# 7700E – EMC Symmetrix 5930 Features Comparison

## Introduction

Our major competitor in enterprise storage subsystems is EMC. The Symmetrix 5930 is EMC's current flagship product. We do not necessarily like to see sales initiatives reduced to lists of items for comparison, but our sales organization must have specific comparisons for those occasions when required. Also, a detailed comparison such as the one below shows clearly the overall technical superiority of the HDS 7700E, therefore it should be useful in conveying the comprehensive advantages of our product in the market. This comparison focuses on the 5930, however please see the table below for a list of their current generation and previous generation model numbers. Although a large number of features are included for completeness, the **items in red** indicate features for which HDS has an advantage for our customers. Also, there are links to more complete explanations for many of the items.

This is a document that will need constant updating in order to keep it useful. Your feedback is most welcome. We will continue to add notes and "mini white papers" as soon as we can. Your contributions are most welcome! Please share your knowledge with your colleagues. Call Robert Ward in Santa Clara at 408-970-7062, or Ros Schulman in NYC at 973 429 0270 or send email to robert.ward@hds.com. or ros.schulman@hds.com

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# I. Symmetrix 4.8

✓ The new model family is called Symmetrix 4.8, which replaces the current Symmetrix 4. The line-up of models:

| | Symmetrix 4 | Symmetrix 4.8 |
|---|---|---|
| Open System Models | 3330, 3330-18 | 3630-18, 3630-36 |
| | 3430, 3430-18 | 3830-18, 3830-36 |
| | 3700-18, 5930-47 | 3930-18, 3930-36 |
| Multi-platform Models | 5330, 5330-18 | 5630-18, 5630-36 |
| | 5430, 5530-18 | 5830-18, 5830-36 |
| | 5930-18, 5930-47 | 5930-18, 5930-36 |

✓ New model maximum capacities:

| | RAID-1 | SRDF |
|---|---|---|
| 3630, 5630 | 579GB | 1,158GB |
| 3830, 5830 | 1.7TB | 3.5TB |
| 3930, 5930 | 4.6TB | 9.3TB |

*Note: the capacities EMC cited in their announcement were SRDF-mode capacities, which of course yield the largest numbers. SRDF-mode is RAID-0 (not mirrored or RAID protected). However EMC will not configure a standalone subsystem as RAID-0. The customer must have a second system, which contains remote-copies of all the volumes on the primary subsystem.*

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✓

| **Storage Architecture** | HDS Architecture is more modern with better redundancy, more bandwidth and superior performance. | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Monolithic architecture (= share all, i.e. global cache, all host connections have access to all volumes) | Yes | Yes |
| Maximum number of array frames | 4 | Integrated, one frame |
| Redundancy for all active components | Yes, including cache | Yes, except cache Note 14 |
| Redundancy for all power | Yes | Yes |
| Hot swap of all active components | Yes | Yes |
| Max subsystem bandwidth (MB/sec) | 745 MB/sec | 720 MB/sec Note 13 |

| **RAID Advisory Board Ratings** | In the early period of the RAID Advisory Board, EMC tried to use it as a means to claim the highest endorsement from this independent board. More recently, the 7700 and 7700E have gained higher ratings than Symmetrix. | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| RAB rating Note 15 and http://www.raid-advisory.com/rabguide.html | DTDS+ | FTDS+ w/o SRDF<br>DTDS+ W/ SRDF |

| **Internal Busses** | HDS has more *useable* system bandwidth. Symmetrix uses the extra bandwidth on the data busses for control messages depending on the workload. | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| # Redundant data busses | 2 | 2 |
| Data bus bandwidth (MB/sec) Note 13 | 2 @252 =504MB/sec | 2 @360 =720MB/sec |
| # Redundant command busses | 2 (M Busses) | None Note 13 |
| Command Bus Bandwidth | 2@120=240MB/sec | N/A Note 13 |

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| **Front End Host Adapters** | HDS has newer adapter designs with more and faster processors. EMC announced quad adapters in Nov. 98, but HDS has more powerful processors | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Adapter boards per system | 2,4,6 or 8 CHIPs (1-4 pairs) | 2,4,6 or 8 CHA Adapters (1-4 pairs) |
| Always installed in pairs | Yes | Yes |
| Total Concurrent I/Os to/from host | 4-32 | 4-32 |
| Type microprocessor | i960 | Motorola 68060 |
| Clock speed of microprocessor | 66MHz | 75MHz |
| Max I/Os (active processors per adapter) | 4 | 4 |

| **S/390 Parallel Host Adapters** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| # Adapter boards per system | 2-4 (1-2 pairs) | 2-4 (1-2 pairs) |
| # Active ports per adapter/per adapter pair | 4/8 | 4/8 |
| # Physical paths | 8-16 | 8-16 |
| # Concurrent I/Os | 4-16 | 4-16 |
| Transfer speed per port (MB/sec) | 3, 4.5 MB/sec | 3, 4.5 MB/sec |
| Unisys parallel channel compatibility | Not tested (RPQ) | Yes |

| **S/390 ESCON Adapters** | HDS maintains lead due to redundant processor design | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Max # simultaneous data transfers from cache | 32 (2 per CHIP) | 32 (two per director) |
| Max logical channels (paths) | 512 | 1024 Note 1 |
| Adapter does CKD to FBA conversion | Yes | Yes |
| # Microprocessors per adapter | 4 (2 for redundancy) | 2 |
| # Adapter boards per system | 2-8 (1-4 pairs) | 2-8 (1-4 pairs) Note 5 |
| Always Installed in pairs | Yes | Yes |
| # Active Ports per CHIP/host adapter | 2 or 4 | 2 or 4 Note 2 |
| # Physical paths | 4-32 | 4-32 |
| # Concurrent I/Os | 4-32 | **4-16** Note 3 |
| Transfer speed per port | 10 and/or 17 MB/sec | 10 and/or 17 MB/sec Note23 |
| Transfer speed per adapter (MB/sec) | 20-68 MB/sec | 20-68 MB/sec Note 4 |
| ESCON Extended Distance Feature support | Yes | Yes |
| EMIF for Dynamic Path Switching | Yes | Yes |
| # Microprocessors / adapter board | 4, 6, or 8 | 4 Note 6 |
| Separate ports for Remote ESCON adapters | Can mix remote/S390 links | Must be dedicated Note5 |
| Dynamically switchable links | Yes (through ESCON directors) | No (static) |

