OpenVMS Technical Journal V8

CHARON-VAX Performance Benchmarks

Bruce Claremont, Software Migration and OpenVMS Consultant

Overview

Migration Specialties International recently conducted independent benchmark and stress testing of the CHARON-VAX emulator. This article contains our findings.

Introduction

Migration Specialties is a small, privately held corporation that specializes in HP OpenVMS porting, software migration, and complementary services. We became involved with the CHARON-VAX emulation product last year. CHARON-VAX is a software-based VAX hardware emulator produced by Software Resources International that runs on Windows-based servers like the HP ProLiant. More product information is available on the HP DSPP site under VAX Replacement.

After working with the emulator, I became curious as to how it would perform against native OpenVMS hardware. I also wanted to stress the product and see how it held up. Migration Specialties has VAX, Alpha, and Integrity servers in-house. We also have a comprehensive, automated DTM test suite that supports our Migration RPG product. Thus, the tools were at hand to benchmark and stress test the CHARON-VAX emulator.

Baseline

I used our MicroVAX 3100-80 as the baseline for these tests. All tests compare performance against the MicroVAX. I ported the MicroVAX environment to the CHARON-VAX environment using a set of image backups and restores.

Equipment

Native OpenVMS environment testing was conducted on the MicroVAX 3100, DECsystem 3000-300X, Digital AlphaServer 1000As, and HP Integrity RX2600. Simulated VAX testing using CHARON-VAX was conducted on an in-house Compaq Presario R3000 equipped with an Intel Pentium 4 Hyper-threaded processor and a SuperMicro server equipped with dual Xeon EM64T processors. More information on the hardware configurations is provided in the Performance Results and Testing Details sections.

Performance Tests

I was interested in two simple criteria: how fast was each system as measured by process elapsed time and CPU utilization. Testing was conducted using our Migration RPG quality assurance suite. The suite consists of eight interactive test sets that primarily check compiler functionality and accuracy. Consequently, the tests are compile-intensive, meaning they use more CPU resources than most production applications. By the same token, they generate less I/O than most production applications. More information on the test sets is provided in the Testing Details section.

Performance Results

The performance results of the VAX emulator are impressive. I experienced no problems with the emulator during all of the testing.

I tested two versions of CHARON-VAX, XM and XL. I tested both the base and enhanced modes within each version. Enhanced mode is indicated by the ***Plus*** designation in the Product column. Enhanced mode deploys an accelerator that optimizes OpenVMS instruction processing.

The following two tables summarize the results. Each table leads off with the native OpenVMS processors, then follows with the simulated VAX results. The first set of columns in the table summarizes the hardware and OpenVMS version used. The second set of columns summarizes either elapsed time or CPU utilization. Performance and speed measurements use the MicroVAX 3100-80 as a baseline.

Important Note: The memory listed under the emulated VAX systems is the emulated VAX memory with which the simulated VAX was configured. It is not the physical memory present in the server. The Compaq system was equipped with 1.28 GB of memory and the Intel system was equipped with 2 GB of memory. Likewise, the models listed in the emulated VAX results are the emulated VAX model,

Migration Specialties CHARON-VAX Benchmark Results: Summary
Elapse Time

	Processor	Product	Model	Memory	OpenVMS Version	Actual	Improve-ment	Speed Factor
Native Systems	VAX	MicroVAX	3100-80	72MB	7.1	1-12:37:08	0%	1.00
	Alpha	DECsystem	3000-300X	112MB	6.2	1-13:16:28	-2%	0.98
	Alpha	AlphaServer	1000A 4/266	128MB	8.2	0-21:52:34	67%	1.67
	Alpha	AlphaServer	1000A 4/266	512MB	8.2	0-22:18:51	64%	1.64
	Dual Itanium-2	Integrity	RX2600	2GB	8.2	0-07:07:49	414%	5.14
CHARON-VAX Systems	Pentium 4 HT	XM	3100-96	128MB	7.1	0-15:19:48	139%	2.39
	Pentium 4 HT	XM/Plus	3100-96	128MB	7.1	0-08:13:09	346%	4.46
	Dual Xeon EM64T	XM	3100-96	128MB	7.1	0-13:24:13	173%	2.73
	Dual Xeon EM64T	XM/Plus	3100-96	128MB	7.1	0-07:11:03	410%	5.10
	Dual Xeon EM64T	XL	3100-98	512MB	7.1	0-13:08:51	179%	2.79
	Dual Xeon EM64T	XL/Plus	3100-98	512MB	7.1	0-07:45:31	372%	4.72

Figure 1 - Summarized elapsed times for native OpenVMS systems and emulated VAX systems.

not the underlying Windows servers.

