

**Sun Network Storage Launch**  
 Solutions Showcase, 14 June 2000

Solid Data Systems demonstrated its solid-state storage products in the Solutions Showcase pavilion at Sun's Network Storage Launch event where Sun announced products and services in Sun's Managed Storage Networks strategy (14 June 2000, Santa Clara).

Other vendor partners participating in the Solutions Showcase include Ancor, BMC Software, Brocade, Gadzoox, Legato Systems, Oracle Corporation, StorageTek and VERITAS Software.

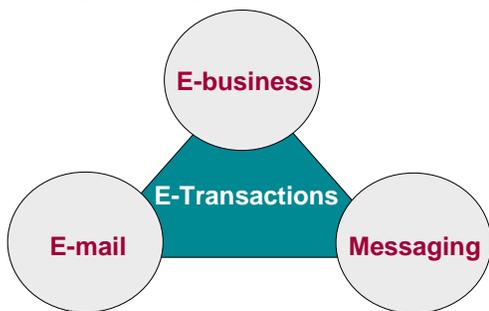
**Solid Data Applications & Benchmark Profile**

Solid Data is proud to partner with Sun to meet the growing infrastructure needs of ISPs, ASPs and e-business enterprises. The expanded Sun StorEdge product line delivers a scalable, flexible storage infrastructure for the Net economy, and Solid Data's file-caching products work with Sun servers and storage to further multiply performance and scalability in transaction-intensive applications.

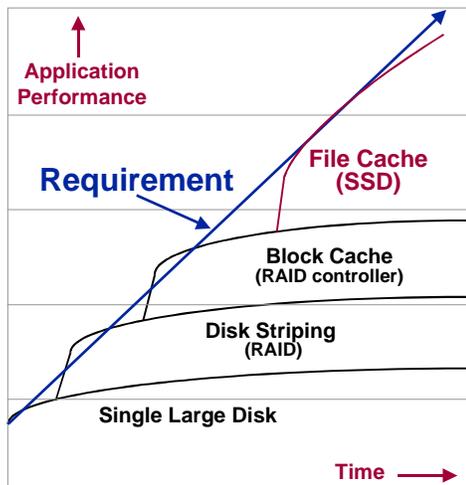
**Applications:** As Figure 1 suggests, E-transaction applications such as e-mail, e-business databases and wireless messaging are driving the growing demand for solid-state disk (SSD) storage solutions. Typically, the most I/O-intensive "hot files"—less than 5% of the total data—are moved from mechanical disk to solid-state file cache. E-transaction customers of Sun and Solid Data include Critical Path, Excite@home, Juno Online, Keynote, Market XT, Charles Schwab and StockMaster.com.

**Architecture:** The move to solid-state file caching is the latest in a series of storage infrastructure developments. Over the past 10 years, as the capacity of mechanical disk drives has increased faster than the I/O performance per drive, system and storage designers have adopted a series of architectural innovations to maintain application performance levels and to respond to demands for increased transaction throughput (Figure 2).

**Figure 1**  
 Rapidly Growing Applications



**Figure 2**  
 Application Needs Drive Storage Architecture

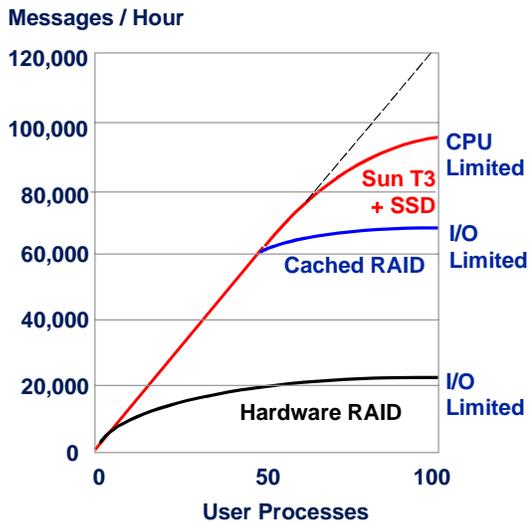


Disk arrays were first proposed to allow system designers to improve performance by striping the data across a redundant array of independent disks (RAID). Next, in response to the ever-increasing demands for application performance and scalability, RAID vendors added significant amounts of block cache to hardware RAID controller designs, such as the Sun StorEdge T3 disk array. Cached RAID meets the I/O performance needs of most applications, until they scale up to very high transaction rates.