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| SCSI-2 Fast and Wide Host Adapters & Ultra Wide SCSI Host Adapters | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| # Adapter boards per system | 2-8 (1-4 pairs) | 2-8 (1-4 pairs) |
| Always Installed in pairs | Yes | Yes |
| # Active ports per adapter | 4 | 4 |
| # Physical paths | 8-32 | 8-32 |
| # Concurrent I/Os to host | 8-32 | 8-32 |
| # Concurrent transfers from cache | 32 (4 per CHIP) | 32 (4 per director) |
| SCSI-2 FW transfer rate per port/adapter/adapter pair (MB/sec) | 20/40/80 | 20/40/80 |
| Ultra Wide SCSI transfer rate per port/adapter/adapter pair (MB/sec) | 40/80/160 | 40/80/160 |

| Fiber Channel Host Adapters | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| # Adapters per system | 2-8 (1-4 pairs) | 2-8 (1-4 pairs) |
| Always installed in pairs | Yes | Yes |
| OEM fibre driver chip | Firefly>Super Fly>Tachyon Lite | Tachyon |
| # Active ports per adapter | 2 | 2 |
| # Physical paths | 4-16 | 4-16 |
| # Concurrent I/Os | 4 -16 | 4-16 |
| Transfer rate per port | 100MB/sec | 100 MB/sec |
| Transfer rate per adapter | 200MB/sec | 200 Mb/sec |
| Host support | **Please check online FAR report for up to date Support. This can be found by launching the Efind Application from Marketplace** http://ntserv.hds.com/ssen/kb/kb.start.cfm | Link to EMC 5930 web site. and Note24 |


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# 7700E – EMC Symmetrix 5930 Features Comparison

| **Disk Device Characteristics** | **EMC No longer offer the23GB and 47GB drives with Symmetrix 4.8, Upgrades may be difficult.** | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| **6GB Drive** | | |
| Platter size | 2.5 inches (3.5-inch case) | |
| Drive manufacturer | Hitachi | |
| Rotation speed (RPM) | 12.030 | |
| Average latency (ms) | 2.49 | |
| Average seek (ms) | 6.0 | |
| **9GB Drive** | | |
| Platter size | 3.5 inches | |
| Drive manufacturer | Hitachi | |
| Rotation speed (RPM) | 6300 | |
| Average latency (ms) | 4.76 | |
| Average seek (ms) | 11.5 | |
| **15GB Drive** | | |
| Platter size | 2.5 inches (3.5-inch case) | |
| Drive manufacturer | Hitachi | |
| Rotation speed (RPM) | 12.030 | |
| Average latency (ms) | 2.49 | |
| Average seek Read/Write(ms) | 5.5/6.5 | |
| **18GB Drive** | | |
| Platter size | 3.5 inches | 3.5 inches |
| Drive manufacturer | Hitachi | Seagate (Cheetah 18 ST118202LW) Seagate Web Site & IBM (UltraStar-18) IBM Web Site |
| Rotation speed (RPM) | 6300 | 10,000 |
| Average latency (ms) | 4.76 | 2.99 |
| Average seek (ms) | 11.5 | 5.7 |
| **36GB Drive** | | |
| Platter size | 3.5 inches | 3.5 inches |
| Drive manufacturer | Hitachi | Seagate (Barracuda ST136475LW) Seagate Web Site |
| Rotation speed (RPM) | 6300 | 7200 |
| Average latency (ms) | 4.76 | 4.17 |
| Average seek read/write (ms) | 11.5/12.5 | 7.6/8.2 |

| | **HDS 7700E** | **Symmetrix 5930** |
|---|---|---|
| Dual ported interface | Active | Not Available |
| Disk buffer size (KB) | 4096 (segmented) Note25 | 1024 (4096 optional) |
| External rate (from disk buffer to ACP or disk director) | 20 MB/sec | 40 MB/sec |
| Mixed capacity configurations | Yes | Yes |

| **Subsystem Capacity (without drive intermix---minimum-maximum GB/Upgrade Increment)** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| **6GB Drive** | | |
| RAID-1 Open | 9.6-570.9/**9.6** | |
| RAID-1 S/390 | 11.4-661.2/**11.35** | |
| RAID-5 Open | 14.6-974.4/**17.03** | |
| RAID-5 S/390 | 17.0-986.0/**14.06** | |

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| | | |
|---|---|---|
| **9GB Drive** | | |
| RAID-1 Open | 14.4-846.8/**14.4** | |
| RAID-1 S/390 | 17.0-986.0/**17.0** | |
| RAID-5 Open | 48.0-1536.0/**48.0** | |
| RAID-5 S/390 | 45.4-1635.2/**45.4** | |
| **15GB Drive** | All open-3 or 3390-3 capacities | |
| RAID-1 Open | 29.53-1713.09/**29.53** | |
| RAID-1 S/390 | 28.38-1646.04/**28.38** | |
| RAID-5 Open | 44.30-2480.69/**44.3** | |
| RAID-5 S/390 | 42.57-2469.06/**42.57** | |
| **18GB Drive** Note16 | | |
| RAID-0 Open | NA | 579-4633 |
| RAID-0 S/390 | NA | 572- 582 |
| RAID-1 Open | 29.2-1948.8/**29.2** | 289-2316/**286** |
| RAID-1 S/390 | 34.1-1977.8/**34.06** | 286-2291/**286** |
| RAID-5 (HDS)/RAID-S (EMC) Open | 48.0-2963.8/**48.0** | N/A |
| RAID-5 (HDS)/RAID-S (EMC) S/390 | 51.1-2906.1/**51.4** | N/A |
| **36GBGB Drive** Note16 | All open-9 or 3390-9 capacities | |
| RAID-0 Open | | 1158 - 9267 |
| RAID-0 S/390 | | 1145 - 9164 |
| RAID-1 Open | 59.07-3426/**59.07** | 579 –4633/**562** |
| RAID-1 S/390 | 68.11-3950/**68.11** | 572 –4582/**562** |
| RAID-5 (HDS)/RAID-S (EMC) Open | 103.38-5995/**103.38** | N/A |
| RAID-5 (HDS)/RAID-S (EMC) S/390 | 102.17-5925/**103.38** | N/A |

| **RAID Levels / Parity Group** | The EMC RAID S/R relatively poor performance problem has led to the ironic situation of HDS RAID-5 configurations being priced against EMC RAID-1 configurations. | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Dynamic sparing | A single drive required for sparing anywhere in subsystem. | A single drive required for sparing anywhere in subsystem Note 17 |
| RAID-0 | No (due to availability policy) | Yes |
| RAID-1 (1D+1P) | Yes | Yes |
| RAID-5 (6D+1P, 3D+1P) | 6GB, 15GB, 18GB & 36GB drives: 3D+1P<br>9 GB drives: 6D+1P | No |
| RAID-S/R (3D+1P, 7D+1P) | True RAID 5 only | RAID-S: 3D+1P<br>RAID-R: 7D+1P (these being shipped RPQ basis only) Note 17 |
| XOR Location Note 17 | ACP level | Disk director level |
| Threshold based dynamic sparing | Yes | Yes |
| Automated reconstruction | Yes | Yes |
| Definable reconstruction priority | Yes | Yes |
| Minimal performance impact of failed drive | Yes | No |
| Dynamic sparing as a standard feature | Yes | No |
| # Spare drives required for full protection | 1 | 1 |
| Write penalty comparison | Four operations (2R 2W) hidden by stripe (effectively two real time operations) | 50% more than RAID-5 (Three operations 1R 2 W) |

