

The Sombrero Distributed Single Address Space Operating System Project

Dr. Donald Miller and his 64-bit OS Group have been developing Sombrero, a research-distributed, single address space operating system (SASOS). The SASOS system was not practical until 64-bit processors became commercially available in the early 1990s. These processors provide a huge 16-quintillion byte address space, making it possible to rethink how operating systems should be designed. In particular, much of the complexity of managing address spaces that currently plagues contemporary operating systems such as Windows and Linux is avoided. The Sombrero project aims to take advantage of the properties of a distributed single address space to make it easier for users to interact with their programs from remote locations, reduce the development costs of software, improve system security and performance.

To this end, the Sombrero project is researching how to virtualize an operating system so that it is not bound to a single computer. Instead, the operating system takes advantage of the large size of the address space available in modern processors and makes it simultaneously available on many computers. It does this so that it can move its programs and data to whatever equipment and location is convenient for the user, reducing the time it takes users to interact it. While this is not a new idea, the approach that Miller's research team uses takes a different look at the best way to implement such a mechanism. The research has shown that most efforts to virtualize data and program access are built on top of complex systems that are bound to a single computer which then have layer upon layer added to allow them to communicate in

groups. The internet browser is currently the most well-known example of such a layer, but is not very efficient. While many internet applications do not require efficiency, many other applications do.

The drawback of this layered approach is its complexity, which results in high cost in both program development and maintenance. In a Sombrero system, the operating system sits on top of all of the grouped computers and allows programs to be designed in such a fashion as to be independent of the underlying computers on which they are running. Put differently, in a Sombrero system, there are no close ties between the computation that is carried out and the location where it is carried out. On a large scale, this means that users of a Sombrero system have a uniform view of the programs on the system regardless of where it is accessed.

Current Sombrero research is on determining ways to bind all data and programs to a large address space that can then be distributed among cooperating computers to provide user and program mobility in a simple way. The research team has already demonstrated that the complexity of such a system can be considerably reduced compared to contemporary operating systems.

The protection mechanism of Sombrero is naturally resistant to security-related, internet threats such as the popular stack and buffer-overflow attacks used to transmit viruses and worms that still plague conventional operating systems. Finally, Sombrero provides higher performance than contemporary operating systems because the single address space reduces inter-program communication and switching times.

The ASU 64-bit OS Group consisting of Alan Skousen, Don White, Rossen Tcherepov, Kris Makris and Don Miller are developing, running and debugging Sombrero on five multi-computer prototype Sombrero systems that are currently running simple applications. The Sombrero project has provided an excellent vehicle for students to get hands-on operating system experience. Two MCS projects, five MS theses and one Ph.D. dissertation have contributed to Sombrero development.



Rossen Tcherepov, Don White, Don Miller and Alan Skousen of the Sombrero research group. Kris Makris not pictured.