Systems Integration and Globalisation

a report by
LINK Medical

"There were too many people involved and too many steps required. We saw an opportunity to be more efficient and it paid off. The new workflow eliminated the problem – and that meant no more lost revenue,"

said James A Stuart, Hillcrest Medical Center.

With the focus on global healthcare, it is appropriate to look at some of the trends and issues relating to the ability of healthcare information systems (IS)[1] to communicate or 'interface' with each other; thus enabling the flow of clinical, administrative, financial and research-related data. While much has been made of the Web as perhaps the ultimate integration tool, at a practical level, there exists an immense installed base of IS that are largely independent of one another and are likely to remain that way for many years to come.

Over the past 10–15 years, many data interchange (interface) standards have emerged to address the growing need to cut costs, improve the efficiency and delivery of healthcare at the patient/clinical level and to improve the efficiency and effectiveness of administration. Established in 1987, Health Level Seven (HL7) emerged as the predominant standard in the US and is gaining ground steadily elsewhere.

History and Background

Given that interfaces help reduce costs, save time and enable clinicians to focus more on patient care (see hospital study), it is useful to examine how and why the standard evolved in the US. That the historical trends and issues will have similar implications for many other countries is becoming increasingly evident.

Historically, the IS environment in the late 1980s and early 1990s was characterised by a wide range of mostly stand-alone equipment and IS developed by multiple vendors. Networking, even at the local area level, was still in its infancy. Most hospital IS departments focused their mainframe or mini-computer operations almost exclusively on administration and billing, and very little clinical data was maintained 'online'. For the data that was available, information bottlenecks occurred as reports containing the data had to be requested specifically from the IS department, the staff of which were the only ones authorised or knowledgeable enough to create and generate this output.

With the advent of the lower-cost (and therefore accessible), more flexible personal computer (PC), frustrated physicians and administrators began exercising their own initiative and building PC-based, local area networks to host database and reporting software. This software was largely custom developed by consultants or was provided by instrument/device vendors to meet the demands by administrators and clinicians for increased, more flexible access to more data. From the vendor's perspective, the ability to provide an interface to or from products quickly evolved from a 'desirable' option to a competitive requirement.

Ironically, to many hospital IS departments, the new PC was perceived (often correctly) as 'lightweight' and unsuitable for the rigorous demands of the hospital. Predictably, the lack of oversight by IS departments resulted in a 'Tower of Babel' proliferation of different hardware, software and networks that were increasingly difficult to manage and maintain. Information bottlenecks were exacerbated as data stored on disparate systems created isolated 'islands of information'.

Custom interfaces, created to enable the flow of data from one system to another, helped ease this information bottleneck but created a different set of problems. In the absence of a widely accepted data interchange standard, these custom interfaces were costly and time-consuming to implement, could not be replicated easily and were difficult to support.

1. *'Healthcare information system' is taken here to include not only those enterprise-wide, administrative and financial systems deployed in large medical institutions, but the multitude of departmental/ancillary systems and instruments that proliferate in hospitals, clinics and even physicians' practices.*

By the mid-1990s, large enterprise-wide IS vendors, faced with a replacement-only market for their products, saw an opportunity to expand by offering clinically based data repositories and by providing integration services and products. HL7 had reached a level of acceptance within the medical community that allowed it to become the common currency for data interchange. In addition, driven by the need to control costs and bring some order to the multisystem environment that had evolved, information technology (IT) departments were given the authority to assert themselves and approve or reject ancillary department purchases, with 'interfacing' often being a key consideration. In numerous situations, equipment or system purchases approved by clinicians and/or administrators at the departmental level were either cancelled or put on hold by the IS department until the vendor could satisfactorily prove their products' ability to interface with other systems.

Examples of some of the relevant factors that could be gleaned from this experience are as follows. In Taiwan, as in other countries, while HL7 was promoted vigorously by the local HL7 affiliate, there were still many vendors and other interested parties that were quite hesitant to take the plunge. Their chief argument was that it would be faster and more cost-effective to develop a custom interface than have to go through the learning curve associated with understanding and adopting HL7 as a standard.

Choosing HL7

Given that the standing joke amongst many HL7 devotees appears to be "the good thing about standards is that there are so many of them to choose from," why choose HL7?

The short answer is that 'everyone else is using it'. HL7 is a voluntary, non-profit, American National Standards Institute (ANSI)-accredited organisation that has a long history (since 1987), broad acceptance and enjoys participation from government, clinical, administrative, consulting and vendor-based constituents. Its membership includes over 2,200 health industry members, including most, if not all, significant IS vendors. At an international level, HL7 currently has 18 international affiliates from as far afield as Taiwan, Turkey, Argentina, Czech Republic, India, China, Korea and South Africa. International membership is quite obviously far broader. HL7 has a specific international committee whose mission is focused on ensuring that the "needs, issues and other input of the HL7 International Affiliates are recognized and effectively acted on by the HL7 organization."[2] In addition, HL7 co-operates with many other standards groups such as American Society for Testing and Materials (ASTM), Accredited Standards Committee's Insurance Subcommittee (ASC X12N), American College of Radiology (ACR), National Electrical Manufacturers Association (NEMA) and Institute of Electrical and Electronics Engineers, Inc. (IEEE) (among others) to minimise conflicts and enhance co-operation. In addition, there is co-operation with other international standards groups such as European Committee for Standardization (CEN), International Organization for Standardization (ISO), and many of the affiliates represent HL7 to their own national standards groups such as Netherlands Normalization Institute, Deutsches Institut für Normung eV (DIN) (Germany) and the Canadian Institute for Health Information.

