matters so the visibility helps create an ecosystem around it. Other competitors and partners can be encouraged to build products around newly open sourced software without fear. If a vendor approaches the strategy properly, the software becomes ubiquitous without spending millions on marketing.

Consulting, Training and Education: If a vendor open sources software, it will be discussed in classes and can be used to develop best practices around the software.

Design Discipline: All future changes to open source software would be public and open to the community – it will create a design discipline that will help establish credibility and ensure utility for a long period.

Building a Community: Vendors can start having real conversations about their products by open sourcing. They can engage a broad group of users, developers, partners, and even competitors.

Design Help: By opening up software, vendors can have other companies help design future improvements and updates to something that they started. Improvements can come from anywhere if that's something they want to foster.

Guidance for a Proprietary Version: If vendors want both a "community version" and a "proprietary version" then they can use the community version to help define and fine-tune the proprietary one. This is a very powerful way of using the "Freemium" business model where they offer a free version that anyone can use and a "premium" version that they control.

Risk Reduction: By open sourcing, vendors help spread and share out the risk of further development and testing. If there are any issues in the software, the community can help find them and correct them.

Commoditise Competition: If there are any competitors that a vendor wants to impact they can commoditise their competitors' products by open sourcing and having everyone build on their standards instead of their competitors'.

GETTING STARTED WITH OPEN SOURCE

1. Choose to do it.
2. Consider what the business goals are for open sourcing – market growth, competitor commoditisation, etc., and if possible come up with metrics to see how to achieve those goals (goals should be realistic and measurable).
3. Choose a "Community Manager" within the company that will manage the move from internal proprietary to external open source.
4. Choose an executive that will make decisions about approving open source activities.
5. Budget the resources necessary.
6. Pick a license model - getting the legal aspects right is challenging but very doable.
7. Prepare source code or algorithms for open sourcing (look for other IP or code you rely on and make sure it's friendly to open source).
8. Create a website to promote the open source product (there are many existing ones).
9. Create a PR campaign around the open source strategy.
10. Create buzz within the open source community and have them publicise the strategy for you.
11. Work with other open source projects to see if there is a way we can implement your IP with theirs.
12. Create a partnership and promotion strategy to encourage use of the open source code in other products.

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IMPLEMENTING

Over the past three decades, the pharmaceutical and biotech industry have incorporated numerous electronic data systems, including large biological databases, chemical inventory and registry systems, workflow and LIS/LIMS systems, and more recently Web-based enterprise applications that require minimal IT support. One basic tool that has not yet received as broad acceptance is the Electronic Laboratory Notebook (ELN). One oft-repeated reason for this reluctance is the laboratory notebook's role as a depository of R&D information and results, and the legal implications of the latter. However, as James Rizzi argues in this article about the use of ELNs by his company Array BioPharma, the legal system needs to adapt to wider changes across society accompanying the use of IT.

AUTHOR

James Rizzi
is Director, Computational Technology, at Array BioPharma, a biopharmaceutical company focused on the discovery, development and commercialisation of orally active drugs to address significant unmet medical needs.

As such, the notebook is frequently a source of evidence in IP (intellectual property) litigation. Legal battles holding millions of dollars in sway have been won and lost on information stored in notebooks - for example, in cases where the first party to make an invention is at issue. With the potential of so much riding on an organisation's ability to prove in a court of law the timing, nature and scope of their R&D efforts, it's understandable why there has been such caution. The paper notebook has been a reliable and trusted source of evidence backed by voluminous legal precedent for protecting IP; this is not yet the case for ELNs. However, over the past five years, as society has embraced electronic technologies, our legal system also needs to embrace it and ELNs have now started to infiltrate the pharmaceutical industry in a large way.

ARRAY'S DECISION ON ELN: MOTIVES AND ORIGINS

In 1999, our biopharmaceutical company, Array BioPharma made a corporate decision that chemistry-based data should be captured electronically. Biology-based data was already captured in commercially available database programs, but valuable chemistry knowledge was still confined to the individual chemist and their recollection. Over time this information was lost either due to attrition or just plain forgetting. To overcome this, Array planned to incorporate an ELN specifically for chemists: one that would replace the standard paper notebook and, most importantly, be electronically searchable across the organisation.

At the time there were essentially no products available on the market. That left two possibilities: design, create, and implement an ELN from scratch using our own internal resources or collaborate with a vendor. The former option ensures that the product will be custom-designed to meet our needs, but wastes time and money on creating a product that is outside a pharmaceutical company's core business. Therefore, Array decided to collaborate with CambridgeSoft to develop a chemistry-based ELN. Array provided input into the early design of the product and CambridgeSoft received an enterprise ELN they can market that was directly related to their core business. Today, there are many more vendor options

A SUCCESSFUL CULTURAL CHANGE

Strategy for the Implementation of Electronic Laboratory Notebooks

available for an organization to consider when selecting an ELN.

COORDINATION WITH LEGAL TEAMS, THE NEED FOR A PHASED APPROACH

With about six years of ELN use under our belts, a number of lessons have been learned. First, it is important for the legal department to be intimately involved in the ELN selection process and in establishing, for example, the SOPs (standard operating procedures) that will be used. Procedures that might be obvious or insignificant to an IT department could be of grave concern to a lawyer who will be responsible for defending any system in a court of law.

