


Задание 9

Отчёт

по SUMMA

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1. Постановка задачи

1. Реализовать алгоритм SUMMA, используя процессные топологии
2. Матрицы предполагаем квадратными, $N \times N$, тип данных - INT или FLOAT
3. Каждый процесс хранит в памяти только свою часть матриц A, B, C (+ приходящие данные)
4. Можете выбрать один из двух типов допущений:
 - a. 
 - i. P - полный квадрат, т.е процессная топология - квадрат
 - ii. Протестировать при $P = 1, 4, 9, 16$
 - iii. Программа должна работать при произвольном размере блока b ($b < N/\sqrt{P}$), N/\sqrt{P} делится на b
- b.
 - i. Программа должна работать при произвольной процессной топологии
 - ii. Протестировать при $P = 1-16$
 - iii. $b = 1$
5. На небольших размерах матрицы убедиться, что алгоритм выдаёт верный результат (сравнимый с последовательным ijk)
6. Провести запуски на Polus (mpisubmit.pl), нарисовать $T(P)$, составить небольшой отчёт

2. Формат командной строки

```
pic++ -std=c++11 -g -Wl,-rpath=/home_edu/edu-cmc-sqi22/edu-cmc-sqi22-29/sem07  
mpiP-3.5 -L /home_edu/edu-cmc-sqi22/edu-cmc-sqi22-29/sem07/mpiP-3.5 -lmpiP summa.cpp -o a  
mpisubmit.pl -p P ./a N b
```

3. Спецификация системы

- Operating system : Polus

4. Записи экспериментов и результаты

Все приведенные ниже результаты теста имеют фиксированный размер матрицы $N=960$.

Результатом работы программы является:

Total execution time (T): 7.568879 seconds

Matrix multiplication result is correct!

В следующей таблице собраны результаты экспериментов.

P	b	T
1	1	19.751643
1	2	22.547624
1	4	19.807645
1	8	19.146859
4	2	5.077606
4	4	7.568879
4	8	4.829490
4	2	4.518537
9	2	2.312985
9	4	2.543733
9	8	3.032588
9	2	3.156816
16	2	2.092877
16	4	2.040919
16	8	2.279634
16	2	1.645324

когда P=4,b=2:

Resource usage summary:

CPU time :	95.54 sec.
Max Memory :	287 MB
Average Memory :	229.80 MB
Total Requested Memory :	-
Delta Memory :	-
Max Swap :	-
Max Processes :	8
Max Threads :	21
Run time :	25 sec.

Turnaround time : 26 sec.

The output (if any) follows:

mpiP:

mpiP: mpiP V3.5.0 (Build Nov 6 2024/21:55:54)

mpiP:

Total execution time (T): 7.568879 seconds

Matrix multiplication result is correct!

mpiP:

mpiP: Storing mpiP output in [./a.4.61470.1.mpiP].

mpiP:

PS:

Read file <a.1251099.err> for stderr output of this job.

[edu-cmc-sqi22-29@polus-ib sem09]\$ cat ./a.4.61470.1.mpiP

@ mpiP

@ Command : ./a 960 2

@ Version : 3.5.0

@ MPIP Build date : Nov 6 2024, 21:55:54

@ Start time : 2024 12 05 17:46:14

@ Stop time : 2024 12 05 17:46:38

@ Timer Used : gettimeofday

@ MPIP env var : [null]

@ Collector Rank : 0

@ Collector PID : 61470

@ Final Output Dir : .

@ Report generation : Single collector task

@ MPI Task Assignment : 0 polus-c3-ib.bmc.hpc.cs.msu.ru

@ MPI Task Assignment : 1 polus-c3-ib.bmc.hpc.cs.msu.ru

@ MPI Task Assignment : 2 polus-c3-ib.bmc.hpc.cs.msu.ru

@ MPI Task Assignment : 3 polus-c3-ib.bmc.hpc.cs.msu.ru

@--- MPI Time (seconds) -----

Task	AppTime	MPITime	MPI%
0	23.8	1.53	6.46
1	7.67	1.35	17.55
2	7.67	0.835	10.88
3	7.67	1.25	16.34
*	46.8	4.97	10.62

@--- Callsites: 14 -----

ID	Lev	File/Address	Line	Parent_Funct	MPI_Call
1	0	0x1000000af2ac		[unknown]	Cart_coords
2	0	0x1000000ae17c		[unknown]	Barrier
3	0	0x1000000b1d0c		[unknown]	Comm_split
4	0	0x1000000ae44c		[unknown]	Bcast
5	0	0x1000000b0dbc		[unknown]	Comm_free
6	0	0x1000000b1d0c		[unknown]	Comm_split
7	0	0x1000000b265c		[unknown]	Gather
8	0	0x1000000b0dbc		[unknown]	Comm_free
9	0	0x1000000b0dbc		[unknown]	Comm_free
10	0	0x1000000ae44c		[unknown]	Bcast
11	0	0x1000000af51c		[unknown]	Cart_create
12	0	0x1000000ae44c		[unknown]	Bcast
13	0	0x1000000ae44c		[unknown]	Bcast
14	0	0x1000000af2ac		[unknown]	Cart_coords