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| Cache Design | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Minimum (MB) | 256 or 1024 Note 8 | 512, 1024, or 4096 |
| Maximum (MB) | 16,384 Note7 Note10 | 16,384 Note 7 |
| MB increments | 256 or 1024 Note 8 | 512, 1024, or 4096 Note 9 |
| MB Disk per MB Cache (max) | 177:1 | 280:1 |
| Separate shared memory for control tables (MB) | 256-512MB Note 10 | None. Regular cache used instead. Note 10 |
| % Cache for writes | 30%-70% with de-stage advantage Note18 | 80% With no de-stage advantage Note18 |
| % Cache adjustable by… | Customer using Resource Manager (Graph-Track), or CS&S | EMC Tech Support Center only. |
| All data goes through cache ("cache all") | Yes | Yes |
| Max data rate to and from cache | 504 MB/sec | 500 MB/sec |

| **Cache Design (RAS Features)** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Fast Write de-stage algorithm optimized for data protection | Yes ("Get writes out of cache") | No (de-stages only when full) |
| Full duplexed writes | Yes | No |
| Duplexed control store | Yes | N/A |
| Cache boards installed in pairs | Yes | Yes- data integrity issue – See Note14 |
| Separate power boundaries for all cache | Yes | No |
| User definable fast write size | Yes | No |
| Generation of DRAM (pre-9/98) | 64Mbit | 64Mbit |
| Separate NVS for ADT (address translation tables = track tables) etc. | Yes | No |
| Single bit detection / correction | Yes | Yes |
| Double bit detection / correction | Yes | Yes |
| Triple bit detection / correction | Detect not correct | Detect not correct |
| Threshold driven cache fencing | Yes | Yes |
| LRC (longitudinal redundancy check) code for cache data | Yes | Yes |
| Time stamped CCW Note21 | Yes | No |

**Cache Algorithms and Microcode.** HDS also has better stripe staging/de-staging for hiding the RAID "write penalty" and the "random read break-in" feature is unique.

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| **Back End Pathing** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| # Disk adapters | 8 | 8 |
| Type microprocessor | Intel i960 | Motorola 68060 |
| # Microprocessors / adapter | 2 | 2 |
| Microprocessor clock rate | 66MHz | 75MHz |
| # Paths per adapter to data bus | 4 (2 data busses, 2 control busses) | 2 (x bus, y bus) |
| Maximum transfer rate to/from cache | 20 MB/sec | 40MB/Sec Note28 |
| # Buffers per adapter | 4 (1 per SCSI path) | 2 (1 per SCSI path) |
| Buffer size per adapter | 128KB (larger for 7700E?) | 128K? |
| Buffer memory type | SRAM 33MHz | SRAM? |
| # Concurrent operations disk to cache | 16 | 16 |
| RAID-5 parity algorithm reduces write penalty | Very Sophisticated [Stripe de-stage advantage] | NA. Note26 |
| Does RAID-5/RAID-S data rebuild | Yes | Yes |
| RAID-1 copy to dynamic spare | Yes | dynamic if opt spare |
| Copy data to replaced HDD | Yes (construction copy) | yes |
| SCSI 2 F/W | Yes | Ultra SCSI Note28 |
| # Host adapter operations per write | One | Two |
| # Disk Devices | 4-128 plus spares | 16-256 including spares |
| # SCSI Paths / Adapter | 4 | 4 |
| # SCSI Paths / Microprocessor | 1 | 1 |
| # Devices / Microprocessor | 0-15 | 0-16 |
| # Devices / SCSI Path | 0-8 | 0-8 |
| Performance degradation if SCSI bus fails | No | Yes- Shared Path |

| **Usage And Performance Monitoring** | HDS has more and better features + SMS compatibility. | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Bypass cache hints | Honored | No |
| Inhibit cache | Honored | No |
| Vendor cache reporting tools | HDS Cache Reporter Tool (HDSCRT) | Symmetrix Cache Reporter (SCR) |
| S/390 SIM (System Information Message) support Note27 | Yes | No |
| SNMP support for system messages | Yes | Yes |

| **Mainframe Controllers Emulated** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| 3990-6 w/ Extended Functions, 3990-3, 3990-2 | Yes | Yes |

| **Mainframe Logical Volumes Emulated** | HDS 3390-3R support provides SMS advantage. | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Maximum number of logical volumes | 1024 | 4096 |
| 3380 E/J RAID-1 | 6GB, 9GB, 15GB, 18GB drives | No |
| 3380 E/J RAID-5 (HDS)/RAID-S (EMC) | 9GB, 15GBdrives | No |
| 3380 K RAID-1 | 6GB, 9GB, 15GB, 18GB,36GB drives | 18GB, 36GB drives |
| 3380 K RAID-5 (HDS)/RAID-S (EMC) | 6GB, 9GB, 15GB, 18GB,36GB drives | No RAID S on 5930 |
| 3390-1/2/3, RAID-1 | 6GB, 9GB, 15GB, 18GB,36GB drives | 18GB, 36GB drives |
| 3390-1/2/3, RAID-5 (HDS)/RAID-S (EMC) | 6GB, 9GB, 15GB, 18GB,36GB drives | No RAID S on 5930 |

| | | |
|---|---|---|
| 3390-9, RAID-1 | 9GB, 15GB,18GB, 36GB drives | 18GB, 36GB drives |
| 3390-9, RAID-5 (HDS)/RAID-S (EMC) | 9GB, 15GB,18GB, 36GB drives | No RAID S on 5930 |
| 3390-3R, RAID 1 | 6GB, 9GB, 15GB, 18GB,36GB drives Note 11 | No |
| 3390-3R, RAID 5 | 6GB, 9GB, 15GB, 18GB,36GB drives Note 11 | No |

## Performance Attributes

The 7700E's bus bandwidth is used efficiently due to separate data and command busses. The 7700E has faster components, better tuning attributes, provides more useable cache, utilizes path redundancy, superior algorithms [especially write de-staging], and provides industry leading sequential performance. Also HDS performance during rebuild is probably twice as fast as EMC performance. The EMC RAID S/R poor performance problem has led to the ironic situation of HDS RAID-5 configurations being priced against EMC RAID-1 configurations.