Initially, we used a hybrid approach where each experiment was printed, signed and bound. Thus, the company's archival copy was the paper bound copy, similar to any paper-based notebook, and the electronic system was just for internal use. Eventually Array converted to a completely electronic version with digital signatures and archived PDF files by purchasing the PatentSafe software from Amphora.

The process we used to define system requirements, identify a vendor, and implement the software was done hand-in-hand with our legal department and is an interesting topic for discussion that's outside the scope of this article. Unfortunately, there are no standard processes, so each organisation will need to define their own method that satisfies their unique legal requirements.

USER ACCEPTANCE AND COMPLIANCE

Initial implementation of an ELN focuses predominantly on compliance and getting buy-in from the user community. Generally, there are early adopters who are willing to put up with the inevitable problems that occur with any new software, along with the reluctant diehards who will eventually convert only after much discontent. There are a number of reasons that a particular individual will use to delay adoption, and here are a few of the more popular reasons:

- Electronic systems, including the ELN, are generally more structured than a user wants it to be. There is always something that needs to be done that the ELN is just not capable of handling.
- There is an operational learning curve associated with shifting to an ELN and a user may not have time to focus on learning a new system.
- Data entry is not always faster, especially if the user doesn't possess adequate typing skills.
- Any computer system can go down and that can cause a major problem for the user.
- Initially, there is nothing to search in the database, the major advantage for using an ELN. It could take years to establish a well populated database, dependent on the size of the user community.
- The 'Big Brother' syndrome – Anyone can see their notebook and this does have a tendency to put some users off a bit.

THE IN-HOUSE SALES PITCH

There are many ways to ensure ELN compliance among users. Most obviously, an ELN must be intuitive to use, allow some degree of flexibility for individuals, and maintain solid performance. Nothing will hamper an ELN project more than a slow, clumsy system that takes too long to learn or use.

Although there is an obvious strategic rationale for the ELN, it is more productive to tout the tactical and other advantages to using an ELN.

This is where integration of an ELN with other data systems really pays off. For example, in the chemistry world, analytical data including NMR (nuclear magnetic resonance), IR (infra-red), HPLC (high-performance liquid chromatography) and MS (mass spectrometry) can be easily integrated with the experimental data, making for a more complete record of the experiment. This can be done manually or more elegantly via direct integration of analytical machinery with the ELN.

At Array, this was seen as a major advantage and was the key feature that drove prompt compliance among the chemistry staff. We also integrated our stockroom inventory system with the ELN so that it matched the chemist's workflow. To begin an experiment, a chemist first obtains the needed experimental reagents and then uses a barcode scanner to enter them into the ELN with all the appropriate data necessary, making the setup simple and efficient. We also found that integrating workflow software and LIMS (laboratory information management) software with the ELN was a good way to improve prompt compliance.

For example, we took our analytical data analysis software, where scientists can review, analyse and interpret their data directly from the equipment, and added a backend that summarises the information for direct input into the ELN. We have found this approach very useful for gaining quick acceptance of an ELN by scientists in other scientific departments like analytical, biology, pharmacology and drug metabolism.

TRAINING WITH PEERS

Another very important way to ensure prompt compliance of the ELN stems

from the training program. Array has found that training by fellow scientists is far better than using the vendor training programs that are generally available; fellow scientists understand the relevant issues and they are in the lab to answer questions as they arise in the normal course of using the software. Rather than train on the software in a classroom setting, scientists train using the ELN within their environment, focusing on the tools and steps necessary to accomplish their work.

LESSONS: A LOOK BACK

Over the past six years, Array has been using an ELN with solid success. All departments have now been moved from a paper-based notebook to an ELN. By using individualised templates, we have found that one software product is sufficient for the whole research organisation, contrary to what others have proclaimed. In addition, we have found that once scientists have made the transition, they do not wish to return to paper, especially when all the integrations mentioned above are incorporated. However, the ELN is not a panacea, and some of the generalisations attributed to an ELN may not necessarily hold true, for example:

- Using an ELN makes you a better note-keeper. This is not true; if you're bad on paper, you're bad on a computer. The real advantage though is supervisors can monitor notebooks from their own desk.
- ELNs make you better organised. This is true, especially when data integration is considered. Having experimental data and its supporting data in the same page of an ELN is very useful.
- ELNs make you more productive. This one varies with discipline. For example in biology and medicinal chemistry, where note-keeping is not the limiting factor, the gain is minimal. However, in analytical chemistry and high speed analoguing, note keeping is an issue and major productivity enhancements can be achieved. There can also be major time savings when writing patents based on the work stored in the ELN. The one area that yields the greatest time savings is the most difficult to quantify: how much time is saved when a search result provides useful information. Whether it's time saved doing the correct experiment or, even better, if time and money are saved – and frustrations avoided - by not doing the wrong experiment.

