

# A Networked Environment for Interactively Viewing and Manipulating Visible Human Datasets

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Over the past 3 years, as part of the University of Michigan Visible Human project, the Pittsburgh Supercomputing Center has been developing software and networking technology enabling simultaneous users to interactively view and manipulate Visible Human datasets. This networked environment provides high speed access to enhanced Visible Human data served from a central high performance data server at the PSC or from intermediate “hop” servers. Users operate from PC, Macintosh, or Unix workstation computers running either the University of Michigan Edgewarp-3D program, for morphometric studies, or the PSC Volume Browser (PSC-VB) for anatomy segmentation and model construction. Both of these client programs, described in separate presentations at this conference, provide interactive navigation through full Visible Human volumetric data sets using arbitrary cutting planes supplemented by 3D surface models.

The project performance goal was to develop a system allowing 40 simultaneous users to perform active, uncorrelated navigation through the Visible Human data for anatomy teaching applications. This performance target precludes the use of disk based service models for multi-user interactive navigation. Instead, we have implemented a compressed data structure driven by a high performance large memory server. The overall architecture including additional data services is depicted in **Figure 1** below. The advantages of the server performance are shared across all of the users to increase the aggregate performance while reducing the per seat expense. During operation the client software requests small cubic regions of volumetric data which intersect the current viewing position. As shown in **Figure 2**, this data is retrieved from server memory and transmitted across the network in its compressed form where it is expanded and displayed. The system is currently being used and evaluated by the UMHV anatomy team as they segment and label the Visible Female dataset and prepare anatomy lessons for use at the University of Michigan. As described in additional papers by the Michigan team the system will be fully deployed in anatomy laboratories at Michigan during the Fall 2002 academic term.

This presentation describes our client-server implementation for the Visible Human application along with the data enhancement and representation techniques that provide high performance and operational flexibility. The project depends on high performance networking and performance monitoring to adapt to changing conditions and load levels. This has been facilitated by the use of the WEB-100 network performance tools developed at the PSC and currently running on the PSC Volume Server host.

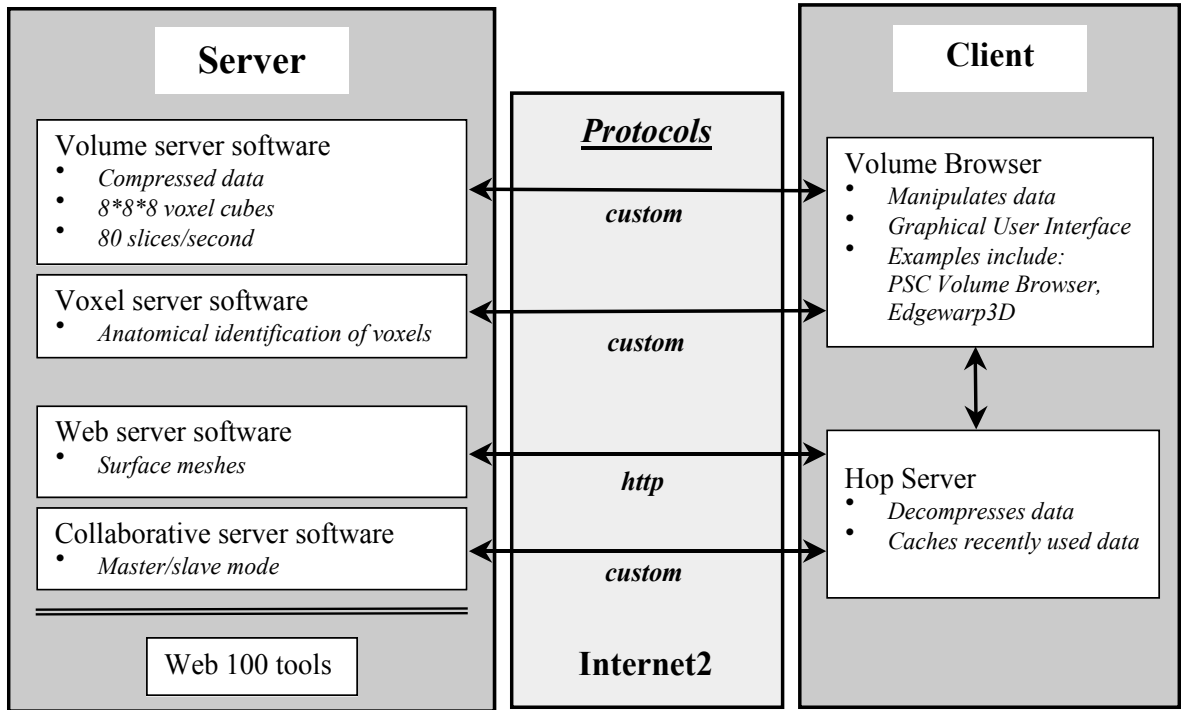


Figure 1 – PSC's Volume Browsing Client-Server Architecture

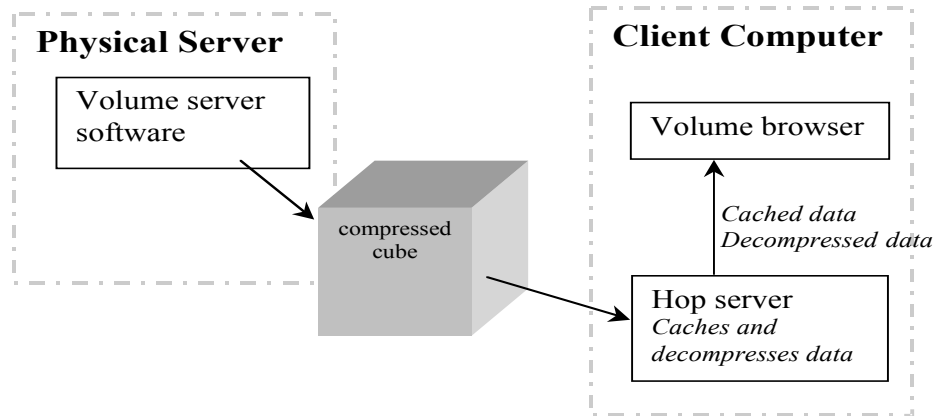


Figure 2 – Sending Compressed Data