

Project 2

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Problem Definition

Implement PushSum and Gossip Protocols for the following topologies:

- Line
- Full
- 2D
- Imp3D

Input

The input provided is of the form: `pushsumgossip:main(numNodes, topology, algorithm)`. Where `numNodes` is the number of actors involved (for 2D based topologies you can round up until you get a square), `Topology` is full, 2D, line, imp3D and `algorithm` is gossip, push-sum.

Working

We managed to run Gossip protocol and the pushsum protocol for all the topologies mentioned. Attaching all 8 runtimes for upto 100000 nodes

```
[ru5hl1@f3d0ra Erlang]$ erl
Erlang/OTP 24 [erts-12.3.2.4] [source] [64-bit] [smp:8:8] [ds:8:8:10] [async-threads:1] [jit]

Eshell V12.3.2.4 (abort with ^G)
1> pushsumgossip:main(1000, 'line', 'gossip').
Time taken: 64 ms.
finished
2> pushsumgossip:main(10000, 'line', 'gossip').
Time taken: 617 ms.
finished
3> pushsumgossip:main(20000, 'line', 'gossip').
Time taken: 2126 ms.
finished
4> pushsumgossip:main(30000, 'line', 'gossip').
Time taken: 2955 ms.
finished
5> pushsumgossip:main(40000, 'line', 'gossip').
Time taken: 3585 ms.
finished
6> pushsumgossip:main(50000, 'line', 'gossip').
Time taken: 4508 ms.
finished
7> pushsumgossip:main(60000, 'line', 'gossip').
Time taken: 5329 ms.
finished
8> pushsumgossip:main(70000, 'line', 'gossip').
Time taken: 6355 ms.
finished
9> pushsumgossip:main(80000, 'line', 'gossip').
Time taken: 6765 ms.
finished
10> pushsumgossip:main(90000, 'line', 'gossip').
Time taken: 9194 ms.
finished
11> pushsumgossip:main(100000, 'line', 'gossip').
Time taken: 11679 ms.
finished
12> █
```

```
[ru5hl1@f3d0ra Erlang]$ erl
Erlang/OTP 24 [erts-12.3.2.4] [source] [64-bit] [smp:8:8] [ds:8:8:10] [async-threads:1] [jit]

Eshell V12.3.2.4 (abort with ^G)
1> pushsumgossip:main(1000, 'full', 'gossip').
Time taken: 89 ms.
finished
2> pushsumgossip:main(10000, 'full', 'gossip').
Time taken: 787 ms.
finished
3> pushsumgossip:main(20000, 'full', 'gossip').
Time taken: 1495 ms.
finished
4> pushsumgossip:main(30000, 'full', 'gossip').
Time taken: 3035 ms.
finished
5> pushsumgossip:main(40000, 'full', 'gossip').
Time taken: 3948 ms.
finished
6> pushsumgossip:main(50000, 'full', 'gossip').
Time taken: 5970 ms.
finished
7> pushsumgossip:main(60000, 'full', 'gossip').
Time taken: 6611 ms.
finished
8> pushsumgossip:main(70000, 'full', 'gossip').
Time taken: 7355 ms.
finished
9> pushsumgossip:main(80000, 'full', 'gossip').
Time taken: 8099 ms.
finished
10> pushsumgossip:main(90000, 'full', 'gossip').
Time taken: 9194 ms.
finished
11> pushsumgossip:main(100000, 'full', 'gossip').
Time taken: 11679 ms.
finished
12> █
```

```
/> pushsumgossip:main(60000, 'full', 'gossip').
Time taken: 9407 ms.
finished
8> pushsumgossip:main(70000, 'full', 'gossip').
Time taken: 6404 ms.
finished
9> pushsumgossip:main(80000, 'full', 'gossip').
Time taken: 8452 ms.
finished
10> pushsumgossip:main(90000, 'full', 'gossip').
Time taken: 115981 ms.
finished
11> pushsumgossip:main(100000, 'full', 'gossip').
Time taken: 9946 ms.
finished
12> █
```

```
[ru5h1l@f3d0ra Erlang]$ erl
Erlang/OTP 24 [erts-12.3.2.4] [source] [64-bit] [smp:8:8] [ds:8:8:10] [async-threads:1] [jit]

Eshell V12.3.2.4 (abort with ^G)
1> pushsumgossip:main(1000, '2D', 'gossip').