In conclusion, Array has found the transition from a paper-based notebook to an ELN to be a very valuable and worthwhile endeavour. We have taken a very conservative approach to what an ELN represents by only focusing on documenting our intellectual property. There are some that believe the ELN should be the portal to all information, outside and inside the company. Although technologically a reasonable idea, we have not shared in that belief.

Over the years, we have gone from a chemistry-based hybrid system to a complete company-wide research ELN with fully electronic signatures, file storage and backup.

DEPLOYING TOP QUALITY TEAMS TO MODERNISE IT SYSTEMS

The Case of Arras Hospital

AUTHOR

Arnaud Hansske,
MD, is the CIO
of Arras Hospital.

Arras Hospital is located in the Nord-Pas-de-Calais region of France. It employs 2,000 staff who treat over 100,000 patients each year. The hospital provides health services to a population of 230,000 residents in the fields of surgery, general medicine, obstetrics and gynaecology, psychiatry, and geriatric care.

By the end of the 1990s, the venerable (over-40 year old) facility was experiencing difficulties.

The running of the institution had become expensive, the buildings were ageing badly and the IT infrastructure was over-extended. In 2001, with a new general manager at its helm, Arras Hospital decided to transform its operation into a modern, patient-centred healthcare campus. This involved an overhaul of its IT architecture and its experience may hold a wealth of insights and lessons for hundreds of other facilities across Europe and beyond.

PILOT PROJECT TO LEARN THE CONTOURS OF CHANGE

We started out with the belief that we had to take a long and sweeping rethink about how IT and new architecture could improve and optimise the organisation of a hospital and the delivery of healthcare.

The ambitious plan involved rebuilding parts of the hospital, refurbishing others, and completely replacing the legacy IT systems. A major undertaking in its own right, the IT overhaul did not seem financially viable without a parallel re-structuring of the organisation's internal processes and a change in its culture.

The new, 100-bed Aloïse Corbaz psychiatric wing (construction began in 2002 and finished in 2004) was chosen as the pilot site for the entire project. With the mission of ensuring that all investments did ultimately result in higher quality patient services, the hospital identified several objectives:

- To reduce operational and administrative costs
- To provide clinical staff such as doctors and nurses with effective tools for mobile working
- To reduce the administrative burden of clinical staff in order to improve patient care
- To use new technology to communicate with the entire medical community in the region, so improving patients' access to services and raising overall standards of care.

Two years later, the psychiatric ward has been deemed to have met these expectations. It works smoothly on the IT side, with its IP network, WiFi, etc.

NEW HIS

In 2002, it was also decided that the new Information Systems Manager at Arras Hospital would introduce a Health Information System (HIS). The aim was to enable the creation and centralised storage of electronic patient records, an important step towards automating processes and reducing the level of paperwork within the organisation. The hospital chose the Clinicom HIS application from Siemens Health Services and its partners. At present, 90% of the software has been deployed satisfactorily.

THE MEDICAL-GRADE NETWORK

Since 2001, the hospital had been seeking to achieve a number of technology-related goals that would contribute to its overall strategy of improving patient care.

- To provide staff - and, ultimately,

patients - with access to a converged platform that would carry voice, data and video applications.

- To remove the IT silos that had built up within each department and instead, create a single, integrated environment for the entire hospital.
- To ensure that the network offered the highest possible levels of performance, reliability and security.

We selected Cisco Systems and a high quality integrator (NCS) because we were laying the foundation for a 'Cisco Medical-Grade Network' which is designed to:

- Be resilient and responsive in a 24x7 environment in which 'mission critical' implies that lives are in the balance.
- Optimise responsiveness at the point of care to reduce the number of medical errors and improve clinical productivity.
- Use intelligence within the network to make the most vital information available when, where and for whom it is needed most.
- Enhance integration of applications and services to improve diagnostic capabilities, reduce time to treatment for patients, shorten billing cycles and create new revenue sources.
- Provide seamless communication independent of device or location. The hospital saw the principles behind the Medical-Grade Network as critical because they would support its over-arching goal of becoming completely patient-centric.

The complete IP-based infrastructure that has been installed throughout the hospital's 18 different sites offers a secure, high-performance and reliable platform for voice, data and video, with a backbone speed of 10 Gbps, which has since been upgraded to 20 Gbps and can quickly be scaled up further - as the organisation inevitably changes and grows.

IP TELEPHONY AND WIRELESS

We initially deployed IP telephony over the network in three departments: the psychiatric wing, the nurses' training institute, and the nurses' home.

Here, both wireline and wireless IP phones offer nurses flexible voice and data services. Staff in these departments are able to access patient records and other data while on the move, using a range of mobile devices such as wireless IP phones and Tablet PCs . After a positive assessment in 2006, telephony for the entire hospital is now over IP.

> The IT overhaul also required a parallel restructuring of the organisation's internal processes and a change in its culture.

Given that the entire infrastructure is wireless enabled, wireless access to voice and data services is available throughout the new hospital since completion in February.

In the new hospital, patients' rooms have been equipped with services on a bedside terminal, among them digital television, IP telephone, video and Internet access, all of which will be delivered over the same network.

