叢集式醫學影像儲存與傳輸系統

Cluster-based Picture Archiving and Communication System

中文摘要

近幾年來，個人電腦叢集（PC Cluster）發展的相當快，主因於個人電腦及相關原件的進步，如中央處理器（CPU）、隨機存取記憶體（RAM）的速度大幅提昇，使得以個人電腦來做科學運算得以實現。同時，高速網路卡（NIC）及交換機（Switch）的普及，促使點對點計算的成本下降；加上，繪圖、儲存設備的能力也是日新月異，各式各樣的電腦產品都能以普及的價錢買到。在軟體上，許多開放原始碼（Open Source）的軟體已經到達一定的成熟度，同時，Linux、FreeBSD 等免費的 UNIX-like 作業系統也都發展出強大功能，使得 Linux / FreeBSD 不再是只有特殊知識背景的人才在使用。因此，在科學運算效能與經濟性的考量下，以個人電腦組成的電腦叢集，吸引了不同的研發人員將其應用於不同的領域，時間最早可朔及至電腦的 486 時代。

其實，舉凡要電腦計算的，都可使用個人電腦叢集，惟科學運算在計算能力的要求更多而已。個人電腦叢集相對於大型主機而言，具有相當優異的價格/性能比以及可自行建置等優點，且有助於高速計算與平行處理相關技術與應用的普及，各個學術或研究單位可依本身的實際需求，以合理的價格架設適合的個人電腦叢集，這對各應用領域的學術發展將有莫大的助益。

近幾年來由於開放式主從架構（Client/Server）的迅速發展，使越來越多的醫院以開放式主從系統架構其院內的資訊系統。不過現階段這些計畫大都局限於醫院資訊系統(Hospital Information System, HIS)及放射部資訊系統(Radiology Information System, RIS)的規劃與製作，處理資料的型態以文字為主，無法與影像、語音等資料相互結合，使得功能受到相當程度的影響。

近年來，高性能工作站的不斷推出，雖然縮短了醫學影像在醫學影像儲存與傳輸系統（Picture Archiving and Communication System, PACS）上影像顯示及處理所需的時間，但是在 3D 立體影響的處理上仍顯不足，將會是未來醫學影像發展上的一大限制，而電腦叢集伺服器的計算處理能力非常強大，並不遜色於超級電腦，對於未來 PACS 的發展，將其應用於 PACS 上是非常適合的。但就本研究而言，個人電腦叢集除了本身的計算能力外，在其對資料的存取及傳輸上亦有很大的改良空間，本研究計劃的主要目的，即應用改良後的電腦叢集伺服器（Cluster-based Server）於醫學影像儲存與傳輸系統，建置一叢集式醫學影像儲存與傳輸系統（Cluster-based Picture Archiving and Communication System），來增加醫學影像在 PACS 上的傳輸速度與處理速度。

英文摘要

In recent years, the rapid development of PC Cluster is creditable to the advancement

of personal computer and components, like the speed of CPU、RAM has upgraded dramatically, which makes personal computer for scientific computation realizable. In the meantime, popular applications of NIC and Switch reduce the cost of point-to-point computation continuously. More, upon with newly development of storage equipment and graphic tools, various computer products could be obtained at reasonable prices. On the other hand, many software providing open sources have been maturely developed such as Linux 、FreeBSD that offer free and powerful capacity UNIX-like operation system to make them widely applied for users without specific background. Therefore, since Intel 486, PC Cluster''s efficient processing and economic advantages have attracted many different researchers and developers among various fields to apply it.

In fact, PC Cluster can be applied to all computation in need, except for scientific filed where will require higher computing capability. Relatively, compared with supercomputer, PC cluster has remarkable capacity and acceptable prices also, including the advantage of self-implementation, that all enable high computing speed and parallel processing to make them widely applied. Hence, every academic or research institute is able to set up his own PC cluster respectively at reasonable budget according to actual needs. Many researches and developments can be then benefited simultaneously.

Along with the fast-moving development recently of client-server architecture, more and more hospitals catch this trend to apply it in information system. But most of the related applications are still limited in HIS (Hospital Information System) and RIS (Radiology information System) where the data processing is mainly based on words. Under such limitation, systems can hardly interact with image and voice to earn the complete performance.

The passed few years, high performance workstation server continuously pushes forward. Although this advancement shortens image display and processing time of medical images on PACS (Picture Archiving and Communication System), it still falls short of handling 3-D images. This shortcoming would become an obstacle for future development of medical images. Nevertheless, PC cluster carries with very powerful computing capability not inferior at all to supercomputer. It is thus very suitable for applying on PACS and future development. More than the computing capacity in this research, the PC cluster can bring much improvement for data storage and communication. The main purpose of this research is to design an improved Cluster-based Server for the storage and communication system and, build up the Cluster-based Picture Archiving and Communication System to enhance transmission and processing speed of medical images on PACS.