@--- Aggregate Time (top twenty, descending, milliseconds) -----

Call	Site	Time	App%	MPI%	Count	COV
Bcast	10	2.72e+03	5.81	54.73	1920	0.35
Bcast	13	1.68e+03	3.59	33.84	1920	1.13
Barrier	2	286	0.61	5.75	4	1.15
Bcast	12	242	0.52	4.88	4	0.66

Gather	7	25.3	0.05	0.51	4	1.84
Cart_create	11	4.12	0.01	0.08	4	0.04
Comm_split	6	3.16	0.01	0.06	4	0.19
Comm_split	3	2.99	0.01	0.06	4	0.36
Bcast	4	2.98	0.01	0.06	4	0.17
Comm_free	9	0.587	0.00	0.01	4	0.38
Comm_free	8	0.278	0.00	0.01	4	0.43
Comm_free	5	0.254	0.00	0.01	4	0.24
Cart_coords	14	0.005	0.00	0.00	4	0.00
Cart_coords	1	0.005	0.00	0.00	4	0.77

@--- Aggregate Sent Message Size (top twenty, descending, bytes) -----

Call	Site	Count	Total	Avrg	Sent%
Bcast	4	4	1.47e+07	3.69e+06	30.77
Bcast	12	4	1.47e+07	3.69e+06	30.77
Bcast	10	1920	7.37e+06	3.84e+03	15.38
Bcast	13	1920	7.37e+06	3.84e+03	15.38
Gather	7	4	3.69e+06	9.22e+05	7.69

@--- Callsite Time statistics (all, milliseconds): 53 -----

Name	Site	Rank	Count	Max	Mean	Min	App%	MPI%
Barrier	2	0	1	0.012	0.012	0.012	0.00	0.00
Barrier	2	1	1	0.293	0.293	0.293	0.00	0.02
Barrier	2	2	1	143	143	143	1.86	17.11
Barrier	2	3	1	143	143	143	1.86	11.37
Barrier	2	*	4	143	71.4	0.012	0.61	5.75
Bcast	4	0	1	0.662	0.662	0.662	0.00	0.04
Bcast	4	1	1	0.935	0.935	0.935	0.01	0.07
Bcast	4	2	1	0.715	0.715	0.715	0.01	0.09
Bcast	4	3	1	0.668	0.668	0.668	0.01	0.05
Bcast	4	*	4	0.935	0.745	0.662	0.01	0.06
Bcast	10	0	480	230	0.977	0	1.97	30.58

Bcast	10	1	480	546	1.52	0	9.52	54.26
Bcast	10	2	480	403	1.09	0	6.82	62.71
Bcast	10	3	480	585	2.08	0	12.99	79.48
Bcast	10	*	1920	585	1.42	0	5.81	54.73

Bcast	12	0	1	0.813	0.813	0.813	0.00	0.05
Bcast	12	1	1	80.8	80.8	80.8	1.05	6.00
Bcast	12	2	1	80.5	80.5	80.5	1.05	9.65
Bcast	12	3	1	80.1	80.1	80.1	1.04	6.39
Bcast	12	*	4	80.8	60.6	0.813	0.52	4.88

Bcast	13	0	480	395	2.21	0	4.46	69.10
Bcast	13	1	480	192	1.06	0	6.61	37.68
Bcast	13	2	480	28.7	0.175	0	1.09	10.05
Bcast	13	3	480	28.7	0.0634	0	0.40	2.43
Bcast	13	*	1920	395	0.876	0	3.59	33.84

Cart_coords	1	0	1	0.001	0.001	0.001	0.00	0.00
Cart_coords	1	1	1	0.002	0.002	0.002	0.00	0.00
Cart_coords	1	2	1	0	0	0	0.00	0.00
Cart_coords	1	3	1	0.002	0.002	0.002	0.00	0.00
Cart_coords	1	*	4	0.002	0.00125	0	0.00	0.00

Cart_coords	14	0	4	0.002	0.00125	0.001	0.00	0.00
Cart_coords	14	*	4	0.002	0.00125	0.001	0.00	0.00

Cart_create	11	0	1	1.04	1.04	1.04	0.00	0.07
Cart_create	11	1	1	1	1	1	0.01	0.07
Cart_create	11	2	1	1.09	1.09	1.09	0.01	0.13
Cart_create	11	3	1	0.997	0.997	0.997	0.01	0.08
Cart_create	11	*	4	1.09	1.03	0.997	0.01	0.08

