



## **From Film to Pixels: *The Future of Medical Imaging Technology***

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### **Medical Imaging in the 21<sup>st</sup> Century**

As medical imaging technology rapidly advances towards mobility and higher resolution detail, the need for compact and/or portable, high-performance computers is also increasing.

- Mobile MRI and CT vans require systems that can fit easily into tightly packed control rooms or on carts that can be wheeled from place to place in a hospital.
- The teleradiology field is defined by its demand for easily portable, high-performance graphical processing systems for capturing, sending, and receiving radiological images.
- Professionals using PACS technology must have vast amounts of storage and high-performance processing in relatively small spaces.
- 3D biomodeling professionals increasingly demand the graphical power of a 3D CAD system in a conveniently mobile platform.
- Service and software providers depend on powerful, portable systems to showcase their products as they would be used in a working environment instead of sacrificing performance for portability (See NextComputing's white paper on "The Sacrifices Users Make for Portability").

This paper discusses several new technological requirements for small, portable, high-performance computers in these various areas, and presents practical solutions to help fulfill those high-end requirements.

#### **▪ Mobile MRI and CT**

Mobile MRI and CT vans have come into more use in recent years as hospitals call for immediate, short term solutions for advanced radiological imaging while planning long term, in-house solutions. These vans are fully equipped, fully shielded mobile scanning facilities that contain everything necessary to scan, capture, digitize, transfer, store, and/or render detailed images as easily and efficiently as a stationary facility.

Space restriction becomes the main issue with equipping mobile MRI and CT vans with the necessary technology. The vans are modified tractor trailer designs that are outfitted with the proper walls and shielding, including the standard 5 gauss exclusion zone. Tables, magnets, wiring, cabinetry, lighting, computers, monitors, and printers are also installed within the confined space. The van still has to offer as much patient and technician comfort as possible during procedures, presenting a challenge incorporating all of necessary the technological equipment.

Typically these vans include bulky, high-performance desktop computers with multiple, equally bulky, monitors for scanning control and image capture purposes.

The space sacrificed for this type of setup could be used for basic creature comforts, or simply open space for a roomier feel; a necessity in a windowless environment.

- **Teleradiology**

Despite the recent, dramatic increase in the use of radiological images, the number of radiologists who read those images is growing more slowly. This circumstance has expanded the field of teleradiology, which allows radiologists to provide services from a different location than the patient. When a number of radiologists work from multiple locations other than the hospital to perform and/or interpret the scans, they will need two or more high-performance systems.

The sending systems require multiple features such as a high-resolution, image digitization and encryption, little or no compression, a high-speed network interface, and possibly 3D rendering capabilities. Depending on the time sensitivity of a reading, live streaming of encrypted images over a network to a receiving system may be an additional critical feature.

The receiving systems require similar features such as a high speed network interface, high volume storage, image manipulation software with possible 3D rendering capability, and one to two 14-21" high-resolution displays. These stationary systems can run anywhere from \$35–55K depending on hardware and software needs.

With the convenience of a portable design, the radiologist can travel with a system to another hospital, an office, or their home, and still be able to perform time sensitive, critical readings and reports for anyone that might need them.

- **PACS**

Picture Archiving and Communication Systems (PACS) demand massive storage space, high speed data and graphics processing, and incredibly fast transfer rates, to capture, digitize, transfer, and store today's high-resolution and 3D medical images. Additionally, PACS must offer secure image backup either via removable or off-site storage. If removable media is the chosen solution, it must be easy to insert and remove with relative quickness.

More and more, hospitals choose off-site storage, usually with a 3<sup>rd</sup>-party provider. Hospitals have to be wary of this option, due to the downsides. If critical data is lost on-site, the PACS must be able to reconstruct the image database locally while simultaneously capturing new images. With 3<sup>rd</sup>-party off-site storage, the infrastructure is often expensive and semi-autonomous, and runs the risk of frequent downtime, which a hospital cannot afford.

Another viable solution for hospitals would be to self-house the images off-site in another building owned or leased, maintained, and staffed by the hospital. This would also allow tighter security for patient information. However, there may be challenges from spatial constraints for housing the bulky equipment commonly found in a today's data centers.

- **3D Biomodeling**

3D biomodeling for prostheses and bone reconstruction, an effective process for locating an exact defect with good measurement accuracy and with no risk to the patients' health, is gaining more of a foothold in the medical world. Along with this innovation, computers and software designed for the process have become significantly more sophisticated, requiring the equivalent graphical and data processing of a Hollywood movie studio special effects department. Add the possible difficulty of moving a patient in critical condition or ICU and mobility can quickly become a necessity for 3D biomodeling specialists. In order to show a patient or their medical team how a reconstruction or fitting will work and what the results will look

like, powerful, portable 3D modeling or CAD-centric computers can allow specialists to take the system to a doctor's office for discussion and adjustment and then to a patient's room for a visual update of the procedure.