| | **HDS 7700E** | **Symmetrix 5930** |
|---|---|---|
| Cache all operations | Yes | Yes |
| Smallest unit of cache | 16KB (segment) | Track |
| LRU | Yes | Yes |
| Read Hit determination | Yes | Yes |
| Read Miss determination | 20 microseconds | 20 microseconds |
| Short Read Miss | Yes | Yes |
| Pre-fetch algorithm RAID –1 | Tracks | Tracks |
| Pre-fetch algorithm RAID-5 (HDS)/RAID-S (EMC) | Stripes | Tracks |
| Mirrored fast writes | Yes | No |
| Normal mode write allocation % | 50% | 80% threshold |
| Selectable Write Cache allocation range | 30%-70% (Graph-Track) | No (Always 80%) |
| Dynamically changeable % write cache available | Yes (256 MB increments) | No (Always 80%) |
| Maximum cache available for reads when low write % | 96% | 80% |
| Delayed fast write | Yes | Yes |
| Duplexed fast write | Yes | No |
| Extended Predictive Write (EPW) feature | Yes | Yes |
| Threshold triggered de-staging | Yes | Yes |
| RAID 5 vs. RAID S/R Sequential pre-stage cache policy when 1 sequential I/O is detected. | RAID 5 [If 1 sequential I/O, then 12-15 tracks [1 stripe] pre-staged | RAID S =? |
| RAID 1 Sequential pre-stage cache policy. | 12 Tracks | 2 –12 Tracks |
| Random read "break-in" feature for RAID 5 | No | Yes |
| Detected sequential I/O go to MRU not LRU | Yes | No? |
| SSD = ability to lock [or "peg"] datasets in cache | HDS FlashAccess | EMC PermaCache Note30 |
| Cross-extent prefetch | Not required | Symmetrix Mgr. Performance Option |
| Algorithm differences mainframe vs. open | Yes | No |
| Record level caching host hint | Yes | Yes |
| Sequential data striping host hint | Yes | Yes |
| PDS Assist host hint | Yes | Yes |
| RAID 5 de-stages stripes | Yes | No |
| RAID-1 de-stages tracks | Yes | Yes |
| Sequential write de-stage strategy | De-stages whenever bandwidth is available. Note 18 | Lets cache fill up. Leads to poor performance for "bursty" high write workloads. Note18 |

## RAID-5 vs. RAID S (Mainframe)

HDS has a superior RAID implementation in terms of performance and RAS. (Hyperlink to Benchmark numbers - Mel Boksenbaum. Performance tests comparing HDS RAID-5 to EMC RAID-S.)

| **Other Performance Attributes** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Performance control from local console | Customer control through remote console | CE only |
| RMF, VM Monitor, VMPPF support | Yes | Yes |
| IDCAMS data gathering | Yes | Yes |
| Disk rebuild time | ~6 hrs per 18 GB drive | Unknown for 36GB Drive |

| **Remote Management via LAN** | HDS has an advantage over EMC of being standards-based for open [SNMP] and mainframe [IBM] environments. | |
|---|---|---|
| | **HDS 7700** | **Symmetrix 5930** |
| Proprietary or Standards based management | SNMP | SNMP |
| IBM System View support | Yes | Yes |
| HP Open View support | Yes | Yes |
| Sun Solstice support | Yes | Yes |
| Sun Net Manager support | Yes | Yes |
| WABI on Solaris support | Yes | Yes |
| CA Uni-Center support | Yes | Yes |
| Tivoli support | Yes | Yes |
| Platinum support | Yes? | Yes |

| **Network Options for Remote Copy** | **HDS 7700E** | **Symmetrix 5930** |
|---|---|---|
| Ethernet, FDDI, ATM, DS3 | Yes through CNT | Yes |
| T1/E1/T3/E3 Communication Protocol | Yes through CNT | Yes |
| **Network Files Served** | | |
| NFS files served | SNFS | Yes |
| CIFS files served | SNFS | Yes |
| HTML files served | SNFS | No |

| | **HDS 7700E** | **Symmetrix 5930** |
|---|---|---|
| **Diagnostics and Call Home** | | |
| Phone home service | Yes | Yes |
| Automatic notification of component failure | Yes | Yes |
| Notification delay in case of component failure | Immediate notification | Immediate notification???? |
| Automatic alert of service person | Yes | Yes |
| Component & environmental monitoring | Yes | Yes |
| SIM message support | Yes | Yes |
| IBM EREP support | Yes | Yes? |
| Type of service processor | Laptop PC | Laptop PC |
| Connection to subsystem | Ethernet | RS232 today |
| Modem connection to service center | Yes | Yes |
| # subsystems supported by one modem connection | 8 | 13 or 29 |
| Diagnostic and maintenance | Yes | Yes |
| Non-disruptive replacement | Yes | Yes |
| Records performance & utilization data | Yes | Yes |
| Sets “rebuild” priorities for RAID | Yes | Yes |

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| **Extended Function Compatibility** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Dual Copy | Yes, but not concurrently with Remote Copy or ShadowImage | No |
| S/390 Cache Fast Write | Yes | No |
| S/390 DASD Fast Write | Yes | Yes |
| S/390 PDS Search Assist- serial & parallel | Yes | Yes |
| S/390 Concurrent Copy | Yes | Yes |
| S/390 Dynamic Cache Management Extensions (DCME) | Yes | No |
| S/390 VSAM Partial Release | Yes | Yes |
| Sequential Data Striping | Yes | Yes |
| S/390 # EMIF Logical Paths supported | 512 | 1024 Note1 |
| S/390 Extended Format Data Sets | Yes | Yes |
| S/390 Host Data Compression | Yes | Yes |
| S/390 Extended Remote Copy XRC compatible | Yes | Announced Jan 1998, not delivered as of Jan. 99. |
| S/390 Peer to Peer Remote Copy (PPRC) compatible | Yes Note 12 | No |

