In 1921, when Gustave Roussy founded the Institut du Cancer, which took his name in 1950, he defended two ideas that were innovative for his era: a global approach to cancer via multi-disciplinary teams who collectively determine the most effective treatment for each patient, and high-level research (based on collaboration between clinicians and researchers) which is essential in understanding cancer mechanisms and the effectiveness of treatment.

These ideas are recognized today as fundamental in the fight against cancer, and have significantly influenced the design of Institut Gustave Roussy's (IGR's) hospital information system—a system entirely focused on the patient and information sharing by care and research teams.

IGR relies on a tiered storage infrastructure based on EMC® CLARiiON® and EMC Centera™ systems to provide medical teams with a complete patient file (encompassing both data and images), thereby improving the quality of patient diagnosis, follow-up, and care. Centralized archives supported by the EMC Centera content-addressed storage platform facilitate fast access to increasing volumes of older images which must be retained for extended periods of time for medical and regulatory reasons.

“With Centera, the patient avoids undergoing tests a second time and carrying suitcases filled with documents,” explains Dr. Robert Sigal who was responsible for the PACS implementation. “For caregivers, being able to easily access images and all of the patient’s data at any time facilitates the monitoring of the evolution of the disease, the assessment of treatment effectiveness, and a better knowledge of the patient’s specific situation. Now that images are digital, we can also share them with our partners, research centers, or pharmaceutical companies, specifically in the context of therapeutic trials.”

**Bringing images to patient files**

In 1986, IGR began developing SIMBAD, a computerized online information system for patient files. In addition to patient identification data, the following were progressively included: appointment scheduling; consultation, hospitalization, and anatomopathological reports; prescriptions, plans, and treatment results.
By the mid 1990s, the SIMBAD patient file was nearly complete and contained almost everything needed for a complete and historical overview of the patient and the treatment of the patient’s pathology—except images.

“We were using film and filing the images in physical files,” says Claude Ruelle, PACS (picture archiving and communication system) project leader, IS department. “In addition to the logistical and maintenance problems resulting from this method, it also meant that the file was missing elements that play an increasingly fundamental role in reaching a diagnosis.”

Based on this finding and the rapid advances in medical imaging systems, the HIS-integrated PACS project was initiated to incorporate images into the existing computerized patient file.

**The first PACS in France**

IGR’s project, which became the first PACS in France, required a thorough technical and functional analysis involving, to a great degree, the future users of the system. A first call for proposals addressed to 25 manufacturers was unsuccessful. After a year of work establishing precise specifications, a new search was conducted. Of the five proposals received, Centricity PACS from GE Healthcare was chosen because it was the most ergonomic and would provide clinicians with the greatest added value.

Deployment began in 2000 and led to the progressive connection of the various digital imaging modalities (MRI, conventional radiology, angiography, echography, mammography, scintigraphy, etc.). In this way, IGR was able to centrally archive and redistribute results, upon request, to those responsible for care within the hospital. Today, the Centricity PACS is connected to 18 diagnostic stations, 20 post-treatment image stations, 500 consultation stations, and two digitizers.

The Centricity PACS was closely integrated into the SIMBAD hospital information system which sent to the acquisition modalities lists of tasks based on the appointments requested by clinicians. This triggered the pre-loading of relevant files for rapid access to data and stored images.

**EMC technology absorbs volume and guarantees long-term protection**

In 2004, IGR was confronted with an issue regarding volume that the initial digital optical disk archiving system could not absorb. As the archiving server became obsolete, IGR sought a solution capable of handling the load increase while guaranteeing the integrity and legibility of the stored images—regardless of the modalities used to produce them. In parallel, IGR needed to update all of its IT equipment as the current heterogeneity was causing increasing maintenance problems.

“The greatest advantage of the EMC SAN is the ability to select a storage level in accordance with the criticality of the data and without volume restriction issues. The immediate availability of the images, the opportunity to share them and keep them as long as necessary, the inclusion of pre- and post-surgery photos, Echo-Doppler filmed sequences, and, over the long term, digital microscope images, undeniably contribute to an improvement in patient diagnosis and follow-up.”

Laurent Tréluyer, Director of IT
“We chose to standardize user stations by opting for the Citrix thin client,” explains Laurent Tréluyer, director of IS. “However, for the heavier PCs and application and storage servers, we selected Dell, and Dell introduced us to EMC storage.”

Dell recommended a SAN storage solution based on EMC CLARiiON and EMC Centera archiving systems to support IGR’s PACS environment. This high-performance yet cost-efficient tiered storage infrastructure now supports the economical retention of digital images over an extensive period and replaces very expensive UDO tape library systems. Dell has integrated this EMC storage environment with the Dell PowerEdge 1855 Blade Server and Dell PowerVault backup library solutions.

Each time a file is requested for consultation (via the SIMBAD appointment system), it is loaded into an EMC CLARiiON CX series system which supports rapid access. The acquired images are stored on the EMC CLARiiON system for 10 days before being transferred to two mirrored EMC Centera archive systems equipped with economical ATA disks. It is expected that by the spring 2006, all of the archives still stored on optical disk will be migrated to EMC Centera online archive storage.

The RAID 5 storage on the EMC CLARiiON CX series system, along with the synchronous replication between this system, another CX series system, and the two EMC Centera bays, guarantee optimal data protection. Furthermore, all of the information system’s critical elements—servers, networks, etc.—are or will become redundant.

Centralized backup of the servers is provided by an EMC NetWorker™ backup solution with a library of 100 cartridge bands equipped with four LTO2 drives. This architecture allows for the delivery of the level of service expected by PACS users while guaranteeing the protection of data and providing for two-hour disaster recovery.

A capacity increase in the EMC CLARiiON CX series system to three terabytes in the near future will allow for 15 additional storage days on the EMC CLARiiON for images most likely to be consulted.

“The greatest advantage of the EMC SAN is the ability to select a storage level in accordance with the criticality of the data and without volume restriction issues,” says Tréluyer. “The immediate availability of the images, the opportunity to share them and keep them as long as necessary, the inclusion of pre- and post-surgery photos, Echo-Doppler filmed sequences, and, over the long term, digital microscope images, undeniably contribute to an improvement in patient diagnosis and follow-up.”