Migration Specialties CHARON-VAX Benchmark Results: Summary
CPU Time

	Processor	Product	Model	Memory	OpenVMS Version	Actual	Improve-ment	Speed Factor
Native Systems	VAX	MicroVAX	3100-80	72MB	7.1	0.401578	0%	1
	Alpha	DECsystem	3000-300X	112MB	6.2	0.362461	11%	1.1079
	Alpha	AlphaServer	1000A 4/266	128MB	8.2	0.224797	79%	1.7864
	Alpha	AlphaServer	1000A 4/266	512MB	8.2	0.223825	79%	1.7942
	Dual Itanium-2	Integrity	RX2600	2GB	8.2	0.073859	444%	5.4371
CHARON-VAX Systems	Pentium 4 HT	XM	3100-96	128MB	7.1	0.157191	155%	2.5547
	Pentium 4 HT	XM/Plus	3100-96	128MB	7.1	0.074098	442%	5.4195
	Dual Xeon EM64T	XM	3100-96	128MB	7.1	0.122865	227%	3.2685
	Dual Xeon EM64T	XM/Plus	3100-96	128MB	7.1	0.055622	622%	7.2198
	Dual Xeon EM64T	XL	3100-98	512MB	7.1	0.122793	227%	3.2704
	Dual Xeon EM64T	XL/Plus	3100-98	512MB	7.1	0.056104	616%	7.1577

Figure 2: Summarized CPU times for native OpenVMS systems and emulated VAX systems.

Acknowledgements

I would like to thank Reynolds Technical Services and Quayle Consulting for loaning us the CHARON-VAX licenses used in the benchmark process. Intel Corporation generously provided the SuperMicro server hardware using in testing.

Testing Details

The following sections provide more details concerning the test hardware, system configurations, test sets, and testing protocols.

Test Hardware

- DEC MicroVAX 3100-80, VAX Mariah processor (12 VUP), 72 MB memory, two RZ29L-AS disk drives.
- DECsystem 3000-300X, Alpha 21064 175 Mhz processor, 112 MB memory, two RZ28M disk drives.
- Digital AlphaServer 1000A 4/266, Alpha 21064 266 Mhz processor, 128 MB memory, two RZ29B disk drives.
- Digital AlphaServer 1000A 4/266, Alpha 21064 266 Mhz processor, 512 MB memory, two RZ29B disk drives.
- HP Integrity RX2600, dual Itanium2 1.4 Ghz processors, 2 GB memory, two Ultra320 15,000rpm disk drives.
- Compaq Presario R3000 Laptop, Intel Pentium 4HT 3.0 Ghz processor, 1.28 GB memory, single 4200 rpm disk drive.
- Supermicro SuperServer 6024H-82R, dual Intel Xeon EM64T processors, 2GB memory, single Ultra320 15,000 rpm disk drive.

Hardware Note: SRI does not officially support CHARON-VAX on single CPU systems or 64-bit Windows systems. Hence, our test beds would not be appropriate production systems.

System Configurations

No special tuning was done on any of the systems used in testing. The native OpenVMS systems are maintained using AUTOGEN with feedback. No special adjustments were made to system parameters for these tests.

The two Windows servers were new, each running a fresh install of the Windows O/S. The systems were configured per published CHARON-VAX recommendations, with no anti-virus, automatic update, or anti-spyware processes running.

The CHARON-VAX configuration on each of the Windows servers was an image copy of our MicroVAX 3100-80. All OpenVMS system parameters were identical to the MicroVAX 3100-80 from which the software was sourced.

Each of the native OpenVMS systems uses a dedicated system drive that supports the O/S, page file, and swap file. The DTM test suite was located on a secondary drive to reduce I/O loads. The VAX emulation systems each contained a single disk drive. The Windows O/S, VAX emulation software, and VAX disk container files were all loaded on this one drive. In the case of the VAX emulator, this is not a recommended configuration; it is simply what I had available for testing.

- MicroVAX 3100, OpenVMS 7.1, DTM version 4.0-4, dedicated system drive, DTM test suite run from second drive.
- DECsystem 3000-300X: OpenVMS 6.2, DTM version 4.0-4, dedicated system drive, DTM test suite run from second drive
- AlphaServer 1000As: OpenVMS 8.2, DTM version 4.1, dedicated system drive, DTM test suite run from second drive
- Integrity RX2600: OpenVMS 8.2, DTM version 4.2, dedicated system drive, DTM test suite run from second drive.
- Compaq Presario: Windows XP SP2. VAX emulation software and VAX disk container files supported on single hard drive. CHARON-VAX version 3.0.39, OpenVMS 7.1, DTM version 4.0-4, system drive emulated as an RZ74 container file, DTM drive emulated as an RZ73 container file.
- Supermicro SuperServer: Windows Server 2003. VAX emulation software and VAX disk container files supported on single hard drive. CHARON-VAX version 3.0.39, OpenVMS 7.1, DTM version 4.0-4, system drive emulated as an RZ74 container file, DTM drive emulated as an RZ73 container file.