| **Multiplatform Data Sharing** | | **Please check online FAR report for latest support. Launch the Efind Application from Marketplace** http://ntserv.hds.com/ssen/kb/kb.start.cfm | |
|---|---|---|---|
| **Platform** | **Operating System** | **HDS 7700E** | **Symmetrix 5930** |
| Bull Escala/Sagister/ Cluster | AIX 4.2 | No | Yes |
| Digital Alpha | Digital Unix V 3.2A | Digital UNIX 4.x | Yes |
| Digital 3000 AXP | Open VMS V6.1 | No | Yes |
| DG Aviion 88K | DG/UX R 4.11 MU03 | No | Yes |
| DG Aviion (Intel) | DG/UX R 4.11 MU03 | No | Yes |
| HP 3000-900 | MPE/ix 5.0 | No | Yes |
| HP 9000/700 | HP-UX 9.05 & 10.01 | HP-UX 11.X | Yes |
| HP 9000 C/J Series | HP-UX 9.04 | HP-UX 11.X | Yes |
| IBM AS/400 all 9406 Except Model B | O/S400 V2R3 | No | Yes |
| IBM RS6000 | AIX 3.2.5, AIX 4.1.3+ | AIX 4.3 | Yes |
| IBM SP | | Yes? | Yes |
| IBM S/370 & S390 | Most MVS/VM OS390/VSE | Yes | Yes |
| | MPLF (TPF 4.1+) | Yes | Yes |
| | ELLF (Before TPF 4.1) | No | Yes |
| Intel Servers | Novell 3.12 | No | Yes |
| | Win NT 3.51/4.0 | NT 4.0 | Yes |
| | AS 3-5 or OS/2 2.1 | No | Yes |
| NCR | UNIX SVR 4.2.03.01 | No | Most |
| Pyramid Nile | Data Center Osx94D079.6 | No | Yes |
| Sequent Symmetry 2K/5K | Dynix/ptx 2.1.5 | Dynix/ptx 4.4.2 | Yes |
| Siemens RM 400/600 | SINIX Reliant V 5.42 | No | Yes |
| Siemens RM 1000 | DC/OSX 95m079 | No | Yes |
| SG Challenge | IRIX 5.3 | No | Yes |
| SG Origin 200/2000 | IRIX 6.4.1 | No | Yes |
| Sun SPARC | Sun OS 4.1.3, Solaris 2.3 | No | Yes |
| Sun Ultra SPARC | Solaris 2.5 | Solaris 2.6 | Yes |
| Unisys ClearPath IX/NX | OS/MCP (Burroughs) | No | Yes |
| Unisys ClearPath IX/NX | OS/2200 (Sperry) | No | Yes |

# 7700E – EMC Symmetrix 5930 Features Comparison

| **Multiplatform Data Sharing** | **HDS 7700E** | **Symmetrix 5930** |
|---|---|---|
| IBM Type I data sharing (Subsystem partitioning) | Yes | Yes |
| IBM Type II data sharing (Data copy sharing) | Hitachi Multiplatform Data Exchange-(HMDE) Note29 | InfoMover (SMTF) |
| IBM Type III data sharing (Concurrent reads and writes to a common volume) | No | No (First promised in 1996!) |
| S/W H/W requirements | HMRS (Standard) | ESP (Separately priced option) |
| Level Within Subsystem | Logical Volume | Logical Volume |

| **Backup / Restore** | HDS offers a more robust subsystem, with better data integrity and error recovery. (See the white paper "Backup/Restore Considerations for Multiplatform Storage", http://ntserv.hds.com/ssen/kb/products/multi_wp.pdf by Hu Yoshida.) | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Mainframe backup/restore used for open volumes | HMBR<br>Hitachi Multiplatform Backup/Restore | FDRSOS<br>Fast Dump Restore Safeguard Open Storage |
| Mainframe backup/restore used for open files | Harbor with links to HMDE | FDRSOS Upstream |
| Other Vendor Storage Devices | No? | No |
| Management point | Mainframe | Mainframe |
| Proprietary | Yes | Yes |
| Partner integration with advanced backup | No | Intelliguard? |
| Direct-attach backup to subsystem | No | Yes |

| **Bulk Data Transfers** | HDS is less complex to manage - 4 vs. 2 steps per copy | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Software Requirements | HMDE with optionally HFT (Harbor File Transfer) | InfoMover, formerly Symmetrix Multiplatform Transfer Facility (SMTF) |
| Intermediate flat file | Yes | Yes |
| Host Connections supported | ESCON, SCSI | ESCON, SCSI |
| Proprietary | Yes | Yes |
| # steps to copy | 2 | 4 |
| Sockets interface to data moving software | No | InfoMover |

| **Database Extracts** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Software requirements | HMDE Hitachi Multiplatform Data Exchange with optionally HFT (Harbor File Transfer) | DataReach[1] (SMTF) DB2 to HP and Oracle only |
| Intermediate Flat File | Yes | No |
| Can handle CKD flat files | Yes, FAL (File Access Library) | No |
| Mainframe Databases Supported | Any (API) | DB2 Only |
| Open Systems Database Supported | Any (API) | Oracle, Sybase, Informix |

[1] BMC is not selling this product and the software piece that EMC developed has flaws in the design.

# 7700E – EMC Symmetrix 5930 Features Comparison

**Remote Copy / Disaster Recovery / Business Continuation.** The only practical alternative EMC has for disaster recovery is synchronous SRDF. EMC's asynchronous adaptive copy is OK for data migration but not for disaster recovery, and EMC has stopped promoting it for disaster recovery and is promising XRC. SRDF uses a proprietary control interface and although many licenses have been sold only a few hundred are in production. HDS is IBM standard. [In the future we will hyperlink to a white paper addressing the Pat Artis paper on the advantages of pipelining and the HDS design approach vs. EMC for all flavors. Is lost data worth the pipeline speed?]

Since HDS is IBM compatible, customers can use TSO commands (or the Remote Console) to manage copy operations. This can be VERY important when considering operational implications such as automation and error procedures (e.g. SIM messges). And also futures such as GDPS Compatibility

| **Remote Copy - Synchronous S/390** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Synchronous Remote Copy (within ESCON distances) | Synchronous HRC | Synchronous SRDF (Symmetrix Remote Data Facility) |
| Distances supported | 43 KM | 43 or 60-66 KM |
| CGROUP support for Geoplex | Yes | No |
| Data Compression improves performance | Yes | No |
| Proprietary Control Interface | No (PPRC commands) | SRDF |
| Response Time Critical | Yes | Yes |
| UltraNet Compatible | Yes | NoYes |
| Homogeneous systems only for synchronous | Yes | Yes |

| **Remote Copy - Semi-Synchronous S/390** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Semi-synchronous Remote Copy | HRCSSO (HRC with Semi- Synchronous Option) | Semi-Synchronous SRDF |
| Distances supported | Not limited | Not limited |

| **Remote Copy - Asynchronous** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Asychronous Remote Copy | HXRC (Hitachi Extended Remote Copy) | Adaptive Copy |
| XRC based | Yes | No |
| Proprietary | No | Yes |
| Uses Sysplex timer | Yes | No |
| Supports pipelining | No (HDS needs to rebut the Pat Artis Paper) | Yes |
| Host Data Mover (IBM - XRC) | Yes | No |
| Real-time | Yes | No. Point-in-time only. |
| Nondisruptive to application | Yes, using HXRC ATTIME Feature | No. Requires quiesce to create point-in-time copy. |

| **Remote Copy - Open Systems** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Synchronous Remote Copy | Open HRC | Open SRDF |
| Semi-synchronous Remote Copy | No | Yes |
| Homogeneous systems only for synchronous | Yes | Yes |
| Management from remote vendor console | Yes | Yes |
| Asynchronous remote copy | No | Yes |
| Mixed vendor storage for asynchronous | N/A | No |
| Host setup software | No (LCP/RCP "on the fly") | No |