International market forces also play their part, in that any vendor active in the large US market is obliged to adopt HL7 as the interface mechanism of choice. Systems deployed elsewhere have this mechanism available and vendors are naturally reluctant to make changes. They are even more reluctant to support multiple standards or custom implementations. Local vendors who wish to implement interfaces to those systems may have little choice but to adopt HL7 in those interface instances.

Tools and Choices

While HL7 may seem obvious for many in the industry, it should be kept in mind that the advent of the Web introduced many new companies with innovative technology but little experience in the healthcare market. In addition, as the overall cost of interfacing has declined through the availability of cost-effective software-based integration tools, more 'lower-end' systems that could not previously cost-justify being interfaced are now doing so. Together with an increasingly stringent regulatory environment and a need to maintain the confidentiality of computerised patient records, even smaller clinics and physician practices are now finding themselves having to address this issue.

Do Not Customise

There is a temptation to short-cut the process and justify an intermediate 'quick and dirty' step. To many, HL7 is seen as a 'necessary evil' to which they are forced to allocate resources that could be better spent on improving their core products or operations. This perspective is compounded by the fact that, as with other standards, HL7 continues to

2. *HL7 Board Appointed Committee, Mission and Charter Statement.*

evolve, and new standards such as X12N and even the XML-based HL7 version 3 are being introduced. Any competent programmer can write a program that will allow two systems to exchange data without having to go through the learning curve associated with HL7. Similarly, one could custom code an HL7 interface that meets the requirements of the specific interface at hand. Both approaches may be a significant mistake.

While it resolves the immediate integration requirement, it is not unusual to find vendors who have unwittingly established a significant installed base of custom interfaces. The vendor discovers one day that the programmer who wrote those interfaces has left or been reassigned, the source code has been lost or has become a patchwork of fixes and add-ons, and no-one else in the organisation is really able to step into the breach. Customer support and, ultimately, customer satisfaction is therefore compromised.

Using a Tool

There are a number of cost-effective integration tools that will significantly reduce the 'time to go live' of an interface and that also ease the user up the learning curve by taking care of many of the details inherent in a standard. In addition, vendors of these tools are more likely to ensure that their product stays abreast of evolving standards.

One needs to ensure that the tool is generic and can be applied to many different formats with an absolute minimum of programming. As noted previously, standards will evolve, and what should be avoided is what may be referred to as the 'HL7-to-HL7-to-HL7 syndrome'. This is where we are requested to provide integration services or tools to a customer who already has an existing HL7 interface embedded in their application. Either because the authoring programmer is no longer available (to provide support or make changes) or because the interface was created in an inflexible, custom manner, the interface cannot be replaced or adapted easily to meet evolving interface requirements. As a consequence, the existing interface has to be supplemented with a second interface that cures the existing interface's defect or shortfall, which is not a very satisfactory solution.

Quantifying the Benefits

There can be no question that the benefits of automating the flow of information and reducing the need for redundant and often erroneous data entry are significant. At the same time, because these benefits are sometimes difficult to quantify, they are seriously underestimated and undervalued by potential beneficiaries, especially when the upfront cost of an interface consumes a significant portion of the department's equipment budget.

It is therefore instructive to review a three-hospital study conducted by LINK Medical and Philips Medical (Agilent at the time) in the summer of 2000. Three hospitals were asked to analyse and assess carefully the effectiveness of automating the processing of electrocardiogram (ECG) orders and test results within their facilities. Each site had an orders interface that allowed technicians to selectively download demographic and orders data received from the hospital IS (via an HL7 interface) into ECGs that were deployed throughout the hospital (minimising or eliminating the need for any manual data entry). Once an ECG had been reviewed and confirmed by a reviewing cardiologist, the result was uploaded automatically back into the hospital IS via an HL7 results interface so that it was available throughout the enterprise. The study's outcome surprised everyone, for example:

- reduction in direct labour costs (US$11–25,000);
- elimination of non-billable tests;
- elimination of lost charges (1% to 2% of ordered tests);
- elimination of lost tests;
- short payback period (less than 12 months); and
- on-going return on investment (ROI) – these savings and associated benefits continued.

Overall cost savings were in the range of US$43,000 to US$59,000 per annum. In effect, the payback on the interface was less than one year. Redundant entry of patient data was greatly minimised, as was manual verification. ECG orders were reconciled immediately with outbound results, ensuring that all orders were performed and that all results were billed properly and immediately. Results were available immediately throughout the enterprise. To quote one of the participants, "What was once a time-consuming process with a strong potential for error" was transformed.

Closing Remarks

The study substantiates the benefits associated with integrating systems within an institution. The availability of a generally accepted standard provides the integration framework. Commercially available tools will increasingly allow a broader spectrum of end-users to rapidly accommodate integration requirements in an efficient and cost-effective manner. Greater participation in the application of standards will expedite the overall adoption rate and evolution of the healthcare market towards a more 'plug and play' integration environment. ■