Test Sets

Our Migration RPG DTM test suite consists of eight automated test sets. The test sets comprise both batch and interactive test processes. The test suites primarily exercise the Migration RPG compiler by compiling and linking programs. Thus, the test suites tend to be CPU intensive while placing little demand on memory or I/O resources.

The two Alpha 1000 systems and CHARON-VAX XL tests support these observations. One Alpha 1000 is equipped with 128 MB of memory while the other is equipped with 512 MB of memory. This had little impact on the benchmarks. Likewise, CHARON-VAX XL permits an emulated VAX to be configured with 512 MB of memory versus the 128 MB available under XM. Again, the difference in performance is negligible.

About 10% of the tests run production style interactive and batch processes. Test set 3 is the most realistic from a production perspective. It consists of a series of interactive processes that acquire, process, update, and display information from general ledger, payroll, inventory, and similar applications.

The results from each test set are listed in the Test Results Details section.

Testing Protocol

The testing protocol was submission of all eight test sets to a batch queue capable of executing six jobs simultaneously. No other user processes were run on the system during the benchmark tests.

Test Results Details

The following tables provide the elapsed time and CPU time used by each test set in the DTM test suite.

Migration Specialties CHARON-VAX Benchark Results: Details

Native OpenVMS Systems

Processor	Product	Model	Memory	OpenVMS Version	Test	Elapse Time	Improved	CPU Time	Improved
VAX	MicroVAX	3100-80	72MB	7.1	1	09:03:39.14		02:25:01.04	
					2	05:30:43.29		01:05:06.37	
					3	01:58:53.85		00:14:47.42	
					4	00:32:44.50		00:02:32.77	
					5	02:04:11.35		00:22:49.71	
					6	09:48:19.16		03:25:47.38	
					7	07:38:36.40		02:02:11.62	
						1-12:37:07.69		**0-09:38:16.31**	
Alpha	DECsystem	3000-300X	112MB	6.2	1	08:31:19.97	6%	01:48:11.61	34%
					2	06:14:36.94	-12%	01:06:56.17	-3%
					3	01:58:51.05	0%	00:03:50.14	286%
					4	00:39:15.99	-17%	00:03:00.60	-15%
					5	02:27:53.14	-16%	00:31:26.36	-27%
					6	09:50:49.08	0%	03:21:27.47	2%
					7	07:33:42.02	1%	01:47:04.24	14%
						1-13:16:28.19	**-2%**	**0-08:41:56.59**	**11%**
Alpha	AlphaServer	1000A 4/266	128MB	8.2	1	05:20:43.00	70%	01:05:42.23	121%
					2	03:29:25.21	58%	00:43:44.87	49%
					3	01:14:36.65	59%	00:02:30.55	489%
					4	00:23:04.94	42%	00:02:00.85	26%
					5	01:21:20.56	53%	00:17:12.72	33%
					6	05:35:15.19	75%	02:07:15.58	62%
					7	04:28:08.48	71%	01:05:15.70	87%
						0-21:52:34.03	**67%**	**0-05:23:42.50**	**79%**
Alpha	AlphaServer	1000A 4+C29/266	512MB	8.2	1	05:02:33.54	80%	01:05:03.31	123%
					2	03:30:11.26	57%	00:43:51.26	48%
					3	02:04:42.61	-5%	00:02:21.67	526%
					4	00:22:53.43	43%	00:02:00.68	27%
					5	01:17:47.25	60%	00:17:10.52	33%
					6	05:34:43.32	76%	02:07:28.74	61%
					7	04:25:59.77	72%	01:04:22.34	90%
						0-22:18:51.18	**64%**	**0-05:22:18.52**	**79%**
Dual Itanium-2	Integrity	RX2600	2GB	8.2	1	01:39:36.20	446%	00:20:31.71	606%
					2	00:58:08.32	469%	00:14:05.87	362%
					3	00:45:24.53	162%	00:00:21.17	4092%
					4	00:06:14.57	424%	00:00:43.26	253%
					5	00:25:49.94	381%	00:06:40.84	242%
					6	01:51:43.10	427%	00:42:10.53	388%
					7	01:20:52.58	467%	00:21:48.04	461%
						0-07:07:49.24	**414%**	**0-01:46:21.42**	**444%**

Figure 3: Native OpenVMS system test results.