The security and reliability of our network are essential, particularly when WiFi terminals are being used. We are confident about the quality of this solution and, having selected an end-to-end system, also benefit from full hardware and software compatibility.

PAPER-FREE, REAL-TIME AND OTHER BENEFITS

The introduction of IP telephony and wireless capabilities allows staff to view, enter or amend data directly, wherever they are. This mobile access has transformed the way in which staff work, often eliminating paperwork and duplication of effort.

For example, doctors on ward rounds in different units can change a patient's medication at the bedside using a Tablet PC, instead of writing out a new prescription. The details can then be sent to the pharmacy, where an automatic stock check ensures that new supplies are ordered as and when necessary.

Similarly, the results of blood tests, carried out when a patient arrives at the hospital, can later be viewed on a Tablet PC anywhere on the entire hospital campus, by any member of clinical staff who is treating the particular patient.
We should also make mention of our new digital dictation (not speech recognition) capabilities.

This is used by almost all the physicians and has enabled a dramatic reduction in delays for accounts and medical letters - from more than 1 month to a few days. The network's high-speed performance is another huge benefit as it allows the transfer of large files (from the PACS for instance) - not only within the hospital campus but also among the wider health community in Arras.

Consequently, all health centres and the hospital have access to the same data, ensuring consistency, and healthcare professionals are able to update the centralised files quickly and easily. This holistic approach will also help reduce the errors that can arise from inaccurate or incomplete patient records.

Alongside, all GPs in our town can reach their patient's electronic medical record, in real time, through a secure Internet link.

THE PRODUCTIVITY IMPACT

In Montreuil-sur-Mer, France, a similar re-organisation was implemented in the period 1995-2001 by the current general manager of Arras and this author. There, the hospital saw a sharp rise in productivity - by 40 per cent - in spite of a 10 per cent reduction in staff and a 20 per cent reduction in the number of beds. At the same time, the institution's medical and financial performance rose almost to the levels of those of private clinics.

At Arras Hospital, we are looking to achieve similar results within the next two years. We also believe this to be a feasible target.

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(*) These figures are an extrapolation over Agfa's current EMR installed base, based on the actual results reported by the DRK Kliniken healthcare facility in Berlin, Germany. Actual results in individual instances may vary.

THE NETHERLANDS

Healthcare reforms will have major impact on hospital IT

OVERVIEW

Recent healthcare reforms in the Netherlands have been relatively radical.

The State has been replaced as the central player in day-to-day operation of the healthcare system by private health suppliers, although the government remains responsible for accessibility and quality of healthcare. Alongside, the previous difference between public and private health insurance has been abolished.

From January 1, 2006, all adult residents have been obliged to purchase basic health insurance from a private insurance firm. This obligation is balanced by a corresponding commitment made on the part of insurers - who cannot reject applicants for the basic package. The price for the basic package, about 1,100 Euros a year, is fixed by the government. However, fees charged by insurers varies, and this has led to a significant degree of competition - as well as shopping by customers (in 2006, one of six policyholders changed their insurer).

The basic package covers medical and dental care, hospitalisation, and a variety of medical appliances, pharmaceuticals and paramedical care. Additional (or complementing) insurance can be purchased to cover requirements beyond the basic package; this type of cover, however, leaves insurance companies free to set prices, and reject applicants.

Since several years, the Dutch authorities have been concerned about the mounting pressures on healthcare finances – not least due to an ageing population. Overall, recent reforms are meant to provide incentives to patients, insurers and the broader healthcare industry (from pharmaceutical companies to hospitals) to become cost conscious.

> Health insurance reforms are expected to impact dramatically on hospitals, and their IT operations

Initial results endorse the reforms. Agreements with the pharmaceutical industry has seen the overall costs of generic drugs falling by about 40 per cent, and for the first time in decades, expenditure on prescription medication fell year-on-year.

Meanwhile, as discussed below, pressures have also mounted on hospitals to operate more efficiently - in other words, to treat "a greater number of patients for the same (amount of) money," in the words of Dutch Health Minister Hans Hoogervorst at a conference on healthcare reform in Budapest at the end of January.

Some have complained that healthcare in the Netherlands, previously considered 'free', has become more expensive after the reforms. But the Welfare State has hardly disappeared. For the lowest-income categories of the population, the government offers a 'zorgtoeslag' (care grant).

THE NETHERLANDS AT A GLANCE

Population:	16,34 million Above 65 years = 13.94%
Live births:	85,124 births
Death rate:	10.9 births/1,000 population 135,809 8.68 deaths/1,000 population
Life expectancy:	76.39 years (male) and 81.67 years (female)
GDP:	GDP at market prices: 505.6 billion Euros (2005)
GDP growth rate:	1.5% (2005), 2.9% (2006 est.)
GDP per capita:	30,942 Euros (20 05) In PPS (Purchasing Power Standards EU 25=100): 125,6
Total healthcare expenditure:	9.2% of GDP (2004)
Healthcare expenditure per capita:	2,846.7 Euros
% of healthcare system financed by public funds	62.3% (2004)
Medical equipment as share of total health expenditure	3.3%
Number of hospitals	178
Number of beds (acute care)	2.8/1,000 population (2003)
Rate of occupancy	58.4%
Length of stay	7.4 days
Number of hospital admissions	8.1/100 population
Percentage of households with Internet access	80%
Percentage of individuals using the Internet for interacting with public authorities	Obtaining information: 46% Downloading forms: 27.3% Returning filled forms: 29.7

Unless specified, all data is for 2006.
Source: EU Commission, OECD, WHO, Government of Netherlands.