# 7700E – EMC Symmetrix 5930 Features Comparison

## Data Migration / Data Duplication

| **Online Data Migration (data replication within or between subsystems)** | HDS has better features for data integrity / protection / error recovery and less disruption with fallback protection. | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Software requirements | HODM or HXRC | SDMF Symmetrix Data Migration Facility/ |
| Systems supported | Any to 7700/7700E<br>Must be XRC compatible for HXRC | Any to Symmetrix Note30 |
| Services available | HDMS (Hitachi Data Migration Service) | SDMS (Symmetrix Data Migration Service) |
| Fallback capability | Yes | No Note22 |
| Volume granularity | Yes | Yes |
| Subsystem granularity | Yes | Yes |
| Optionally manage from a remote console | Yes | Yes |
| Volume relocation within a subsystem | Yes | Yes |
| Volume relocation from single to multiple targets | Yes | Yes |
| Additional HW required | CNT Conversion Unit only (if parallel on old controller) | RLD (remote link directors) |
| PPRC Extension for volume relocation within subsystem | P/DAS (IBM compatible) | S/DAS (proprietary) |
| Difficulty of setting relocation priorities | Much easier | Difficult |
| Replicates data for testing without disrupting system | Yes | Yes |
| Replicates data for dual batch without disrupting system | Yes | Yes |
| Recommended for Point in Time backups | Yes | Yes |
| Recommended for Y2K final system resting | Yes | Yes |
| Recommended for dual batch processing | Yes | Yes |
| "Point in Time" Backups | Yes (No suspended pair) | Yes (Suspend pair) |

| **Data Duplication (data replication within a system)** | HDS has better data integrity plus the ability to parallel copy to three targets with less operations restrictions. [EMC is expected to announce some type of Timefinder/SRDF cluster integration and TimeFinder single LPAR server management features]. (See the white paper "Hitachi Remote Copy, and FDR InstantBackup™ at Orange and Rockland Utilities, Inc http://hdsnet.hds.com/freedom/products/hrc_wp.pdf by Ros Schulman and Jim Sottile.) | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Software requirements | HS- DataPlex, Internal HRC or ShadowImage | Timefinder and/or SRDF |
| Volume level | Yes | Yes |
| BD/DC integration | No | No |
| Number of simultaneous active targets | 3 | 6 BCVs |
| Open systems support | Yes | Yes |
| Dedicated disk drives | No (Big operations plus) | Yes BCV's Note31 |
| No outage required to define BCV's | Yes (Can do 512 under customer control) | No |
| Industry standard | Yes (PPRC compatible) | No |
| Can use flexible volume size | Yes (VLVI) | No, cannot use HyperVolumes |
| Resynch options: primary (A), secondary (B) | A to B | A to B or B to A |

# 7700E – EMC Symmetrix 5930 Features Comparison

| **Subsystem Management Software** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Windows 95/NT GUI | Yes | Yes |
| UNIX Motif GUI | No | Yes |
| Connection to subsystem | Ethernet | LAN |
| Configuration & performance monitoring | Graph-Track | Symmetrix Manager |
| User defined performance thresholds | Yes | Yes |
| Diagnostics monitoring | Hi-Track (better due to more features) | Yes |
| Remote Copy monitoring | Yes | Yes |

**Reliability / Availability /Serviceability.** HDS has far superior RAS for supported platforms, EMC is so afraid of the Symmetrix old and non-fault tolerant design that they have taken the unusual step of requiring customers to sign tight contractual clauses to prevent disclosure of data loss. MTDL is significantly worse for Symmetrix customers vis-à-vis 7700/7700E customers. [A white paper is being developed on this point and other RAS features].

| **Redundant Design** | The Symmetrix design is not fault tolerant, especially cache. | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Higher probability of data loss with larger non-duplexed cache | No | Yes 9/98 announcement |
| Contractual clauses to prevent disclosing data loss | No | Yes |
| Redundant data busses | Two | Two |
| Redundant command busses | Two (M Busses) | None |
| Dual ported SCSI drives | Yes | No |
| Dual initiator disk directors / adapters | Yes - 2 active microprocessors / adapter | Yes - 1 inactive microprocessor / disk director |
| Redundant cooling fans | Yes | Yes |

| **Open Systems "Alternate Pathing"** | **Please check online FAR report for up to date Support. This can be found by launching the Efind Application from Marketplace** http://ntserv.hds.com/ssen/kb/kb.start.cfm | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| All components connect to two "alternate paths" | Yes | Yes |
| Alternate pathing for AIX 4.2X | Yes | Yes |
| Alternate pathing for Digital Unix | No | Yes |
| Alternate pathing for HP 10.01 + through PVlink | Yes | Yes |
| Alternate pathing for NT 4.0 | | Yes PowerPath |
| Alternate pathing for Sun Solaris 2.5 | Veritas with DMP (Check FAR) | EMC PowerPath |
| Veritas Dynamic Path Management (DMP) support | Yes ( Check FAR) | Yes |

# 7700E – EMC Symmetrix 5930 Features Comparison

| **Cluster Host Failover Support** | **EMC supports more low market share hosts<br>Please check online FAR report for up to date Support. This can be found by launching the Efind Application from Marketplace** http://ntserv.hds.com/ssen/kb/kb.start.cfm | | |
|---|---|---|---|
| | | **HDS 7700E** | **Symmetrix 5930** |
| Digital Intel PCs | Digital Clusters / Windows | Future? | Yes |
| Digital Alpha Stations | Digital Clusters / Windows | TruCluster | Yes |
| Digital Alpha Server | DEC SAFE | Yes | Yes |
| Digital Alpha Server | Tru Cluster | Yes | Yes |
| Digital Alpha Server | VMS Cluster | Yes | Yes |
| Digital / VAX | VMS | No | Yes |
| HP9000 HP/UX | MC Service Guard | In testing | Yes |
| HP9000 HP/UX | MC/ Lock Manager | In testing | Yes |
| IBM RS6000 AIX | HACMP | Yes? | Yes |
| IBM SP AIX | HACMP | CLAM Certified | Yes |
| IBM SP AIX | RVSD | Yes? | Yes |
| Wintel | NT 4.0 MSCS Wolfpack | Yes | Yes? |
| NCR UNIX SVR 4 | Lifekeeper | Yes? | Yes |
| NCR Intel PCs | Lifekeeper | Yes? | Yes |
| Sequent DYNIX/ptx | ptx Cluster | Yes? | Yes |
| Sun Solaris | Veritas Firstwatch | Yes | No |
| Sun Solaris | Qualix Firstwatch | No? | Yes |
| Sun Solaris | Open Vision | No? | Yes |
| Sun Solaris | Sun PDB | No? | Yes |
| Cluster integration with vendor software | (9/98) | ? | SRDF/ TimeFinder single LPAR cluster mgmt |

| **BBU and Power Subsystem Design** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Non-volatile cache | Yes | Yes |
| Dirty writes de-staged after interval (specifiable) | No | 30 seconds to 15 minutes |
| Recommended timer value for de-staging | N/Ap | 3 minutes |
| Max battery backup time (control frame only) | 48 hours | <1 hour Note 20 |
| Single BBU option | No? | Full system |
| Full system or Cache Only BBU | Cache Only | 37XX/57XX |
| Battery life | 3 years | 3 years |
| Dual AC power | Yes | Yes |
| Dual DC power | Yes | Yes |
| AC/DC power supply dynamic switchover | Yes | Yes? |