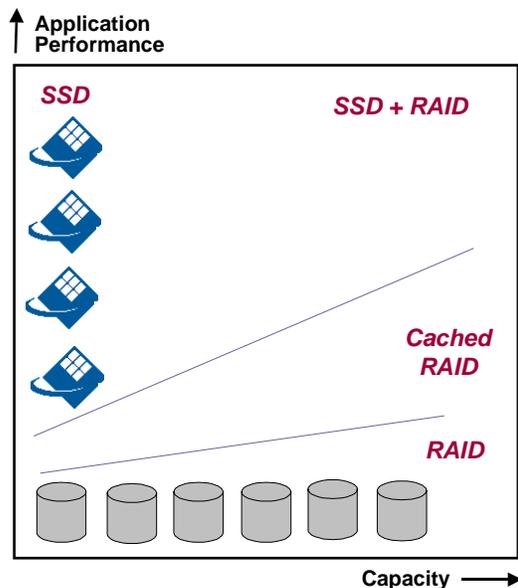
Today, the performance demands on e-business infrastructures are being driven to new levels by exploding demand, unpredictable peak loads, and an increasingly impatient population of on-line customers. As these applications scale up, many ISPs and e-commerce enterprises are deploying another architectural innovation: hot-file caching on external, persistent solid-state storage.

**Benchmark Tests:** At the Sun Network Storage launch, Solid Data is demonstrating its Excellerator 800™ solid-state disk (SSD), connected to a Sun E450 server and a Sun StorEdge T3 disk array through a

**Figure 3**  
E-mail Benchmark Demonstrates Scalability



**Figure 4**  
Modular Scalability for Capacity & Performance



Reference:  
Solid-State File Caching for Performance and Scalability  
[http://www.soliddata.com/whitepapers/file\\_caching.html](http://www.soliddata.com/whitepapers/file_caching.html)

Gadzoox Fibre Channel switch. This hardware configuration was employed in a recent series of performance benchmark tests that illustrate the impact of hot-file caching on the performance and scalability of suitable applications.

For the benchmark tests, Solid Data configured the Sun E450 as an e-mail server, running the popular Sendmail message transfer agent along with Procmail and IMAP. An external load generator (Benchmark Factory) simulated the workload produced by 50 or 100 active user processes, each generating a mix of message sizes at high volume. Tests were performed for three different storage configurations:

- Uncached hardware RAID
- Cached hardware RAID
- Sun StorEdge T3 Cached RAID plus SSD

The benchmark results (Figure 3) illustrate the extended performance and scalability that can be achieved by combining RAID and SSD in a transaction-intensive application.

When all files were placed on a hardware RAID, the maximum message throughput was I/O-limited: the CPU was spending more than 60% of its time waiting for I/O. This restricted the number of messages that could be processed to 22,000 per hour. The use of high-performance cached RAID increased the throughput to 66,000 messages per hour.

By placing the Sendmail message queue on SSD (with all other files on the Sun StorEdge T3 cached RAID), the I/O waits were effectively eliminated. This increased message processing capability to over 95,000 per hour. With I/O waits eliminated, the throughput of the test configuration was limited only by available CPU power. Additional benchmark tests will demonstrate that the SSD-enhanced configuration can take full advantage of a more powerful CPU, further extending the performance and scalability of the architecture.

**Modular Scalability:** Flexibility and ease of use are two major benefits of an architecture that combines cached disk arrays (RAID) and solid-state file cache (SSD). Storage administrators can add capacity in the form of disk storage components, or increase transaction performance capability by adding SSD modules (Fig. 4). This architectural approach extends beyond the e-mail demonstration, and embraces a wide range of internet and e-business applications.

**Conclusion:** Solid Data's file-caching products work with Sun servers and storage to further multiply performance and scalability in transaction-intensive applications. As SSD components are integrated into managed storage networks, policy-based storage management tools will further extend the range of suitable applications.