Trusted ePlatform Services

ADVANTECH

MEDICAL GRADE PANEL PC'S AT THE MEDICAL CENTER ALKMAAR, THE NETHERLANDS

COMPUTERS HAVE BEEN WIDELY ADAPOTED AT DIFFERENT STAGES OF MEDICAL CARE TO ACHIEVE EFFECTIVE INFORMATION COL LECTION AND PRECISE DATA ANALYSIS, AND TO AID IM MAKING FINAL TREATMENT DECISIONS

THE MEDICAL CENTER ALKMAAR (MCA) IS A BIG CL INICAL TEACHING HOSPITAL OF THE NORTH WEST OF THE NETHERLANDS, WITH MORE THAN 900 BEDS AND COVERING AN AREA OF 600,000 INHABITANTS. IN ADDITION TO PATIENT CARE, THE CORE ACTIVITIES ARE TRAINING AND SCIENTIFIC RESEARCH. THIS MAKES THE MCA A DYNAMIC INSTITUTION, AND NEW CARE DEVELOPMENTS ARE BEING CAREFUL LY MONITORED. AT THE BEGINNING OF 2004 MCA STARTED THE "MATRIX-1" PROJECT, THE AIM OF WHICH IS TO DIGITAL IZE THE HOSPITAL . GER SEL ISSEN, MEDICAL TECHNIQUE & COMMUNICATION SUPERVISOR, IS HIGHLY INVOLVED IN THE MATRIX PROJECT AND STUDIED ADVANTECH'S MEDICAL GRADE PANEL PC'S (POC SERIES). GER SEL ISSEN SAYS:
"I WAS ESPECIAL LY ENTHUSIASTIC ABOUT THE CERTIFICATES ON UL60601-1/EN60601-1 (PREVENTING ELECTRONIC RADIATION), THE IP65/NEMA4 RATING AND IPX1 DRIP-PROOF, WHICH MAKES THEM VERY APPROPRIATE TO USE IN OUR S3 AREAS BUT ALSO IN OUR FIRST AID DEPARTMENT AND PLASTER ROOM!

THESE AREAS ARE HUMID AND YOU CANNOT PLACE JUST ANY PC NEXT TO A WASHBOWL. WE STARTED TO TEST A FEW DEMO UNITS WITH OUR OWN SOF TWARE ON PATIENT INFORMATION. THE TOUCH SCREEN IS AN ADVANTAGE. WE HAVE SPECIAL WATER-RESISTANT KEYBOARDS INSTAL LED FOR WORKPLACES WHERE A LOT OF PATIENT INFORMATION HAS TO BE ENTERED. FOR BOTH DIAGNOSTICS AND PATIENT INFORMATION WE HAVE CREATED DUAL SCREEN SOLUTIONS (PANEL DISPLAY CONSOLE COMBINED WITH PANEL COMPUTER). THAT WAY OUR MEDICAL STAFF ARE ABLE TO SEE ELECTRONIC X-RAYS AND PATIENT INFORMATION AT THE SAME TIME. THE ORTHOPAEDIST IS EVEN ABLE TO SEE X-RAY IMAGES IN DETAI L. ONE OF OUR WISHES FOR THE FUTURE IS A FAN LESS PC WHICH WE CAN USE FOR AUDIO MEASUREMENTS."

THE NEW GENERATION OF PC'S, THE POC-SL IM L INE SERIES, HAS IMPROVED ON THIS POINT: IT IS FAN LESS, NOISE-FREE, AND IT IS READY FOR THE APPL ICATION OF A BARCODE-ENABLED POINT OF CARE SYSTEM. AS FOR AL L ADVANTECH'S MEDICAL PANEL PC'S, IT HAS A SPI L L- AND DUST-RESISTANT IPX1, WIRELESS LAN AND TOUCH SCREEN OPTIONS, AND MEDICAL CERTIFICATION EN60601/UL60601. SIZES ARE 12", 15", 17" & 19" TFT LCD.

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BRANCHE OFFICE BENELUX & NORDICS
BRIGITTE SEBREGTS
PRODUCT SALES MARKETING
BI JSTER 20A,
NL 4817 HX BREDA
THE NETHERLANDS
T:+31 (0)76-5231279
F:+31 (0)76-5231280
E:BRIGITTE.SEBREGTS@ADVANTECH.NL
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SUPERVISOR MEDICAL TECHNIQUE & COMMUNICATION
WI LHELMINALAAN 12
1815 JD ALKMAAR
THE NETHERLANDS
T:+31 (0)72-5483992
F:+31 (0)72-5483996
E:G. J .H.SEL ISSEN@MCA.NL
W:WWW.MCA.NL

SALIENT POINTS ABOUT THE HEALTHCARE SYSTEM IN THE NETHERLANDS

➘ The share of healthcare in GDP and per capita health care costs in the Netherlands are higher than the EU (15) and the OECD average.

