Technology Trends: A Look into the Future

By Shawn McKenzie, *MPA*

For just a moment, I wish I were gifted with the amazing imagination of a Gene Roddenberry. After all, the communicator was a precursor of the cell phone. Even the medical facilities of the Starship Enterprise boasted wireless monitoring and digital images. If we were to make the same Herculean leap into the future, as Star Trek did in the late 1960s, what would we see?

Since we don't often receive invitations to the "eyes only," "keep it under your hat," "you were never here" world of medical research and development dungeons to see what future technologies are blossoming, it is difficult to predict what imaging sciences are being developed. As imagination spawns action, I will write with the mindset that I am extending my wish list, in hopes that the engineers in development might read this article. I hope it stimulates the mind motors in developing the next medical tricorder that will take us to the next level of healthcare technology.

Anyone having any tenure in the imaging services will note that our technology is developing over the last 10 years with breathtaking speed. In 1965, Gordon Moore, founder of Intel, made the prediction that computer chip technology will double every 18 months and cost would reduce by 50% every 3 years. It never fails each and every time I pop into the local computer mart, the personal computer (PC) I bought 6 months prior is offered as a third- or fourth-tier PC. The new model is the same price as my "old one" and has 2 or 3 times the functionality. I sense some accuracy in Gordon Moore's prediction. In fact, the industry recognizes it to the point that the prediction is now referred to as "Moore's Law." Computing memory capacity, 16 kilobytes in 1985 and 512 megabytes in 2000, has surpassed the gigabyte barrier. Storage memory is well above the terabyte range—a far cry for those of us who started with cassette tape drives in the early 1980s!

Advancements Evident in Diagnostics and Treatment

These advances have increased the sensitivity of diagnostics and focused treatment planning, all of which result in better patient care. For example, computed tomography (CT) scanners that once took 5 minutes to produce a single slice image of very poor quality are now capable of multiple slices with excellent detail in less than a half of a second. In addition, computer monitors have increased in technology such that display resolution is to the point at which the Federal Drug Administration (FDA) has approved the reading of digital mammography. These advances provide increased speed, sensitivity and specificity in diagnoses.

It's all about information. In the healthcare industry information is the Holy Grail. When caregivers have information, they can act with the appropriate steps. Without information, clinicians must continue to act, but without the information and certainly with more deliberation.

The healthcare enterprise of the future will incorporate amazing new data acquisitions—technologies capable of displaying pathology in a static format, dynamic format, or metabolic state. Acquisition will be paired with ability to fuse or correlate this data using computerized cross-checking systems.

For a number of years, healthcare organizations and research centers around the world have been reporting and filing diagnosis, treatment plans, and outcomes into database registries. As these databases of information fill with case studies, it is entirely possible that after a diagnosis is determined, treatment strategies will become individualized for that specific patient based by accessing useful information found on the databases archived full of cases studies, outcome reports, and abstracts to support the clinician in determining best practices.

Trends in medical technology are focused on faster and more detailed acquisition of information and the distribution of the data on-demand to the clinical staff when and where they need it. This includes historical data used for comparison and correlation. Envisioning the healthcare environment of the future, I see a system of interoperability where the patient is truly the owner of his or her information. We hear Washington-speak of the electronic health record (EHR). If the patient owns their information in a transportable format, the issue related to where the information is archived and accessibility becomes moot.

Predictions for the Future

Okay, I have moved to a semi-private office to write this next section. I have fastened on my synthetic Spock ears and feel prepared to predict. Please do not hold me to any of this mind meld…unless it, in fact, comes true. Then I take all credit for this article. Healthcare of the future will follow a pathway similar to the items below.

Patients in need of care from emergency medicine in the field to hospitals and clinics to the physician's office will own and transport their entire EHR. This information can be embedded on a smart card carried by the patient, or in a computer chip located in jewelry such as watches, bracelets, necklaces, etc. Recent news from the FDA even suggests a more Orwellian approach, as they have approved an implantable medical ID chip. The patients transportable EHR will incorporate data such as:

- medical history
- reports and/or images of prior procedures
- primary physician information
- medication use
- allergic reactions
- advanced directives
- insurance information
- demographic information
- emergency contact information

The ability to access the patient-held information will be reliant on standard formatting. We see movement toward the development of standards in the way information is stored and displayed. As more and more data are remotely available, standards for interoperability among healthcare organizations will continue to evolve.

Wireless handheld devices will be more powerful and secure. The use of voice recognition software is already in use on many handheld PDAs and cellular phones. It is entirely possible to load or access Web-based order entry software through these devices. Hanging on Moore's Law, it will not be long before physicians will order studies remotely and accurately by use of voice-activated computerized physician order entry (CPOE).

Diagnosis will be accomplished faster and with increased accuracy. Computer-aided diagnosis programs will rival even the best minds and will serve as a primary diagnostic tool, subject to human oversight. Physicians will have the ability to check their findings via real-time consultation with specialists because of the ability to visualize the exam data simultaneously from multiple locations. Physicians will also be able to access an online database that would provide them an inventory of similar cases, the treatment plan, and the outcomes.

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Distribution of the findings is a focal point in the delivery of healthcare today. Systems integration with an EHR is becoming common practice. Accessing information relevant to a medical procedure will be available through a single access point using a single user sign-on or authentication. Secure access to the information will be simplified by proximity badges, proximity chips, and/or biometrics such as retinal or fingerprint scanning hardware and software. Once access is granted, the system will launch the user through a portal capable of displaying text information, streaming video, wave form or static images through a single user interface. Patients being discharged will have their personal EHR updated to reflect the latest treatment, change in medication, or altered medical status.

While some of these ideas may sound remote, we must not forget that we live in a world experiencing the technology revolution at an exponentially fast pace. If the PC sitting in the business office adheres to the premise of Gordon Moore, 10 years from now general purpose computers will come standard with nearly a terabyte of operating memory and price tag of about 10% of today's cost. If the standard PC will progress this dramatically, just imagine what the clinical healthcare setting might look like.

Time to recharge my dylithium crystal. Spock (Shawn) out.

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