EPCC OpenMP benchmark results

The EPCC OpenMP benchmark suite has been run on a Discover Harpertown node (from 1 to 8 threads, with a 2.5 GHz clock), a Discover woodcrest node (from 1 to 4 threads, with a 2.66 GHz clock), and the new scalemp machine (from 1 to 16 threads, with a 2.8 GHz clock), with and without setting KMP_AFFINITY to recommended values, and then using "numactl --cpunodebind=0 benchmark". Note that the "numactl --cpunodebind=0" forces all threads onto one node, which oversubscribes 16 threads onto 8 CPUs in the 16 thread results, which is not normally done when running real applications. Discover code was compiled with ifort 10, scalemp code was compiled with ifort 11. The results are given below, with all times given in microseconds. The code and scripts used to parse the output are found on Discover in /discover/nobackup/swartzbr/21293/EPCC.

The benchmark is described here:
http://www2.epcc.ed.ac.uk/computing/research_activities/openmpbench/openmp_index.html

Syncbench results:

scalemp: numactl --cpunodebind=0

Nthread	PARALL	DO	PARA_I	BARRIE	SINGLE	CRITCA	LOCK/ UN	ORDER	ATOMIC	REDUC	WORKS	PARALLEL_WORKSH
1	0.30	0.21	0.31	0.19	0.21	0.24	0.23	0.20	0.02	0.33	0.05	0.07
2	1.56	0.62	1.58	0.61	0.58	0.55	0.55	0.36	0.06	1.79	0.59	0.07
4	2.35	0.90	2.40	0.94	0.80	0.62	0.62	0.61	0.10	2.76	0.79	0.10
8	3.39	1.54	3.40	1.52	1.52	0.55	0.56	1.03	0.36	4.23	1.53	0.19
16	35.13	31.70	45.25	31.75	26.46	5.62	5.54	8.11	0.44	34.77	26.54	0.29

scalemp: KMP_AFFINITY=granularity=thread,verbose,compact

Nthread	PARALL	DO	PARA_I	BARRIE	SINGLE	CRITCA	LOCK/ UN	ORDER	ATOMIC	REDUC	WORKS	PARALLEL_WORKSH
1	0.31	0.21	0.32	0.20	0.21	0.24	0.24	0.20	0.02	0.33	0.05	0.06
2	0.75	0.41	0.77	0.39	0.39	0.34	0.34	0.29	0.05	0.84	0.26	0.07
4	1.70	0.61	1.75	0.60	0.59	0.50	0.49	0.59	0.24	2.12	0.55	0.10
8	3.25	1.18	3.30	1.15	1.15	0.56	0.56	0.96	0.37	4.12	1.15	0.17
16	368.15	194.17	363.68	198.31	221.48	28.90	31.88	36.52	0.13	383.53	220.89	0.29

scalemp: KMP_AFFINITY=

Nthread	PARALL	DO	PARA_I	BARRIE	SINGLE	CRITCA	LOCK/ UN	ORDER	ATOMIC	REDUC	WORKS	PARALLEL_WORKSH
1	0.30	0.21	0.32	0.20	0.21	0.24	0.24	0.20	0.02	0.32	0.05	0.06
2	1.59	0.62	1.59	0.61	0.59	0.55	0.55	0.36	0.06	1.78	0.59	0.07
4	2.23	0.85	2.26	0.80	0.83	0.62	0.62	0.62	0.10	2.76	0.85	0.10

8	3.28	1.41	3.33	1.42	1.43	0.56	10.82	26.53	0.18	394.22	352.21	0.16
16	34.71	32.44	389.01	348.75	484.38	27.09	71.03	94.15	0.13	695.99	480.09	0.30

Discover: harp:

Nthread	PARALL	DO	PARA_I	BARRIE	SINGLE	CRITCA	LOCK/ UN	ORDER	ATOMIC	REDUC	WORKS	PARALLEL_WORKSH
1	0.32	0.23	0.34	0.21	0.23	0.26	0.26	0.22	0.02	0.35	0.07	0.07
2	1.02	0.51	1.08	0.48	0.48	0.48	0.48	0.33	0.09	1.28	0.46	0.07
4	1.65	1.01	1.69	0.98	0.95	0.71	0.70	0.72	0.11	2.43	1.00	0.11
8	3.08	1.56	2.99	1.53	1.77	0.67	0.66	1.12	0.13	4.15	1.76	0.19

Discover: wood:

Nthread	PARALL	DO	PARA_I	BARRIE	SINGLE	CRITCA	LOCK/ UN	ORDER	ATOMIC	REDUC	WORKS	PARALLEL_WORKSH
1	0.31	0.22	0.32	0.20	0.21	0.25	0.25	0.21	0.02	0.33	0.06	0.07
2	1.22	0.65	1.24	0.63	0.60	0.63	0.64	0.37	0.07	1.51	0.61	0.07
4	1.32	0.88	1.45	0.86	0.83	0.55	0.56	0.55	0.12	1.72	0.87	0.10

schedbench results:

scalemp: STATIC numactl --cpunodebind=0

Nthread	S1	2	4	8	16	32	64	128
1	4.67	4.67	4.66	4.68	4.66	4.66	4.66	4.66
2	5.44	5.93	5.30	5.26	5.23	5.22	5.22	5.22
4	5.75	6.24	5.63	5.58	5.55	5.52	5.53	5.50
8	6.19	6.84	6.04	5.99	5.96	5.95	5.93	5.96
16	59.23	46.79	51.30	40.92	40.75	60.36	40.69	51.02

scalemp: STATIC KMP_AFFINITY=granularity=thread,verbose,compact

Nthread	S1	2	4	8	16	32	64	128
1	4.70	4.70	4.70	4.70	4.70	4.70	4.70	4.70
2	5.15	5.57	5.01	4.95	4.93	4.91	4.91	4.92
4	5.40	6.06	5.28	5.20	5.18	5.16	5.16	5.17
8	6.02	6.73	5.90	5.82	5.81	5.79	5.78	5.79
16	341.84	344.38	339.77	338.65	343.01	343.28	340.47	336.85

scalemp: STATIC KMP_AFFINITY=

Nthread	S1	2	4	8	16	32	64	128
1	4.75	4.76	4.75	4.76	4.74	4.76	4.75	4.75
2	5.55	5.95	5.41	5.40	5.32	5.31	5.36	5.32
4	5.81	6.32	5.65	5.57	5.56	5.54	5.53	5.53
8	6.39	7.00	6.23	6.20	6.15	6.15	6.13	6.16
16	66.44	198.45	508.79	549.15	560.86	559.19	556.85	565.67

Discover: harp: STATIC

Nthread	S1	2	4	8	16	32	64	128
1	5.64	5.63	5.63	5.63	5.63	5.63	5.63	5.63
2	6.23	6.61	5.95	5.92	5.90	5.90	5.89	5.91
4	6.80	7.37	6.50	6.48	6.54	6.49	6.56	6.56
8	7.54	8.21	7.21	7.23	7.26	7.26	7.23	7.28

Discover: wood: STATIC

Nthread	S1	2	4	8	16	32	64	128
1	4.87	4.87	4.87	4.87	4.87	4.87	4.87	4.87
2	5.80	5.96	5.48	5.43	5.41	5.39	5.38	5.39
4	6.03	6.29	5.72	5.66	5.63	5.61	5.60	5.65

scalemp: DYNAMIC numactl --cpunodebind=0

Nthread	D1	2	4	8	16	32	64	128
1	4.68	4.68	4.68	4.68	4.68	4.68	4.68	4.68
2	22.14	12.90	8.85	7.16	6.32	5.87	5.67	5.56
4	26.57	14.07	9.71	7.76	6.80	6.32	6.08	5.97
8	32.93	20.26	11.54	8.26	7.29	6.83	6.58	6.51
16	104.61	69.11	62.22	45.10	53.71	41.92	51.94	41.25

