

TMS History of Working With the US DoD

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Texas Memory Systems, Inc. (TMS) has been delivering very fast electronic storage systems to the **DoD** and the **IC** for over twenty years. TMS is well aware of the unique requirements of these applications and has delivered RAM and Flash based storage systems to meet and exceed their specifications. Also, during this time TMS has designed and delivered four generations of Digital Signal Processors (DSP) systems and boards. This paper will describe a few of these applications and the methods used by TMS to solve them.

Early Days

The first DoD application to use TMS storage was a high-speed data acquisition recorder with simultaneous playback capability. The disk drive technology at the time (1988) was bandwidth limited and prone to failures as the heads were in constant motion. The initial RAM-based system (with 128 MB) included several high-speed ports for ECL input or ECL output for data acquisition and downstream processing. Also, TMS designed the special input (IPP) and output (OPP) devices to handle the protocol used at the time. For the next several years, TMS delivered hundreds of SAM-600/800 (Shared Attached Memory) systems to analysts for monitoring signals in real-time. This gave the analysts the ability to keep the last few hours of the signals they were acquiring. The connection to a host computer allowed the analysts to save these signal data files for later processing. These common capabilities of today were established by TMS 20 years ago.

Entrance into DSP Field

After this success RAM-based storage products established TMS as a viable manufacturer of high performance storage systems, TMS developed, manufactured, and delivered an optional DSP board to be incorporated into these storage systems. With the storage system being RAM-based, a fast DSP board could be included in the SAM system that could also access the storage array. This capability allowed faster signal processing while removing the DSP load from the host computer. Instead of moving the data to the processing unit, TMS provided specialized DSP boards to be installed within the data storage system. Now data is acquired and processed within the same memory space; thereby, giving the analyst additional real-time processing power.

With less data movement, this architecture demonstrated a simple solution to a complex problem. This architecture has evolved into the current fourth generation incarnation. The DSP configurations evolved with these products: SAM-2000, SAM-350, SAM-450, XP-15, XP-30, XP-35, XP-100. The XP-100 (TMS designed DSP ASIC) is the current DSP product. It is rated at 100-GFLOPS, 48 GB/s chip bandwidth, with a local RAM of 512-MB. TMS has always matched processing power with external bandwidth power to maintain a balanced architecture that minimizes bottlenecks and is easy to program. Who wants to write additional lines of code just to move data around because of hardware limitations?

The XP-100 (PCIe based) card processes FFTs very efficiently at over 100-GFLOPS with (32-40 bit) floating point resolution. The XP-100 has extremely fast bandwidth (48-GB/s) to its local 512-MB RAM in providing excellent performance. FFTs are extremely fast on the XP-100. With its built-in twiddle generator, fast local memory, and an architecture that is designed for the 256-point FFT butterfly function, it does small and large FFTs very FAST. Its math library includes 500 algorithms, it is easy to program efficiently, and it only dissipates about 50 Watts. Several FFT times are shown below:

8-million point CFFT in 19 ms
1-million point CFFT in 2.3 ms
256-K point CFFT in .6 ms
64-K point CFFT in 98 μ s

Acceptance as Enterprise Solution

Over the years, TMS has provided generation after generation of faster and smaller storage and DSP systems for these DoD/IC applications. Today, TMS is still delivering fast real-time systems (both DSP and Flash storage products) to these users. During this ongoing development of TMS DSP products, the emergence of Flash chips has given TMS the opportunity to deliver very high-bandwidth storage systems at a reasonable cost to the DoD as well as the Enterprise storage community. Although TMS has been delivering RAM based storage to the DoD community since 1988, TMS introduced the RamSan[®] storage (RAM based) to the Enterprise community in 2001 and Flash based RamSan products in 2008. The latest TMS generation RamSan-630 product is ideally suited for DoD, IC, and Enterprise users.

The latest generation RamSan-630 has faster access to storage than any other 3U storage unit. With its 10 InfiniBand I/O links, it has a sustained bandwidth of 10 GB/s. The RamSan-630 can provide 1-million IO operations/sec (IOPS) with small 4KB random data blocks. The RamSan-6300 has 14 RamSan-630 systems (140-TB Flash storage) installed in one 42U rack. This storage array provides almost unlimited bandwidth (140-GB/s) and IOPS (14-M IOPS) while still only dissipating 7000 watts.

Looking Forward

Since TMS designs and manufactures the RamSan products, we can quickly add features for a specific requirement as needed. For decades TMS has delivered specialized products for special high-bandwidth applications to the DoD community. By catering to special DoD applications, TMS is able to design advanced storage systems earlier than needed by commercial Enterprise applications. As these cutting-edge applications transition into mainstream Enterprise applications, TMS continues to improve these products, making them ever higher bandwidth, higher IOPS, lower powered, smaller sized, more reliable, and more cost-effective. As Texas Memory Systems has been the high-bandwidth leader in storage and DSP for decades, we will continue to do so in the foreseeable future for both the DoD and Enterprise user.