# 7700E – EMC Symmetrix 5930 Features Comparison

| **RAID Levels / Parity Group** | | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| RAID-0 | No | No |
| RAID 0+1 | No | No |
| RAID-1 (1D+1P) | Yes | Yes |
| RAID-5 (6D+1P, 3D+1P) | Yes/Yes | No |
| RAID-S/R (3D+1P, 6D+1P) | No | RPQ only |
| XOR parity generation | Disk adapter (ACP) level Note17 | Drive level Note17 |
| Automated reconstruction | Yes but faster rebuild time (6 vs. 24 hours for an 18 GB drive) | Yes |

| **Preventive Maintenance** | Although the EMC story sounds good, there are major deficiencies such as the lack of customer monitoring and control and the fact that errors are sometimes not reported to EMC for 24 hours. | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Number of service processors | 1 | 1 |
| Parity on data and control busses | Yes | Yes |
| Parity for sequential, random writes | Yes | Yes |
| Cache scrubbing | Yes | Yes |
| Threshold based disk scrubbing | Yes | Yes |
| Dynamic sparing as a standard feature | Yes | No |
| # Hot spare disks | 1 Standard –7 optional | Optional |
| Threshold activated dynamic sparing | Yes | Yes |
| SIM notification to host when failure occurs | Yes | Yes |
| Failures can be delayed in reporting | No | Up to 24 hours???? |
| Automated service notification | Yes | Yes |
| User definable “pacing” | Yes | Yes |
| Phone Home service | Yes | Yes |

| **Predictive Maintenance** | HDS has better data integrity and performance. | |
|---|---|---|
| | **HDS 7700E** | **Symmetrix 5930** |
| Dynamic sparing as a standard feature | Yes | No |
| # Hot spare disks | 1 Standard –8 Optional | Optional |
| Threshold activated dynamic sparing | Yes | Yes |
| SIM notification to host when failure occurs | Yes | Yes (up to 24 hour delays) |
| User definable “pacing” | Yes | Yes |
| Phone-home service | Yes | Yes |

## Reference Notes/Links

| Reference Number | |
|---|---|
| **1** | EMC's 1024 logical paths feature started shipping in 3Q98. It will be a standard feature on Symmetrix 4.8. Symmetrix 4 systems shipped earlier than 3Q98 may require a box swap to go from 512 to 1024 paths. |
| **2** | The EMC increase from 2 to 4 active ports per adapter started shipping 3Q98. Subsystems shipped earlier have only 1-2 active ports. It will be a standard feature on Symmetrix 4.8. Symmetrix 4 systems shipped earlier than 3Q98 may require a box swap for this feature. |
| **3** | EMC have 4 physical connections per channel director, but only two can be active, given only 16 concurrent Escon I/O capability vs 32 for the 7700E. This can be a disadvantage when you are sharing a large system like the 5930 between Open and Mainframe and also using features like SRDF which require dedicated links. This is as per Evaluator Group. |
| **4** | 68MB/sec per host adapter capability started shipping 3Q98. Subsystems shipped earlier had 34MB/sec capability It will be a standard feature on Symmetrix 4.8. Symmetrix 4 systems shipped earlier than 3Q98 may require a box swap for this feature. |
| **5** | SRDF (Symmetrix Remote Data Facility, EMC's remote copy) requires RLDs (remote link directors) to connect the primary subsystem to the secondary subsystem. Each RLD pair (max of 2 4 pairs) displaces slots for a host adapter pair. RLDs can be used only as SRDF links, not for host connections. In the case of the 7700E, we use standard ESCON adapters for remote copy, and the customer may opt to use the same adapters for host connections at another time.With the two port version both ports may be used for SRDF or one for SRDF and one for serial channel connections. With the 4 port version only one port each side may be used for SRDF and one may be used for serial connections. This is as per evaluator group |
| **6** | Symmetrix: 4 microprocessors / adapter board started shipping 3Q98. Subsystems shipped earlier had only 2 microprocessors / adapter board. It will be a standard feature on Symmetrix 4.8. Symmetrix 4 systems shipped earlier than 3Q98 may require a box swap for this feature. |
| **7** | EMC's cache capacity increased from 4GB to 16GB in Nov. 1998. However Symmetrix still uses Motorola 68020 microprocessor, which has direct address capability of only 4GB. The additional 12GB of cache memory is used (we believe) by register switching or memory-to-memory paging, which causes cache performance overhead compared to the HDS design. |
| **8** | The 7700E has 16 card slots for cache memory. There are two card sizes: 256MB, and 1024MB. Cards of different capacity cannot be intermixed in the same subsystem, but a subsystem can be upgraded from one size card to the other size non-disruptively. |
| **9** | The Symmetrix has only four card slots for cache memory. There are four card sizes: 512MB, 1024MB, and 4096MB. EMC attempts to use all 4 card slots whenever possible, due to the fact that Cache is a single point of failure ( See also Note14). Additionally due to only 4 slots vs. the 7700E they do not have as much flexibility in cache sizes. |

