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A Holistic Approach to Date Management

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There is no doubt that the installation of a Picture Archiving and Communications System (PACS), designed for image and data storage and accessibility, necessitates that the system includes a well planned disaster recovery and data management structure. New generation storage solutions are proving to be more efficient than their conventionalPACS archive predecessors inachievingthis, with an increased level of interoperability that will allow disaster recovery, data management and accessibility, to become better organised and more efficient.

First generation PACS archives were dedicated solutions aimed at the long-term preservation of DICOM-based information. There was a single interface to the local imaging modalities and data was accessed quite rarely because of the pre-fetching of relevant priors. Information from other clinical systems, such as cardiology and laboratory data, were stored in separate dedicated solutions, resulting in multiple archiving islands inside one enterprise. In fact, despite the benefits brought by the first PACS archives, their lack of integration meant that there was a long way to go before the potential for this technology could be fully realised.

Future Challenges for Healthcare Networks

At the same time, the rising trend in Europe for the consolidation of small practices into larger institutions which are then integrated into expansive healthcare networks capable of exchanging data and expertise, is creating a challenge in utilising the data stored in a set of archiving islands using different solutions from different vendors.

There is a clear need for healthcare providers to efficiently manage these disparate storage systems and, at the same time, to meet the disaster recovery requirements of the EU and HIPAA regulations.

There are a number of factors that are driving healthcare organisations to view a holistic approach to the sharing of data and resources across a heterogeneous mix of hardware platforms and software systems as the way forward. Such interoperability is needed to support electronic patient records, which in many European nations are being designed or implemented at a national level. In the United States, many healthcare organisations are consolidating operations, especially regarding ambulatory services, which also require data and resource sharing across enterprises.

Furthermore, as the healthcare sector begins adopting new practices and technologies, such as evidence-based medicine and genomics, the need to link together and analyse the different sources of patient data will become even more paramount. Therefore, it is clear that a comprehensive, holistic approach to data storage and management is the best answer to this problem.

Optimal Data Storage Solutions Today

Consolidation of patient-centric data in a common archiving solution is a growing trend in healthcare IT markets. New start-up companies like Bycast and NDMA are emerging in the US, to join established heavyweights such as IBM, Hewlett Packard, and Kodak. The new solutions allow any type of fixed content data including images, laboratory results, video files, etc. to be stored in one system. New generation enterprise archives are configured as network-attached systems and they allow a set of standard interfaces and protocols – not just DICOM.

In new generation solutions, management of data, like the healthcare process itself, is patient-centric, enabling medical data coming from various sources to be consolidated into a patient record and managed as a single object. This allows global functions to be applied to the whole patient record, for example, keeping the patient record on one single media. This object-oriented approach is also a key factor in keeping massive archives efficient and scalable.

An integral part of a modern, streamlined storage solution is a meta-data (index) layer enabling efficient searching and retrieval of patient data. Archived information is by no means dead and has to be retrievable fast and reliably when relevant.

Planning Ahead: How to Avoid Losing Information

An optimal storage solution creates one large virtual system – a grid, but not necessarily one physical storage site. A computing grid is a 'standards-based application/resource sharing architecture that makes it possible for heterogeneous systems and applications to share computing and storage resources transparently'. The advantages of grid computing are, that various systems can interoperate, and computing resources can be distributed throughout an enterprise. As the amount of patient data grows, and analyses become more complex, grid-computing can provide a scalable and efficient technique for meeting the increasing computational needs.

Grid-computing for medical data is being enabled by the adoption of standards for interoperability, and by the use of meta-data techniques for integrating disparate systems and sources of data. The service-oriented architecture (SOA) provides the structures and standards that allow disparate computing resources and services, and data sources, to be integrated into a computing grid.

Technically, a software module is placed above various archives containing meta-data indexes to the full contents of each separate archive. Hierarchies keep track of which meta-data indexes are available at which module instance. Thus searches of large, complex and diverse repositories of data can be completed locally and extremely rapidly. All the meta-data are kept updated and synchronised across instances via various database features. The storage grids also support encryption and compression.

ObsolescenceMmanagement

In the new generation storage grid solution, the seamless removal and addition of servers and storage slots is possible. This is critical in obsolescence management: storage obsolescence has a three to four year cycle, while patient data have to be stored sometimes for decades. In a grid-based architecture we can build a resilient, self repairing architecture with no single points of failure. Data can be replicated in real time and it is also possible to determine the number of replicas (including archive indexes) to gain the desired level of redundancy.

In case of a disaster, image storage and retrieval are automatically re-routed to other resources and generation of new replicas starts immediately. Recovery can be completed easily, when the remote archive is directly in use. In conventional settings recovery from a secondary storage device is not allowed because of the hierarchical structure of storage media.

In conventional PACS archives, disaster recovery has been highly reactive and complex or even impossible to achieve in clinical practice, resulting in extended service disruptions. In addition, moving to a data grid rather than relying on traditional long-term archival back-up can provide considerable cost savings.

The required retention period for stored information varies country by country and also differs for images and other patient data. New generation storage solutions allow intelligent information lifecycle management to automate and optimise storing of data, taking different national legislations into account. The storage rules can be based on the DICOM meta-data or even diagnosis or other data in the meta-data layer.

Final Thoughts

In conclusion, next-generation storage solutions deliver fast access to information, comprehensive security and service continuity, simplify storage management and disaster recovery and, notably, lower storage costs. Besides storing individual patient data, the storage grid could also help researchers to identify health-related trends. In this way, they provide direct benefits in a holistic, institution-wide sense, maximising the applications of PACS technology while at the same time making them more efficient and user-friendly.

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