scalemp: DYNAMIC KMP_AFFINITY=granularity=thread,verbose,compact

Nthread	D1	2	4	8	16	32	64	128
1	4.72	4.72	4.72	4.72	4.72	4.72	4.72	4.72
2	13.37	9.59	7.02	6.03	5.52	5.28	5.15	5.10
4	15.12	10.87	7.77	6.60	6.04	5.74	5.61	5.54
8	32.89	20.23	11.72	8.21	7.24	6.78	6.55	6.45
16	464.42	423.86	415.52	419.57	417.38	412.75	412.47	413.31

scalemp: DYNAMIC KMP_AFFINITY=

Nthread	D1	2	4	8	16	32	64	128
1	4.77	4.77	4.76	4.77	4.77	4.77	4.77	4.77
2	22.44	12.99	9.06	7.31	6.45	6.00	5.77	5.66
4	26.77	14.45	9.91	7.87	6.92	6.39	6.11	6.03
8	33.29	20.55	11.67	8.27	7.39	6.93	6.73	6.62
16	746.57	723.17	718.21	719.59	718.54	724.92	718.86	716.18

Discover: harp: DYNAMIC

Nthread	D1	2	4	8	16	32	64	128
1	5.66	5.66	5.65	5.65	5.65	5.65	5.65	5.65
2	25.88	14.79	10.18	8.20	7.25	6.68	6.42	6.30
4	34.74	16.71	11.32	9.18	8.05	7.50	7.23	7.11
8	45.53	27.80	16.44	10.40	9.16	8.49	8.18	8.07

Discover: wood: DYNAMIC

Nthread	D1	2	4	8	16	32	64	128
1	4.90	4.90	4.89	4.89	4.89	4.89	4.89	4.89
2	21.57	13.36	9.23	7.63	6.51	6.07	5.85	5.74
4	28.43	15.53	9.45	7.65	6.76	6.34	6.10	6.00

scalemp: GUIDED numactl --cpunodebind=0

Nthread	G1	2	4	8	16
1	4.68	4.68	4.68	4.68	4.68
2	13.59	11.76	10.81	9.15	8.01
4	25.02	21.40	18.76	16.20	13.87
8	44.38	37.72	32.83	28.20	23.80
16	131.17	116.19	103.16	93.88	

scalemp: GUIDED KMP_AFFINITY=granularity=thread,verbose,compact

Nthread	G1	2	4	8	16
1	4.72	4.72	4.72	4.74	4.72
2	7.79	6.85	6.56	6.39	5.95
4	20.27	17.43	15.25	13.24	11.29

8	44.31	37.52	32.60	28.09	23.73
16	4012.11	3311.53	2758.85	2291.11	

scalemp: GUIDED KMP_AFFINITY=

Nthread	G1	2	4	8	16
1	4.76	4.77	4.77	4.77	4.77
2	13.99	12.12	11.17	9.38	8.29
4	24.83	21.29	18.40	16.25	14.07
8	1356.90	2413.27	2075.26	1763.39	1430.96
16	1980.00	1647.85	1430.96	1285.51	

Discover: harp: GUIDED

Nthread	G1	2	4	8	16
1	5.65	5.66	5.66	5.66	5.65
2	16.12	14.06	13.05	10.93	9.40
4	28.91	24.65	21.64	18.70	16.24
8	53.29	45.57	39.49	34.57	28.65