<table>
<tr><td>10</td><td>The Symmetrix architecture uses significant amounts of cache for control storage and housekeeping operations, reducing the amount of cache available for user data. This is a significant disadvantage relative to the 7700E. The Symmetrix overhead requirement for control store memory is approximately 67MB plus 32 bytes per logical track in the subsystem. The incremental cache requirement for each logical volume is as follows:<br><br>
<table>
<tr><th></th><th>Tracks/Volume</th><th>Cache Required (MB) per Volume</th></tr>
<tr><td>3380K</td><td>39,825</td><td>1.27</td></tr>
<tr><td>3390-1</td><td>16,695</td><td>0.53</td></tr>
<tr><td>3390-2</td><td>33,390</td><td>1.07</td></tr>
<tr><td>3390-3</td><td>50,085</td><td>1.60</td></tr>
<tr><td>3390-9</td><td>150,255</td><td>4.81</td></tr>
</table>
<br>Using the following formula it is possible to include in your proposals an estimate of the amount of “useable cache for data” for comparable EMC configurations relative to HDS.<br><br>Useable EMC cache for Data formula:<br>“Size of useable EMC cache for data” = Total EMC Cache less [67MB plus the # of volumes per subsystem x cache per logical volume from the above Table.]<br><br>For example a procurement for a subsystem for (256) 3390-9 volumes and 4 GB of Cache will show that Symmetrix has useable cache of 4096MB – [67MB + 256 x 4.81MB] = 2798 MB of cache. Almost a third of the physical cache is not available to the user. Using this formula will allow an “apples to apples” comparison between HDS and EMC. It can also be used to equate differences in pricing since pricing should be on an “apples to apples” basis for “useable cache for data”.<br><br>Note also that effective cache size is also reduced for EMC due to the de-stage policy differences for fast write data. EMC waits for cache to fill before de-staging whereas HDS does not. See also Note18.</td></tr>
<tr><td>11</td><td>The 3390-3 and 3390-3R (RAMAC 3390 image) logical volumes cannot coexist in the same 7700E subsystem. The 3390-3R logical volume is recognized by IBM’s DFSMS program product, giving the 7700E more flexibility in a system managed storage environment then EMC 5930.</td></tr>
<tr><td>12</td><td>PPRC between two 7700s or between 7700E & 7700 Classic is supported. No storage vendor supports PPRC between one of its storage subsystems and another vendor’s subsystem.</td></tr>
<tr><td>13</td><td>EMC Symmetrix uses the data bus to send both commands and control information. It has no separate command busses; therefore each command message causes an interrupt on the data bus. In periods of heavy command message activity (e.g. high IO rates and error recovery), message traffic can affect bus performance. The 7700E also employs a separate reset bus (i.e. a fifth bus) to provide higher availability.</td></tr>
</table>

| | |
|---|---|
| **14** | Symmetrix uses double-bit error correction and triple-bit error detection, but it does not have dual cache like the 7700 and 7700E. If there is an unrecoverable error in the cache, there is not backup copy. EMC has a very effective presentation on how they do not need multiple copies of data or tables for reliability and they will not "lose" data on a cache card failure. They imply that they only have 1 bit per byte on a cache card and they do double bit error correction so no data loss. This isn't true since they have a max of 4 cache cards and there are 9 bits per byte with parity so at least 2 bits per byte per card. We believe that they don't always lose data, but they seem to always lose status for channels or SCA or whatever that causes them severe channel interface disruption. They seem to suffer a data loss about half the time. The loss of the "hardware status area" or part of it seems to be the most disruptive issue. The 7700 of course, can never have this problem since all status areas (ECM) and write data is duplexed. |
| **15** | DTDS+ (Disaster Tolerant Disk System Plus, the7700/7700E rating) is the highest rating given by the RAB. FTDS+ (Failure Tolerant Disk System Plus, the Symmetrix rating) is the fourth highest rating given by the RAB. For further information about the RAID Advisory Board and its rating system, go to http://www.raid-advisory.com/rabguide.html For definitions for the *RAB's* Disk System Classifications, go to http://www.raid-advisory.com/EDAPDef.html. EMC played a major role in promoting the RAB when the RAB was getting started. One of the first subsystems rated was the Symmetrix, which was given the highest rating available at the time. EMC promoted the rating aggressively. However when other vendors became more influential in establishing RAB standards, and other storage systems including the 7700 and 7700E gained higher ratings than Symmetrix, EMC stopped promoting RAB. |
| **16** | SRDF Mode Raid 0 (Not Mirrored or RAID protected.)<br>In RAID 1 Mode the scaleable Capacity is 286GB increments for 18GB drives and 572GB with the 36GB drives on the 5930 series. Users who require more flexibility and scalability should be looking at the 5630 series. |
| **17** | EMC does not formally offer RAID-S or RAID-R on the Symmetrix 4.8 series, although they have shipped some RAID-S on RPQ basis. RAID-S is so unstable that EMC traditionally does not ship it on major new releases until it has gotten several months of field experience. In a Raid-S implementation, one spare is required for the failing volume, but EMC strongly recommends at least three spares in their user guide. If three spares are available, the Symmetrix will use three spares to recover from a RAID-S drive failure. If only one spare is available, the recovery time for a failed RAID-S drive failure can be very long—reported sometimes to be longer than a day! |
| **18** | The 7700/7700E have a significant advantage over Symmetrix in the way they de-stage data from cache. Symmetrix waits until cache has filled up, usually a relatively short time after startup. Then it de-stages data out of cache to the disk as more cache space is required for new data. The 7700/7700E, on the other hand, continuously de-stage data (write to disk but also leave in cache) in background operations. This process makes additional cache capacity available more quickly when additional cache space is required for new data. |
| **19** | |
| **20** | While in BBU mode, EMC has no error detection or reporting capability, therefore a data integrity exposure exists since multiple intermittent power failures may drain batteries. The HDS [and IBM] more conservative policy is to keep cache alive for >48 hours to guard against this possibility. |
| **21** | Time stamps are appended to the CCW chain to support IBM's XRC (Extended Remote Copy). Time stamp records are stored separately from data in 7700E cache. |
| **22** | After EMC Symmetrix starts migrating a volume from the "source" storage device to the "destination" Symmetrix, the data on the source is no longer updated while |

| | |
|---|---|
| | the migration is underway. If there is a disruption during the migration (e.g. a break in the link) the user no longer has a complete, current copy of the volume either at the source or the destination. |

| | |
|---|---|
| **23** | EMC claims 20 MB/sec in their Web site, but this speed exceeds host channel specifications. |
| **24** | EMC announced HP fibre channel (FC-AL) 11/97 (started shipping August 97). Announced Sun Solaris 12/97. |
| **25** | Advantages of segmented drive cache - During Striping I/O, EMC typically runs into a buffer invalidation problem that impacts their sequential prefetch performance as I/O takes place between different logical disks on the same |
| **26** | Symmetrix has potentially serious bottlenecks with concurrent writes to parity volumes when using RAID-S |
| **27** | The 7700E is fully compatible and Symmetrix is not. A Symmetrix can lose key components of a subsystem, e.g. a mirror or battery, and customer and support center may not be notified for up to 24 hours. The system waits for 24 hours if the "call home" feature doesn't work before issuing a system message. |
| **28** | Even though the back end speed was improved to 40MB/Sec with the introduction of Ultra SCSI, on Symmetrix 4.8. The number of disk drives was doubled from 128 to 256, also doubling the number sharing each Ultra SCSI Bus. Additionally the smaller disk buffers may restrict some of the Ultra SCSI benefit. See also Note25 |
| **29** | HDS offers the flexibility of library functions as well as a copy program. This allows customers to incorporate HMDE function into their own routines and procedures. |
| **30** | Ironically Symmetrix cannot migrate PermaCache volumes. HDS can migrate FlashAccess data and Symmetrix PermaCache data. Our understanding is also that PermaCache data is not remote copied. |
| **31** | BCV's must be defined ahead of time to a pool by a CE. We believe this is disruptive as it requires a bin file change. |
| **32** | |