- **Service and Software Providers**

Medical imaging software and service providers require flexible, portable, high-performance systems to fully demonstrate the features and benefits of their imaging software, for use in PACSs, 3D biomodeling, or teleradiology and radiological imaging. Often, it is difficult to find a portable system that packs enough processing and graphical power, as well as meets flexibility requirements. Laptops are generally accepted for their portability, but they lose traction in the performance area and distinctly lack the flexibility that makes other portable systems more cost-efficient.

## 21<sup>st</sup> Century Solutions

All of these fields described so far show a trend of needing incredibly powerful graphical capture and data processing power, high volume storage with possible removable storage media, and secure, high speed network connectivity, in a very small package. Since 1999, NextComputing has become the leading innovator in the high-performance, portable workstation market, and have developed solutions for some of the largest names in the medical imaging community. NextComputing has also developed relationships with major component manufacturers, such as Seagate, Intel, AMD, NVIDIA, and PNY, which allows them to offer tailor-made solutions that fit the specific needs of any sector.

- **The NextDimension Family**

Equipped with a comfort-grip handle and weighing less than 25 lbs, depending on model and configuration, NextComputing's briefcase-sized, NextDimension series offers service and software providers, teleradiology professionals, and mobile imaging providers, systems that can be transported with extreme ease between locations or stowed neatly into small confines of a mobile van. Service and software providers in particular have discovered that the convenience and flexibility of NextComputing's quick-time, no-tools removable hard drives gives them the ability to easily swap out drives loaded with different software packages when traveling and demonstrating a variety of software to various customers.

*Key features of the NextDimension Evo or Pro models include:*

- up to eight (8) processing cores from Intel and AMD
- potential for up to 2TB of removable storage and over 9TB of fixed, internal storage
- up to 24GB of memory
- up to four (4) PCI-X/PCIe slots for high-performance graphics cards from NVIDIA or AMD, or other 3<sup>rd</sup>-party cards
- integrated 17" HD displays with resolutions to 1920x1200
- numerous USB, GbE, and eSATA ports

While originally designed as a high-end 3D CAD workstation solution for manufacturing, architecture, and design, the NextDimension XGE provides 3D biomodeling specialists with a superior portable system fully capable of meeting any reconstructive modeling need.

*Key features of the NextDimension XGE include:*

- up to two (2) quad-core Intel® Xeon® processors

- up to 24MB of memory
- up to 1.5TB of combined removable and fixed storage
- choice of high-end graphics cards from NVIDIA and AMD
- integrated 17" HD displays with resolutions to 1920x1200

In addition to the internal features, NextComputing also offers optional touch-screen capability; ultra-light, clip-on 17" HD displays; and up to 2.5TB of extra, attached storage.

▪ **NextServer Evo**

For hospitals that decide to utilize their own off-site data center, but want to reduce costs, NextComputing offers rack mountable servers that are powerful, fast and offer up to 24TB of SATA and/or SAS storage capacity with options for various PCI-based RAID arrays in a conveniently-sized 3U chassis.

*Key features of the NextServer Evo include:*

- Sixteen (16) front-access removable drives (1TB/7200 RPM or 300GB/15K RPM each)
- Four (4) quick-time, no-tools removable drives and up to (13) internal drives (500GB/7200 RPM, 300GB/10K RPM, or 147GB/15K RPM each)
- up to four (4) PCI-x/PCIe slots
- up to 24GB of memory
- support for a variety of 32- & 64-bit Windows- or Linux-based operating systems

## **NextComputing: Innovation for the Medical Imaging Community**

NextComputing's high-performance, small form-factor, portable solutions offer teleradiology and 3D biomodeling professionals, as well as medical imaging software and mobile imaging service providers, with compact, portable solutions they require in the 21<sup>st</sup> century. For these professionals to properly diagnose, treat, and service patients, doctors, and hospitals more effectively and less expensively than the average larger, non-portable options prevalent in the industry today, they must be equipped with the technology they so desperately need. With an array of innovative, mobile solutions from NextComputing, the medical imaging community's demands have been answered.

Call us or visit us on the web at [www.nextcomputing.com](http://www.nextcomputing.com) to find out how a NextComputing solution can help to reduce your organizations costs, enhance productivity, and provide you with the technology you and your staff needs to keep up with the competition in the fast-paced, 21<sup>st</sup> century medical imaging industry. It's not your grandpa's X-ray anymore!

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