➘ The number of hospital discharges per full time employee (a key measure of hospital productivity) is lower than in neighbouring Belgium, Germany and Luxembourg.

➘ The Netherlands has a very low share of physicians and a high proportion of nurses, compared to the European average. Per 100,000 population, physician numbers in the Netherlands stands at 192, the lowest in the European Union (with the possible exception of some new Members). In France, Germany and Spain the number is approximately 65% higher.

➘ In contrast, the number of nurses working in the Netherlands is relatively high, at 1,381 per 100,000 population, or 85% over the European average (according to 2002 figures available from the EU Commission). However, the country is by no means at the top of the EU table, an honour accorded to Finland (with 2,168 per 100,000); it is also outranked by Denmark and Ireland.

E-HEALTH IN THE NETHERLANDS – AN OVERVIEW

A variety of research and investigative studies in the Netherlands have sought to assess the impact of IT on health care services. Some key findings:

➘ One out of two GPs routinely use the EVS electronic prescription system. 84% already had access in 2002.

➘ IT has contributed to a rise in the rate of one-day surgeries.

➘ Personalised healthcare education via IT shows a high rate of response from patients, but involves little extra work for the GP.

➘ One highly-promising IT application in healthcare is to facilitate the selection of high-risk patients in targeted prevention campaigns.

➘ Teledermatology has resulted in a decline in referrals to dermatologist.

➘ Overall, key drivers for e-Health lie in perceptions of more efficiency and cost savings. A significant trend here is 'extramuralisering' – to shift care from hospitals to living at home. This is reinforced by growing healthcare demands (about 3% a year in 2000, according to official estimates), due to an ageing population.

➘ Data silos in hospitals are seen as a key reason for problems in effective healthcare delivery.

continued from page 42

TRENDS IN THE HOSPITAL ENVIRONMENT

The health insurance reforms were predated by a new system for hospital financing established in 2005, and known as Diagnose Behandeling Combinaties (DBCs).

The DBC is a diagnosis-related-group (DRG-type) system covering all hospital-provided products and services, beginning from the initial consultation and diagnosis of the medical specialist in the hospital through to discharge.
The DBC facilitates bilateral negotiations between health insurers and hospitals on prices, and also enables drawing up differences between coverage in the new, compulsory basic insurance package and coverage under complementary schemes. In effect, the reforms in the Netherlands mark a new phase in the ongoing shift from a supply to demand orientation in healthcare.

IMPLICATIONS FOR HEALTHCARE IT

The above trends are expected to impact dramatically on hospitals, and their IT operations - to quickly enhance efficiency in the face of a rise in systemic, internal competition.

For example, the State-supported Website (www.kiesbeter.nl) already offers comparative information about healthcare services, and will shortly offer data about the record of different hospitals in the treatment of six conditions (a figure due to rise to 80 by the turn of the decade).

Such factors are expected to make insurers more selective in awarding contracts – to the most competitive, and cost-effective hospitals.

In the worst-case scenario, inefficient hospitals face the risk of being unbundled and disaggregated into centres for separate healthcare services – consolidated around different DBCs.

For the more nimble and fleet of foot, however, there is a choice: to use the reality of reforms to usher in innovative new medical and supportive technologies. Most of these will inevitably centre on IT and e-Health (above all, in terms of telemedicine and the EHR).

The overriding aim will be reduce demand for costly inpatient care and increase hospital productivity – an area, where the Netherlands has been lagging other industrialised countries (see box). (TS, CC and CV)

HEALTHCARE IT IN THE NETHERLANDS

Policy And Perspectives

HITM interview with Drs. Ellen Maat

Given the Netherlands' ambitious healthcare financing reforms, some observers expect an impact on hospitals in terms of productivity and efficiency pressures. To obtain insights into official policy on this issue, Healthcare IT Management interviewed Drs. Ellen Maat, Director of Healthcare ICT in the Ministry of Health, Welfare and Sport.

HITM: Hospital IT departments are at the center of many changes such as e-Health and e-business. Will the new reforms have implications for hospital IT departments ?

Drs. Ellen Maat: In our view, e-Health describes the application of information and communication technologies across the whole range of functions that affect the healthcare sector. e-Health can therefore function as a lever to improve the access, affordability and quality of healthcare.

HITM: What are the key challenges and priorities for healthcare IT - for example, on new standards ? Do you believe it is too ambitious to harmonise IT systems at a European or international level, before things like big legacy mainframe systems have been modernised ?

Drs. Ellen Maat: Due consideration needs to be given to the fact that EU Member States and other countries around the world have different approaches and priorities to IT implementations in healthcare and may be starting from different points in the development cycle.

Before any degree of harmonisation of IT systems can take place at an international level, consensus needs to be reached on a more abstract level. This would include topics such as identification, authentication and authorisation mechanisms and intermediation services to achieve semantic interoperability between diverse codification systems and languages.

HITM: What about skills and demographics ? We hear there is a decline in IT student intakes by universities and technical schools in Europe. Is this true in the Netherlands ?

