DoD (and IC) Industry

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DoD and IC

Texas Memory Systems, Inc. (TMS) has been serving the DoD and Intelligence Community (IC) for over 20 years by delivering high-performance storage systems, interfaces, and digital signal processing (DSP) products. These specialized devices have helped the United States process data, signals, and images in real-time to provide a positive impact on the security of the U.S. For additional details regarding TMS' relationship with the DoD and the IC, please refer to the white paper titled "TMS History of Working With the US DoD."

Since its inception, TMS has continually strived to design, manufacture, and support high-performance computer equipment. As the name of the company implies, TMS concentrates on Memory Systems, Storage Systems, and their connectivity.   Most of our products were specially designed to meet a particular requirement or to solve a difficult problem. TMS has excelled in these specialized applications, and is now beginning to experience success in the mainstream commercial storage market with a few exceptional high-performance Flash-based storage systems. The extreme performance of TMS products, once required by only a limited number of users, is now being required by the mainstream market segment of the Enterprise storage market. While TMS still retains the expertise and ability to design fully custom products, our technology is now being used in more commercial off-the-shelf applications than ever before.

This move toward more commercial market acceptance meshes well with the DoD's desire to purchase more of its computing equipment from commercial sources.   The RamSan® product line was started in 2001 as a family of DRAM-based storage products. More recently, the RamSan product line has expanded to include Flash-based storage. The continuous trend toward lower Flash memory prices gives TMS a huge opportunity to bring TMS high-performance storage products to the DoD, IC, and mainstream markets at price points that were never before achievable.

While many TMS RamSan products could meet the DoD requirements, the remainder of this document focuses only on the RamSan-630, the RamSan-640, and the RamSan-6300. These products are the latest generation of TMS Flash storage products that are designed for performance.

The **RamSan-630** (3U) provides **10-TB Flash storage** with an access bandwidth of 10-GB/s and with support for 10 InfiniBand (QDR) links. For small 4KB block transfers, the RamSan-630 is capable of sustaining 1-million IOPS during random, sequential, read, or write operations.

The **RamSan-640** (4U), a derivative of the RamSan-630, has been specifically designed for airborne operations. While it incorporates the same technology as the RamSan-630, it has additional features requested by airborne users. It has a Flash capacity of 8-TB with bandwidth of 8-GB/s. The RamSan-640 has additional rugged components, additional airflow, better EMI shielding, and four removable and replaceable Flash modules.

The **RamSan-6300** (42U) comprises 14 RamSan-630 units installed in a single rack to deliver truly incredible performance numbers: **140-TB Flash Storage**, 140-GB/s Bandwidth, 14-million IOPS, 140 Links (Fibre Channel or InfiniBand), and power consumption of only 7000 Watts.

Real-Time Data Acquisition – The RamSan-630 can be configured to continually acquire data at any rate up to its maximum bandwidth (10 GB/s). Data acquisition can proceed simultaneously with the retrieval of previously stored data, allowing external processing operations to focus on limited areas of interest within an ongoing acquisition. Since the storage is Flash based, retrieval of random data is as fast as sequential data. The abundance of I/O ports provides sufficient headroom for increased connectivity and bandwidth as faster processing capability becomes available.

Airborne Data Acquisitions – The RamSan-640 was designed for airborne operations. With its 8-TB capacity, it can acquire a large data set during flight and then have its Flash modules swapped out quickly when the aircraft returns to ground. After replacement of the modules, airborne acquisition of the next data set may be performed while the previous data set is being processed or moved to ground-based storage. A similarly configured RamSan-640, installed in the ground station, allows data from previously filled Flash modules to be moved offline or processed immediately out of the RamSan.

The power of the RamSan-640 is apparent in flight, as it can acquire data at rates unheard of in rotating media. In the ground station, the data can be retrieved as fast as the connected servers can offload it. Also, the RamSan-640 ground station can immediately process this data for quick analysis. Because of its ability to quickly access data randomly, operators can "hop" backwards and forwards through images or signals very quickly, stopping to dwell on areas of interest or concern. The RamSan-640 has the necessary power to perform in the air and on the ground with bandwidth and IOPS to spare.

