GUEST COLUMN

Jeff Sutherland
jeff.sutherland@idx.com

Healthcare

Technology Futures

Opportunities One of the most significant opportunities for implementing distributed object computing is in healthcare, the largest service industry in the US. Heathcare institutions are evolving into large integrated delivery networks (IDNs), supporting applications in multiple hospitals, physician groups of all sizes, and a wide variety of specialty groups. The IDN requires seamless integration of data across hundreds of applications, built by dozens of software vendors, running on a wide variety of hardware platforms, on a network integrating a large geographic region.

Perceptions Recent surveys show that hospitals, doctors, and health insurance have the lowest perceived values of commonly purchased goods and services. Consumers say the systems' inconvenience robs them of their good health and limited free time. They bemoan its inefficiency. Data about prices, cost, quality, and availability are stunningly absent. System expenses exceed a *trillion dollars.* The cost of a single episode of care remains unknown. Consumers hold great respect for medical research, drugs, devices, and technology, but are increasingly upset about lack of efficient services that they see automated in other industries.[1]

Problems Data availability is a major problem—30% of medical records are not available, 11% of lab tests must be reordered, 38% of physicians' and 50% of nurses' time is spent on documentation, 70% of data needs of physicians are unmet during patient visit, 27% of records have missing information, 40% of diagnoses are unrecorded. Seventy-six billion dollars is spent on drug interaction related disease and death each year.[2]

In the United States, physicians are 5% automated. In the United Kingdom, physicians are 60% automated. Lack of physician automation in the US is equivalent to the situation in underdeveloped countries such as Croatia.[3] In the emergency room, your medical record is your skin. US healthcare automation is roughly as efficient as the Irish Post Office was in the late 1980s. Thousands of clerks kept millions of slips of paper, some of which were more than 100 years old. Most of it was filed away in boxes that were inaccessible.

Jeff Sutherland is Senior Vice President Engineering and Product Development at IDX Systems Corporation in Boston, MA.

The Irish Post Office has made significant investment in automation during the last decade and now uses distributed object computing to seamlessly integrate thousands of offices throughout the country. The UK, Denmark, Australia, Germany, and other countries are adopting the same post office technology. Meanwhile, the US healthcare industry has historically invested less than 2% of revenues in automation, compared to 7% in the typical US industry. The lack of ability to modify and automate business processes is crippling to both the healthcare system and its patients.

Futures The healthcare market is transforming itself. A few leading integrated delivery networks are enhancing the patient experience to drive increasing market share. The Internet is transforming innovative individuals into self-empowered care providers. Electronic medical records (EMRs) can dramatically improve patients' experience. The integration of the EMR with financial, scheduling, and managed care systems provides information necessary to reduce incidence and severity of illness. Enhanced profitability and Internet technologies will allow innovative service providers to develop "customer-intimate" strategies that will allow them to dominate regional markets.

Patient admissions are already 50% lower in physician-owned IDNs compared with traditional fee-for-service arrangements. It is possible to decrease patient visits and admissions by another 50% by improving patient treatment and health status. Margins will be significantly enhanced (providers will become more profitable); patients will migrate to networks that improve their patient experience and demonstrate radically reduced disease rates and enhanced longevity in populations under care. Capitation (the assumption of risk by healthcare providers through fixed annual payments per person in treatment plans) increasingly forces service providers to become competitive by adopting strategies already in widespread use in other industries.

