In most tomographic imaging modalities, including positron emission tomography (PET), image reconstruction requires long computation times, and the reconstruction is therefore usually postponed until the end of the data acquisition. However, there would be significant advantages to be gained in reconstructing the image in real-time as the projection data are being collected: accurate positioning of the subject before the true image acquisition, early detection of potential problems during image acquisition, direct assessment of image quality as a function of time, and thus potential reduction of the duration of imaging procedures. A real-time image reconstruction prototype was developed as an extension to an existing data acquisition system for a small animal PET scanner. The system was initially implemented on a network of field programmable gate arrays (FPGA) and digital signal processors (DSP), using a fast PET image reconstruction algorithm based on the SVD decomposition and regularized pseudo-inversion of the system matrix. Different configurations of the reconstruction system were examined in order to obtain the fastest reconstruction times for images of at least 64×64 pixels. Updating the image event by event, as they are received, was shown to be possible, but the maximum event rate that such a system can tolerate proved to be limited to about 18,000 events per second. Further investigation showed that a 64×64 pixel image could be completely reconstructed and updated twice per second using the entire acquired projection data set with the SVD algorithm implemented on a 900 MHz conventional PC.