Discover: wood: GUIDED

Nthread	G1	2	4	8	16
1	4.89	4.89	4.90	4.89	4.89
2	14.58	12.62	11.61	10.19	8.59
4	22.38	19.32	17.31	14.90	13.04

arraybench results:

scalemp: arraybench (16 threads) numactl --cpunodebind=0

Narray	PRIVATE	FRSTPRV	COPYPRV	COPYIN	REDUCTION
1	53.30	52.89	72.58	94.75	134.39
3	72.60	36.27	59.46	71.85	90.41
9	86.75	86.84	122.32	110.71	129.74
27	58.63	59.56	97.12	98.36	96.83
81	60.83	58.38	84.09	69.85	72.98
243	58.79	59.49	95.80	100.26	125.19
729	46.33	47.81	87.19	72.57	103.75

2187	58.44	47.38	81.10		
6561	59.81	79.01	131.98	116.36	305.03
19683	54.59	99.93	210.66	105.84	762.14
59049	54.17	191.37	468.12	181.16	2276.05

scalemp: arraybench (16 threads) KMP_AFFINITY=granularity=thread,verbose,compact

Narray	PRIVATE	FRSTPRV	COPYPRV	COPYIN	REDUCTION
1	305.15	307.06	668.90	688.96	519.88
3	388.65	388.13	629.69	685.79	611.57
9	303.40	305.79	598.43	687.51	520.06
27	364.90	364.87	705.83	658.23	551.37
81	362.00	390.37	612.09	623.81	604.27
243	377.79	536.69	617.60	673.75	615.91
729	362.85	576.13	617.90	687.86	657.50
2187	378.44	474.42	611.56	796.72	701.49
6561	373.54	411.00	727.90	742.99	1120.08
19683	376.20	371.82	721.48	796.22	2033.89
59049	374.56	468.18	946.87	763.57	

scalemp: arraybench (16 threads) KMP_AFFINITY=

Narray	PRIVATE	FRSTPRV	COPYPRV	COPYIN	REDUCTION
1	45.07	34.23	53.55	67.46	71.66
3	44.34	35.89	52.61	67.73	68.42
9	61.36	60.67	85.39	114.03	118.16
27	41.84	41.46	76.17	70.38	71.32
81	55.11	57.90	108.24	84.37	90.97
243	47.49	42.88	71.96	72.89	88.68
729	42.41	36.13	71.21	67.66	105.16
2187	58.52	57.03	85.94	87.79	159.03
6561	36.62	48.75	104.12	83.96	1045.69
19683	54.15	105.11	189.47	126.85	856.01
59049	52.82	169.46	390.29	183.15	8515.18

Discover: arraybench (8 threads)

Narray	PRIVATE	FRSTPRV	COPYPRV	COPYIN	REDUCTION
1	2.86	3.34	4.02	4.60	4.92
3	2.80	2.81	4.05	4.37	4.84
9	2.60	3.16	3.96	5.34	5.28
27	2.90	3.34	4.76	5.14	6.33
81	2.79	2.85	4.67	4.14	7.70
243	2.72	3.37	9.37	4.80	11.98
729	2.73	3.23	18.35	4.16	26.78
2187	2.70	5.24	41.14	6.11	171.25
6561	2.92	10.26	71.35	12.41	544.56
19683	2.66	24.28	177.82	26.53	478.57
59049	2.89	67.72	523.16	66.63	1488.44

Discover: Woodcrest : arraybench (4 threads)

Narray	PRIVATE	FRSTPRV	COPYPRV	COPYIN	REDUCTION
1	1.70	1.89	1.79	2.29	3.40
3	1.97	1.86	1.84	2.22	3.43
9	1.97	1.87	1.85	2.13	3.59
27	1.82	1.97	2.02	2.34	4.04
81	1.77	1.83	1.83	2.52	5.10
243	2.01	2.01	4.38	2.39	8.03
729	1.77	2.12	1.97	2.72	19.97
2187	1.72	4.06	24.75	4.05	52.18
6561	1.62	8.66	49.72	9.26	79.12
19683	1.71	21.54	139.65	22.12	480.79
59049	1.63	61.66	406.33	60.25	1330.54