Drs. Ellen Maat: No, recent statistics are demonstrating an increase in new intakes for IT-related studies. The number of new registrations at universities throughout the country have gone up from 14.550 in 1995/96 to 16.310 in 2006/07. The same applies to technical schools: 9.680 students enrolled in 1995/96 against 21.510 in 2006/07.

HITM: Can you comment on finance and budgetary pressures ? IT has often to cope with competition from demands for new medical equipment like scanners, bedside monitors etc. Will this change because of the new environment ?

Drs. Ellen Maat: The use of ICT was, until a few years ago, more common in other market areas then in the health care sector. This is about to change due to the acknowledgement of the importance of medical data exchange for the quality of health care. Over the past few years, the mobility of patients has increased and this demands a focus on exchange of information between healthcare institutions. Due to a new focus on electronic exchange of information, we expect this to lead to an increase of investment on ICT-applications for medical data exchange.

HITM: Globalization is also becoming an issue. The EU identifies healthcare technologies as a priority for Europe. However, it is also opening up research cooperation with countries like India and China. Do you believe this is a Trojan Horse for large Asian IT companies ? Especially given their close ties to the US technology industry and financial firms ?

Drs. Ellen Maat: One of the basic assumptions of our national program for health IT is that the healthcare professionals are themselves responsible for the implementation of IT applications. Apart from taking into account the governmental regulations regarding the connection to the national IT infrastructure, healthcare professionals are at liberty to choose their own IT supplier. This supports the Dutch free-market approach and the recent healthcare reforms. Given the Netherlands' ambitious healthcare financing reforms, some observers expect an impact on hospitals in terms of productivity and efficiency pressures.

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KEY ORGANISATIONS INFLUENCING HEALTHCARE IT IN THE NETHERLANDS

A variety of organisations impact upon the healthcare IT environment in the Netherlands.
The principal ones include:

- The Health Council
(Gezondheidsraad – www.gr.nl).

This is a statutory, independent advisory body of experts providing Ministers and Parliament with scientific advice on health issues, including the effectiveness, efficiency, safety, and availability of health technologies.

- Council for Public Health and Health Care
(Raad voor de Volksgezondheid en Zorg - www.rvz.net).

The Council is a nine-member governmental advisory body, with explicit mandates on information technology in healthcare, and professionals in health care. Initiatives of interest include home care and e-Health.

- National IT Institute for Healthcare
(Nationaal ICT Instituut in de Zorg, NICTIZ – www.nictiz.nl)

NICTIZ was founded in 2002 by organizations representing the Dutch healthcare and IT sectors. It is funded by the Ministry of Health, Welfare and Sports. It is principally focused on two initiatives: to develop an Electronic Health Record and to build AORTA, a national secure electronic communication infrastructure for the healthcare sector, based on Health Level 7, version 3 (HL7. v.3).

- Netherlands Institute for Telemedicine
(Nederlands Instituut voor Telemedicine, NITEL – www.nitel.nl) seeks to stimulate the implementation and use of telemedicine services. It works closely with NICTIZ and the Economics Affairs Ministry, which funds the organisation.

- Institute for Health Care Improvement
(Centraal begeleidingsorgaan voor intercollegiale toetsing – www.cbo.nl).

The Institute, known by its Dutch acronym CBO, was established in 1979 as an independent private foundation. Its services seek to improve patient care, via the development of guidelines and indicators, peer-review systems, establishment of a national registry of quality indicators, best practices and knowledge management and training. One of its programs, Better Faster, seeks to implement improvements in the area of patient logistics and safety, and covers hospital IT departments.(TS)

CORPORATE SNAPSHOTS

GCX Corporation is the worldwide leader in medical instrument and IT mounting solutions. More than 35 years of medical industry experience provides GCX an unmatched understanding of the integration of medical devices and IT into all healthcare environments. Visit www.gcx.com.

GCX Corporation
Netherlands — EMEA Region
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Netherlands
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F: +31 (0) 73 62 72 60 9
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Agfa Press Office
Septestraat 27
B-2640 Mortsel
Belgium
Tel: +32 (03) 4509693
Fax: +32 (03) 4509889
www.agfa.com/healthcare

Misys Healthcare Systems Corporate Profile
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Misys
Healthcare Systems International
1 Woodlands Court
Albert Drive, Burgess Hill
West Sussex, RH159TN, UK
T: +44 (0) 1444 231500
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ADVANTECH EUROPE GMBH
Branche Office BENELUX &
NORDICS
Brigitte Sebregts
Product Sales Marketing
Bijster 20A,
NL 4817 HX BREDA
The Netherlands
T: +31 (0) 76 5231279
F: +31 (0) 76 5231280
E:Brigitte Sebregts@advantech.nl
www.advantech.com/eplatform/med/

Healthcare IT Events

April

IHE CONNECTION-A-THON
15 – 20 April 2007
Berlin, Germany
www.ihe-europe.org/europe

