AIPS DDT benchmark results

for

SUN's SPARCstation 2GX (SUN 4/75)

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1. Introduction

AIPS memo 65 presented DDT benchmark results for the IBM RISC system 6000 model 320 and compared them against a Convex C210. DDT results for several SUN systems were also presented but, as emphasised by the authors, these were not obtained under comparable benchmarking conditions.

On 26-27/Nov/1990 we benchmarked a SUN SPARCstation 2GX (SUN 4/75) under conditions suitable for comparison with those of the IBM machine. The basic configuration was as follows

1x 669Mb SUN0669 disk drive for AIPS with a separate drive for unix
1x Exabyte tape drive used for installing AIPS
32Mb memory
Graphics accelerator (standard on the 2GX)
SunOS 4.1.1_BETA1.0
FORTRAN f77 v1.4 (pre-release)

In the first instance we simply copied the complete AIPS directory tree and DDT data files to the benchmark machine from ATNF Epping using tar. The executables, which were completely unoptimized, were compiled under SunOS 4.1, f77 v1.2. After adding the benchmark machine to the list of known AIPS hosts, and enabling the AIPS account and AIPS TV services, we had a fully functioning system, thereby demonstrating compatibility with the SPARCstation 1. This unoptimized system was used to run the small and medium DDT benchmarks.

At the request of the SUN representative, we rebuilt the AIPS libraries and DDT executables (INSTEP3) from scratch using the "-fast -O4" optimization level in the f77 v1.4 FORTRAN compiler. This proceded without problems except for $APLNOT/DATBND,DATCAL,GACSIN, and GAININ for which the compiler complained about non-alignment of variables in equivalence statements. These were recompiled without optimization. The compiler also found an invalid integer constant -2147483648 in $APGNOT/FITTP,IMLOD, and UVLOD. However, these tasks are not used in the benchmark, and the problem was ignored. The optimized system was again used to run the small and medium DDTs.

The results of the optimized and unoptimized DDT are presented below, together with those of the Convex C210 (selectively optimized) and IBM 320 (optimized) for comparison. The importance of the optimizing compiler for SPARC systems is immediately apparent, as it is for the Convex and, we believe, the IBM RISC systems. AIPS managers will therefore have to confront the problems of the reliability of the optimizer, and the debugging of optimized

code.

As for the benchmark timings, the ratio of the total real time taken by the SUN to that of the IBM was 1.24 for both the small and large tests. On the other hand, the ratio of CPU times was relatively smaller, being 1.17 for the small DDT, and 1.12 for the medium DDT. This indicates that the SPARC 2 is slightly I/O bound by comparison with the IBM. We believe that SUN will counter this by introducing disk striping in the near future. However, SPARC 2s may be disadvantaged in a networked system where they must rely on an NFS disk server for AIPS data storage.

The accuracy measurements quoted in AIPS memo 65 for the C210, IBM 320, and SUN 4/60 (SPARC 1) are reproduced below, together with that of the SPARC 2. There was no significant difference between the optimized and unoptimized versions. Although the results are acceptible, it is interesting to note that the accuracy for the SPARC 2 is systematically less than for the SPARC 1.

In subjective terms the SPARC 2 handles beautifully. Not surprisingly, it seems significantly faster in interactive use. Graphics handling, which includes scrolling and AIPS TV display (SSS), benefits noticably from the GX accelerator. The FORTRAN compiler is also much faster, despite the extra overhead of code optimization.