Comm_free	5	0	1	0.073	0.073	0.073	0.00	0.00
Comm_free	5	1	1	0.079	0.079	0.079	0.00	0.01
Comm_free	5	2	1	0.045	0.045	0.045	0.00	0.01
Comm_free	5	3	1	0.057	0.057	0.057	0.00	0.00

Comm_free	5	*	4	0.079	0.0635	0.045	0.00	0.01
Comm_free	8	0	1	0.072	0.072	0.072	0.00	0.00
Comm_free	8	1	1	0.058	0.058	0.058	0.00	0.00
Comm_free	8	2	1	0.039	0.039	0.039	0.00	0.00
Comm_free	8	3	1	0.109	0.109	0.109	0.00	0.01
Comm_free	8	*	4	0.109	0.0695	0.039	0.00	0.01
Comm_free	9	0	1	0.206	0.206	0.206	0.00	0.01
Comm_free	9	1	1	0.112	0.112	0.112	0.00	0.01
Comm_free	9	2	1	0.088	0.088	0.088	0.00	0.01
Comm_free	9	3	1	0.181	0.181	0.181	0.00	0.01
Comm_free	9	*	4	0.206	0.147	0.088	0.00	0.01
Comm_split	3	0	1	0.914	0.914	0.914	0.00	0.06
Comm_split	3	1	1	0.519	0.519	0.519	0.01	0.04
Comm_split	3	2	1	1.04	1.04	1.04	0.01	0.12
Comm_split	3	3	1	0.519	0.519	0.519	0.01	0.04
Comm_split	3	*	4	1.04	0.747	0.519	0.01	0.06
Comm_split	6	0	1	0.679	0.679	0.679	0.00	0.04
Comm_split	6	1	1	0.923	0.923	0.923	0.01	0.07
Comm_split	6	2	1	0.639	0.639	0.639	0.01	0.08
Comm_split	6	3	1	0.923	0.923	0.923	0.01	0.07
Comm_split	6	*	4	0.923	0.791	0.639	0.01	0.06
Gather	7	0	1	0.523	0.523	0.523	0.00	0.03
Gather	7	1	1	23.8	23.8	23.8	0.31	1.77
Gather	7	2	1	0.393	0.393	0.393	0.01	0.05
Gather	7	3	1	0.652	0.652	0.652	0.01	0.05
Gather	7	*	4	23.8	6.34	0.393	0.05	0.51

@--- Callsite Message Sent statistics (all, sent bytes) -----

Name	Site	Rank	Count	Max	Mean	Min	Sum
Bcast	4	0	1	3.686e+06	3.686e+06	3.686e+06	3.686e+06

Bcast	4	1	1	3.686e+06	3.686e+06	3.686e+06	3.686e+06
Bcast	4	2	1	3.686e+06	3.686e+06	3.686e+06	3.686e+06
Bcast	4	3	1	3.686e+06	3.686e+06	3.686e+06	3.686e+06
Bcast	4	*	4	3.686e+06	3.686e+06	3.686e+06	1.475e+07

Bcast	10	0	480	3840	3840	3840	1.843e+06
Bcast	10	1	480	3840	3840	3840	1.843e+06
Bcast	10	2	480	3840	3840	3840	1.843e+06
Bcast	10	3	480	3840	3840	3840	1.843e+06
Bcast	10	*	1920	3840	3840	3840	7.373e+06

Bcast	12	0	1	3.686e+06	3.686e+06	3.686e+06	3.686e+06
Bcast	12	1	1	3.686e+06	3.686e+06	3.686e+06	3.686e+06
Bcast	12	2	1	3.686e+06	3.686e+06	3.686e+06	3.686e+06
Bcast	12	3	1	3.686e+06	3.686e+06	3.686e+06	3.686e+06
Bcast	12	*	4	3.686e+06	3.686e+06	3.686e+06	1.475e+07

Bcast	13	0	480	3840	3840	3840	1.843e+06
Bcast	13	1	480	3840	3840	3840	1.843e+06
Bcast	13	2	480	3840	3840	3840	1.843e+06
Bcast	13	3	480	3840	3840	3840	1.843e+06
Bcast	13	*	1920	3840	3840	3840	7.373e+06

Gather	7	0	1	9.216e+05	9.216e+05	9.216e+05	9.216e+05
Gather	7	1	1	9.216e+05	9.216e+05	9.216e+05	9.216e+05
Gather	7	2	1	9.216e+05	9.216e+05	9.216e+05	9.216e+05
Gather	7	3	1	9.216e+05	9.216e+05	9.216e+05	9.216e+05
Gather	7	*	4	9.216e+05	9.216e+05	9.216e+05	3.686e+06

@--- End of Report -----

5. Заключение