MED-E-TEL
18 – 20 April 2007
Luxembourg, Luxembourg
www.medetel.lu

12TH FINNISH NATIONAL TELEMEDICINE AND E-HEALTH CONFERENCE
26 – 27 April 2007
Kuopio, Finland
www.fimnet.fi/telemedicine/index2.html

E-HEALTH WEEK BERLIN 2007
16 – 20 April 2007
Berlin, Germany
http://www.ehealth2007.org/

May

CROSS-BORDER IN THE BALTIC SEA REGION
Healthcare Delivery for the Patients of Today and Tomorrow
21 – 22 May 2007
Stockholm, Sweden
www.ehealthconference.info

HIT PARIS 2007
Health Information Technologies
22 – 24 May 2007
Paris, France
www.health-it.fr/

June

TTEC-07
Tromsø Telemedicine and e-Health Conference
11 – 13 June 2007
Tromsø, Norway
www.telemed.no/ttec2007

CARS 2007
Computer Assisted Radiology and Surgery
21st International Congress and Exhibition
27 – 30 June 2007
Berlin, Germany
www.cars-int.org

July

EGEH '07
e-Government and e-Health
4th International Conference and Exhibition
9 – 10 July 2007
Milan, Italy
www.aitim.net/pdf/Eventi_2007/eGeH07.pdf

August

IEEE EMBS 2007
29th Annual International Conferece of the IEEE Engineering in Medicine and Biology Society
23 – 26 August 2007
Lyon, France
www.embc07.ulster.ac.uk/

IASTED 2007
13th IASTED International Conference on Robotics and Applications
29 – 31 August 2007
Würzburg, Germany
www.iasted.org/conferences/home-563.html

October

MEDNET 2007
12th World Congress on the Internet in Medicine
7 – 10 October 2007
Leipzig, Germany
www.mednet2007.com/content/

ECEH 07
European Conference on e-Health 2007
11 – 12 October 2007
Oldenburg, Germany
www.eceh07.offis.de/

WORLD OF HEALTH IT 2007 CONFERENCE AND EXHIBITION
Connecting Leaders in Technology and Healthcare
22 – 25 October 2007
Vienna, Austria
www.worldofhealthit.org/

November

MEDICA 2007
39th World Forum for Medicine
14 – 17 November 2007
Düsseldorf, Germany
www.medica.de

TELEMED & E-HEALTH 2007
Supporting Self Care
14 – 17 November 2007
London, UK
www.rsm.org.uk/telemed/

December

CEHR INTERNATIONAL CONFERENCE 2007
E-Health: Combining Health Telematics, Telemedicine, Biomedical Engineering and Bioinformatics to the Edge
2 – 5 December 2007
Regensburg, Germany
www.cehr.de

BIG EASY RECEIVES RINGING ENDORSEMENT FROM HIMSS07

'Battered, but unbroken – and resolved to make a return'.

Such a caption may edify the spirit of New Orleans, still recovering from the after-effects of Hurricane Katrina. And yet, given the scale of the disaster, the city clearly needs a hand to help it return to business.

This was the message brought to the city and the world outside by HIMSS, the Healthcare Information and Management Systems Society, which decided to hold its 2007 annual meeting – one of the largest IT industry conferences - in New Orleans. A year previously, CEO H. Stephen Lieber had said that the decision to host the 2007 conference in the Big Easy had drawn "overwhelming support" from HIMSS members and exhibitors and was also to be seen "as a positive contribution to the rebuilding of New Orleans and the Gulf area."

HITM, which was represented at HIMSS07, can attest to the fact that Mr. Lieber's confidence was not misplaced. The 25,000 attendees saw the four-day proceedings pass without a hitch. HIMSS was, in fact, quick to reach out to New Orleans and the Gulf Region in the immediate aftermath of Katrina in 2005. Aside from cash donations, it launched the Katrina Phoenix Project - a collaborative effort focused on rebuilding paper-based physician practices with electronic health record (EHR) systems, donated by hardware and software vendors.

One continuing initiative is an alliance with Common Ground Health Clinic, a free medical clinic and outreach facility for uninsured residents, set up just after Katrina struck. HIMSS hopes to grow this into a permanent fixture, equipped with state-of-the-art equipment and EHR technologies – several of which were on display at HIMSS07.

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European Association of HEALTHCARE IT MANAGERS

The European Association of Healthcare IT Managers is a non-profit pan-European umbrella organisation for all relevant national healthcare IT associations in Europe.

OUR MISSION:

- **The European Association of Healthcare IT Managers** supports and encourages the emergence of common healthcare IT standards at both EU and international levels.

- **The European Association of Healthcare IT Managers** believes that the European Healthcare IT sector needs a common voice - especially in the face of rapid technological change and growing socioeconomic pressures.

- **The European Association of Healthcare IT Managers** invites you to be involved in a community to exchange opinions and experiences with like-minded colleagues. We defend your interests and make your voice heard, effectively.

If you are a CIO, CMIO or IT Manager in the healthcare area

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European Association of
HEALTHCARE IT MANAGERS
28, Rue de la Loi
B-1040 Brussel, Belgium

Tel.: +32/2/286 85 01
Fax: +32/2/286 85 08
Email: office@hitm.eu
Website: www.hitm.eu

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