Migration Specialties CHARON-VAX Benchark Results: Details
Emulated VAX Systems

Processor	Product	Model	Memory	OpenVMS Version	Test	Elapse Time	Improved	CPU Time	Improved
Pentium 4 HT	XM	3100-96	128MB	7.1	1	03:45:43.08	141%	00:57:25.78	153%
					2	02:18:37.10	139%	00:25:07.70	159%
					3	01:25:51.48	38%	00:05:53.34	151%
					4	00:14:15.90	130%	00:00:59.19	158%
					5	00:44:16.72	180%	00:09:02.61	152%
					6	03:52:55.40	153%	01:21:09.10	154%
					7	02:58:08.66	157%	00:46:43.60	162%
						15:19:48.34	**139%**	**03:46:21.32**	**155%**
Dual Xeon EM64T	XM	3100-96	128MB	7.1	1	03:16:35.90	177%	00:45:07.66	221%
					2	01:43:48.42	219%	00:19:13.66	239%
					3	02:00:30.04	-1%	00:04:37.57	220%
					4	00:11:26.28	186%	00:00:45.19	238%
					5	00:35:39.20	248%	00:06:56.71	229%
					6	03:11:41.30	207%	01:03:50.99	222%
					7	02:24:31.60	217%	00:36:23.72	236%
						13:24:12.74	**173%**	**02:56:55.50**	**227%**
Pentium 4 HT	XM/Plus	3100-96	128MB	7.1	1	02:05:43.82	332%	00:25:28.80	469%
					2	01:12:08.88	358%	00:13:00.35	401%
					3	01:07:07.86	77%	00:02:26.54	506%
					4	00:07:35.22	332%	00:00:30.71	397%
					5	00:20:54.52	494%	00:04:14.57	438%
					6	01:52:30.04	423%	00:39:10.37	425%
					7	01:27:08.70	426%	00:21:50.76	459%
						0-08:13:09.04	**346%**	**0-01:46:42.10**	**442%**
Dual Xeon EM64T	XM/Plus	3100-96	128MB	7.1	1	01:46:12.00	412%	00:19:06.49	659%
					2	00:57:24.92	476%	00:09:27.35	589%
					3	01:10:10.04	69%	00:01:49.50	710%
					4	00:06:23.16	413%	00:00:21.94	596%
					5	00:16:56.30	633%	00:03:10.69	618%
					6	01:37:46.74	502%	00:29:49.65	590%
					7	01:16:09.78	502%	00:16:20.08	648%
						07:11:02.94	**410%**	**01:20:05.70**	**622%**
Dual Xeon EM64T	XL	3100-98	512MB	7.1	1	03:02:34.82	198%	00:44:57.39	223%
					2	01:45:02.30	215%	00:19:46.90	229%
					3	01:58:39.76	0%	00:04:36.48	221%
					4	00:11:25.04	187%	00:00:44.47	244%
					5	00:35:31.64	250%	00:06:54.29	231%
					6	03:11:41.04	207%	01:03:30.07	224%
					7	02:23:56.74	219%	00:36:19.75	236%
						13:08:51.34	**179%**	**02:56:49.35**	**227%**
Dual Xeon EM64T	XL/Plus	3100-98	512MB	7.1	1	01:52:51.70	382%	00:19:15.03	653%
					2	00:58:22.64	467%	00:09:50.35	562%
					3	01:37:47.08	22%	00:01:53.39	683%
					4	00:06:13.39	426%	00:00:22.21	588%
					5	00:16:50.64	637%	00:03:10.44	619%
					6	01:37:26.30	504%	00:29:45.87	591%
					7	01:15:59.14	504%	00:16:30.10	640%
						07:45:30.89	**372%**	**01:20:47.39**	**616%**

Figure 4: Emulated VAX system test results.

For more information

More information about VAX emulation, porting OpenVMS systems, and Migration Specialties services can be found at www.MigrationSpecialties.com.

About the Author

Bruce Claremont has a degree in Computer Science and is a certifiable VMS bigot, having worked with OpenVMS since 1983. In addition to OpenVMS skills, Bruce understands legacy programming languages like RPG and DIBOL and knows how to code in Macro-32. He also knows a thing or two about software migration. He has worked all sides of the fence, as a customer, software engineer, system manager, support specialist, and project manager. He founded Migration Specialties International, Inc. in 1992 and, when not dealing with all the distractions that come with owning a business and being married, continues to deliver OpenVMS and software migration related services.