2. Benchmark timings

SMALL TEST

	Convex C210		IBM 320		SUN 4/75		SUN 4/75*	
	real	CPU	real	CPU	real	CPU	real	CPU
UVSRT	11	6.70	14	3.98	19	5.34	16	7.80
UVDIF	7	2.77	10	2.49	6	2.47	6	4.14
CCMRG	4	1.97	2	0.91	2	0.87	2	1.12
SUBIM	3	2.42	2	1.49	2	1.32	3	1.72
COMB	16	10.17	15	6.62	22	6.44	11	7.77
UVMAP	7	5.04	9	4.97	12	6.94	16	12.45
APCLN cln	17	14.25	60	57.97	59	53.36	148	144.87
APCLN res	6	3.36	4	3.05	6	3.62	10	8.36
ASCAL	10	8.05	26	24.54	43	39.67	52	49.63
MX map	11	7.42	8	5.47	14	8.90	23	19.37
MX cln	36	30.82	89	82.54	109	97.13	176	168.01
VTESS	25	16.98	20	15.54	27	18.76	51	45.19
total	153	109.95	259	209.57	321	244.82	514	470.43
ratio	1.00	1.00	1.69	1.91	2.10	2.23	3.36	4.28

MEDIUM TEST

	Convex C210		IBM 320		SUN 4/75		SUN 4/75*	
	real	CPU	real	CPU	real	CPU	real	CPU
UVSRT	14	9.31	21	5.87	58	8.91	54	12.55
UVDIF	8	4.38	12	4.12	7	3.83	10	6.90
CCMRG	6	3.10	3	1.60	3	1.65	4	2.44
SUBIM	5	3.84	5	3.95	7	3.10	6	4.38
COMB	22	16.33	38	15.75	77	14.14	73	18.20
UVMAP	14	10.87	26	14.22	45	22.50	64	41.15
APCLN cln	84	77.14	529	517.12	492	455.13	1403	1367.76
APCLN res	14	10.56	17	11.91	40	16.72	53	38.00

ASCAL		20	17.70	77	74.83	268	261.93	322	316.14
MX	map	22	17.42	25	17.26	55	30.23	86	65.32
MX	cln	124	112.96	611	586.12	625	570.66	1108	1058.31
VTESS		47	39.18	68	48.26	95	63.06	182	145.44
total		380	322.79	1432	1301.01	1772	1451.86	3365	3076.59
ratio		1.00	1.00	3.77	4.03	4.66	4.50	8.86	9.53

Notes:
*) The results for UVSRT are the sum of 2 runs, likewise UVDIF 2 runs, SUBIM 2 runs, and COMB 8 runs.
*) Real times are measured to the nearest second.
) The results for SUN 4/75 are for the unoptimized FORTRAN compiler.
*) The ratios quoted are referred to the Convex.

3. Determination of accuracy

SMALL TEST:

	Peak				Rms			
	C210	IBM	4/60	4/75	C210	IBM	4/60	4/75
UVMAP	13.0	13.1	13.3	12.4	18.8	18.2	18.8	17.9
UVBEAM	10.1	10.2	9.9	8.9	16.2	15.8	16.2	15.3
APCLN	18.8	13.6	14.1	14.1	24.1	16.4	20.7	20.7
APRES	16.9	17.0	17.0	17.0	22.2	22.4	22.4	22.3
MXMAP	12.6	12.3	12.9	11.8	18.5	18.1	18.7	17.9
MXBEAM	13.9	11.1	13.7	11.4	19.3	17.7	19.3	17.6
MXCLN	14.8	14.3	14.3	14.3	17.6	17.6	17.6	17.6
VTESS	4.1	4.1	4.1	4.1	10.9	10.9	10.9	10.8

MEDIUM TEST:

	Peak				Rms			
	C210	IBM	4/60	4/75	C210	IBM	4/60	4/75
UVMAP	13.5	12.9	13.5	12.6	17.8	18.0	18.1	17.9
UVBEAM	14.0	13.0	13.9	12.7	17.8	18.3	18.5	18.3
APCLN	17.3	12.0	11.8	11.7	23.7	14.8	14.7	14.7
APRES	15.4	15.4	15.4	15.3	21.2	21.4	21.3	21.3
MXMAP	13.0	13.3	12.6	13.0	17.8	18.0	18.1	17.9
MXBEAM	14.3	13.0	13.9	12.2	17.8	18.4	18.5	18.2
MXCLN	10.3	10.0	10.3	10.3	14.2	14.2	14.2	14.2
VTESS	3.3	3.3	3.3	3.2	10.8	10.8	10.8	10.8