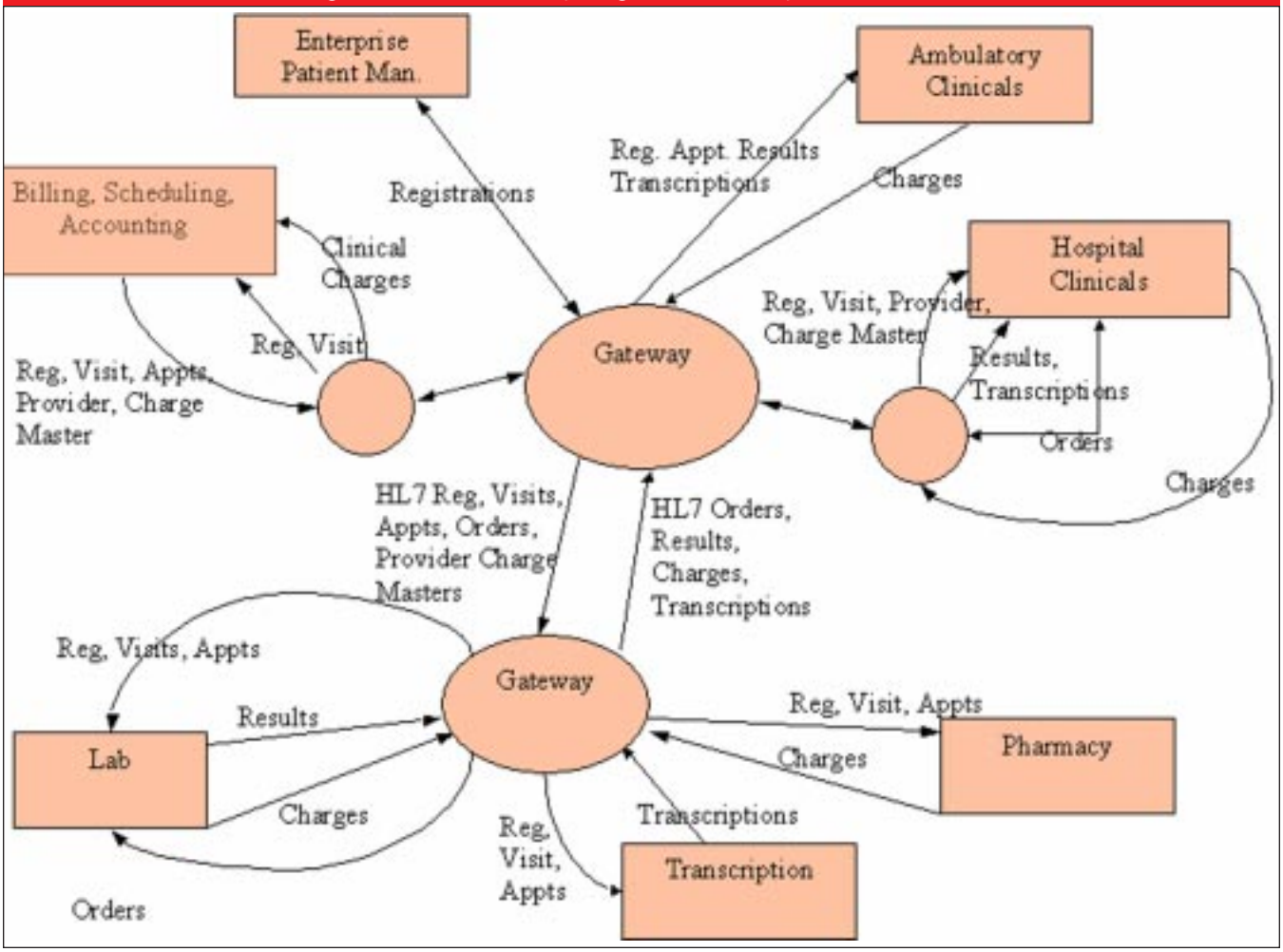
Strategies There are four key strategies already in various stages of implementation in leading healthcare institutions.

- ***Automation*** of the medical record and integrating this information with registration, scheduling, and financial systems allows enhancement of the patient experience. Initially, this is the most effective strategy to gain market share because until now patients have had no way to quan-

continued on page 63

continued from page 64

Figure 1. Distributed Computing Network for Improved Healthcare



tify the benefit of treatments across providers. This strategy requires interobject communication among enterprise patient management systems, hospital and ambulatory clinical systems, scheduling systems, and accounting and billing systems. All of these systems may be running software from different vendors on different hardware platforms. The only way to provide true integration is distributed object network computing.