Image, Signal, or Data processing – While the RamSan-630 is excellent at data acquisition, it excels at image, signal, and data processing. The speed of the RamSan-630 eliminates the I/O bottlenecks usually associated with storage units, regardless of the access type : random, sequential, reads, writes, or heavy storage I/O operations. Application programs can leverage the RamSan's performance without resorting to storage-specific code or buffering schemes. As a result, software applications become simpler, faster, and more efficient for supporting fast analysis of complex problems. Application programmers need only worry about the analysis algorithm and not the limitations of the hardware. Data system managers can now buy hardware with longer lifetimes, better reliability, faster throughput, and less power consumption.

Faster Analysis, More Complete Analysis – The RamSan-630 provides 10-TB Flash storage, 10-GB/s bandwidth, and 900K IOPS in a single 3U chassis. For larger configurations, a single-rack RamSan-6300 provides a Flash storage capacity of 140-TB, 140-GB/s bandwidth, 12 million IOPS, and uses only 7000 watts. This storage system could connect to several racks of low profile servers with the processing power to search,

find, detect, and locate even the most obscure feature detail within a few minutes. This cluster of high-performance servers and high-performance RamSan units, coupled with several racks of lower-cost traditional RAID storage, would be ideal for a physically small but very powerful cloud computer configuration to meet the demanding processing requirements of hundreds of analysts.

Faster, Smaller, Better, Cheaper – The RamSan-630 Flash storage system is faster, smaller, and better than a huge array of rotational disk drives or dozens of solid state disks (SSD). The architecture of the RamSan-630 integrates the storage media, the storage controller, and the storage interface into a single, highly effective storage unit. It is designed to maintain high bandwidth through all elements of the storage system without comprise. While some storage suppliers try to shoehorn new "pieces" of technology into legacy infrastructure, Texas Memory Systems has always designed complete systems to maximize performance and avoid incremental "Band-Aid" improvements.

Return on Investment (ROI) for RamSan Flash storage units should reflect the total benefit to the user. Many times the cost of new hardware is compared to the cost of older and lower performance hardware instead of analyzing the overall benefit that the newer hardware provides. The analyst's time is often your most expensive asset. Reducing the time required for an analyst to complete his job will reduce your biggest expense and generate more productive output from the analyst. If the benefit to the user is compared to the cost of the RamSan-630, it becomes clear that the RamSan hardware cost is often justified within a single year of operation. Additionally, since the RamSan-630 can service multiple users, the cost benefit per user is multiplied. The ideal configuration would have multiple RamSan units operating in a cloud configuration. Numerous analysts would have immediate access to this computing and storage power to provide analysis on demand.

Oracle is the preferred database for many DoD operations, and TMS has installed most of its RamSan Flash storage units to run under Oracle. During factory testing, TMS hardware is subjected to burn-in tests while running Oracle and other DBs. Before, during, and after the RamSan installation, TMS offers support from our Oracle experts for advice regarding tuning I/O operations for maximum efficiency. Mike Ault (TMS Oracle guru) has written many books and white papers that are available on our web site. See the Oracle section on this web site for more details about the benefits of a RamSan Flash storage unit. Also, TMS has an Oracle analyzer available on the web site for use in determining if your Oracle bottlenecks can be reduced with a RamSan storage unit.

Flexibility – Since TMS designs and manufactures the RamSan, we can quickly add features for a specific requirement as needed. For decades TMS has been delivering its products for special high-bandwidth applications. As these applications hit mainstream, TMS will continue to deliver these high-bandwidth RamSan products.

Summary – As with all TMS products, the RamSan provides a higher level of performance than other Flash storage SSDs can deliver. While the RamSan is more

expensive than traditional RAID storage, this expense can be offset by faster processing and quicker results. In the near future we expect Flash storage prices to be reduced faster than RAID prices. Eventually, all Enterprise grade computer systems will have a tiered storage structure with Flash storage units replacing rotating drives at the highest-performance tier. RAID storage will continue to be utilized, but only at the lower-performance and less frequently used tiers. Flash storage is the media of the future, with many high performance applications incorporating Flash now.