- ***Intervention*** to reduce disease incidence and severity—while not visible to the patient in a system that provides virtually no outcome data—can dramatically reduce costs. For example, proper monitoring of asthmatic patients can reduce the average number of emergency visits per year from 15 to 0. Data analysis required for action plans requires large data warehouses, often with real-time feeds. Tracking and monitoring patients and alerting physicians is best achieved through component to component communication between data warehouse, scheduling, and clinical systems.
- ***Triage*** before the patient enters the clinic or hospital can eliminate 80% of emergency room visits using strategies adopted by Access Health.[4] This is accomplished by nurses and physicians using computing resources to triage patient problems, automate scheduling of patients at disparate facilities, and network communication of medical data to a healthcare provider while the patient is driving to the treatment facility.

The fourth strategy, eradicating disease at the source through patient education, merits fuller discussion:

Breakthrough: Distributed Computing Over the Internet

"The Internet access breakthrough presents huge opportunities to make substantial strides … not only in reducing costs, but in improving clinical quality and customer service."[6] At point of service, patient education on physical fitness and diet management can reduce the occurrence of many diseases, thereby avoiding many episodes of care. Every coronary artery bypass graft that is averted can fund hundreds of prenatal care visits for high-risk pregnancies. Preventing a single low birth-weight baby from requiring a

neonatal intensive care unit saves hundreds of thousands of dollars.

Automatic detection of conditions in a medical record that indicate a need for a physician visit could generate email and schedule followup by a customer service representative. Appointments could be scheduled from home and relieve administrative burdens and overhead costs. Vital signs could be followed at home using devices communicating via wireless to the internet. Virtual appointments over the Internet could dramatically increase the number of patients a physician can serve. Self empowerment through Internet education leading to alternative modes of care and prevention can dramatically improve health while radically reducing cost.

Technology for monitoring vital signs on a population basis is already available in the laboratory. An MIT faculty member and his students swallowed little computers when they ran the Boston Marathon last year, transmitting bodily function data to CNN. It would not be a bad idea to take a computer each morning like a vitamin. Negroponte, Director of the MIT Media Lab, argues that these computer pills would flow into the "millennium toilet" and provide a vast amount of public health data. When you visit the doctor, you could say, "Here is the data on me for the past month, and I feel crummy."[5]

Challenging Realities The challenging reality is that in 1998, even for a small IDN, the distributed computing network in Figure 1 needs to be implemented. When a patient enters the system, a central medical record number and associated identifiers in other systems must be accessed through an Enterprise Patient Management System (EPMS). Registration data must flow from EPMS into all other systems. The scheduling system is accessed and appointments made in ambulatory and inpatient clinics. During treatment visits, clinical data generates transcription, orders, results, and charges, which must flow seamlessly through the network.

Today, distributed computing is largely supported by hand-crafted interfaces. In the future, it will be supported by interobject communication using Internet standards. Self-describing XML data objects will be transferred over the network, stored as XML objects in emerging object repositories, and presented as XML objects on thin-client browsers. Interfaces will no longer be constructed by hand. Gateways will be eliminated. Components will be specified with visual tools, and the infrastructure will seamlessly automate interoperability.

The ability to rapidly implement, change, and reconfigure distributed object systems will allow business process reengineering to enhance patient treatment, lower the cost of implementation and support, and provide the right information in the right time and place to improve patient flow, lower costs, and enhance profits. The return on investment will be very high on implementation of advanced systems, particularly when improved patient perception results in dramatically increased market share among innovative providers, a result that is achieved on a routine basis in other service industries.

References

1. Herzlinger, R., *Market Driven Health Care: Who Wins Who Loses in the Transformation of America's Largest Service Industry,* Addison-Wesley, 1997.
2. *Wall Street Journal,* April 1992.
3. Bushko, R., Opening Remarks from the Chair. Future of Health Technology Summit and Discussion Forum: Personalized Health Education & Patient Physician Communication, MIT Media Lab, Sept. 25–26, 1997.
4. Access Health, www.access-health.com/
5. Negroponte, N., Being Digital in a Digital Age. HIMSS/CHIME CIO Workshop Keynote Address, Feb. 22, 1998, Orlando, FL.
6. Jones, C. M. The Internet Access Breakthrough: Bringing Healthcare Home, *Healthcare Informatics* 14:7:62-64, 1997.