Time taken: 142 ms.
finished
2> pushsumgossip:main(10000, '2D', 'gossip').
Time taken: 1070 ms.
finished
3> pushsumgossip:main(20000, '2D', 'gossip').
Time taken: 2119 ms.
finished
4> pushsumgossip:main(30000, '2D', 'gossip').
Time taken: 3262 ms.
finished
5> pushsumgossip:main(40000, '2D', 'gossip').
Time taken: 4063 ms.
finished
6> pushsumgossip:main(50000, '2D', 'gossip').
Time taken: 5516 ms.
finished
7> pushsumgossip:main(60000, '2D', 'gossip').
Time taken: 6735 ms.
finished
8> pushsumgossip:main(70000, '2D', 'gossip').
Time taken: 6011 ms.
finished
9> pushsumgossip:main(80000, '2D', 'gossip').
Time taken: 8356 ms.
finished
10> pushsumgossip:main(90000, '2D', 'gossip').
Time taken: 8737 ms.
finished
11> pushsumgossip:main(100000, '2D', 'gossip').
Time taken: 10739 ms.
finished
12>
```

```
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Erlang/OTP 24 [erts-12.3.2.4] [source] [64-bit] [smp:8:8] [ds:8:8:10] [async-threads:1] [jit]

Eshell V12.3.2.4 (abort with ^G)
1> pushsumgossip:main(1000, 'imp3D', 'gossip').
Time taken: 96 ms.
finished
2> pushsumgossip:main(10000, 'imp3D', 'gossip').
Time taken: 810 ms.
finished
3> pushsumgossip:main(20000, 'imp3D', 'gossip').
Time taken: 1499 ms.
finished
4> pushsumgossip:main(30000, 'imp3D', 'gossip').
Time taken: 2630 ms.
finished
5> pushsumgossip:main(40000, 'imp3D', 'gossip').
Time taken: 4268 ms.
finished
6> pushsumgossip:main(50000, 'imp3D', 'gossip').
Time taken: 5371 ms.
finished
7> pushsumgossip:main(60000, 'imp3D', 'gossip').
Time taken: 7494 ms.
finished
8> pushsumgossip:main(70000, 'imp3D', 'gossip').
Time taken: 7032 ms.
finished
9> pushsumgossip:main(80000, 'imp3D', 'gossip').
Time taken: 9159 ms.
finished
10> pushsumgossip:main(90000, 'imp3D', 'gossip').
Time taken: 8897 ms.
finished
11> pushsumgossip:main(100000, 'imp3D', 'gossip').
Time taken: 11745 ms.
finished
12> █
```

```
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Erlang/OTP 24 [erts-12.3.2.4] [source] [64-bit] [smp:8:8] [ds:8:8:10] [async-threads:1] [jit]

Eshell V12.3.2.4 (abort with ^G)
1> pushsumgossip:main(1000, 'full', 'push-sum').
Time taken: 61 ms.
finished
2> pushsumgossip:main(10000, 'full', 'push-sum').
Time taken: 1112 ms.
finished
3> pushsumgossip:main(20000, 'full', 'push-sum').
Time taken: 2095 ms.
finished
4> pushsumgossip:main(30000, 'full', 'push-sum').
Time taken: 3429 ms.
finished
5> pushsumgossip:main(40000, 'full', 'push-sum').
Time taken: 3926 ms.
finished
6> pushsumgossip:main(50000, 'full', 'push-sum').
Time taken: 5213 ms.
finished
7> pushsumgossip:main(60000, 'full', 'push-sum').
Time taken: 6256 ms.
finished
8> pushsumgossip:main(70000, 'full', 'push-sum').
Time taken: 7651 ms.
finished
9> pushsumgossip:main(80000, 'full', 'push-sum').
Time taken: 8185 ms.
finished
10> pushsumgossip:main(90000, 'full', 'push-sum').
Time taken: 12373 ms.
finished
11> pushsumgossip:main(100000, 'full', 'push-sum').
Time taken: 8706 ms.
finished
12> █
```

```
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Erlang/OTP 24 [erts-12.3.2.4] [source] [64-bit] [smp:8:8] [ds:8:8:10] [async-threads:1] [jit]

Eshell V12.3.2.4 (abort with ^G)
1> pushsumgossip:main(1000, 'line', 'push-sum').
Time taken: 72 ms.
finished
2> pushsumgossip:main(10000, 'line', 'push-sum').
Time taken: 997 ms.
finished
3> pushsumgossip:main(20000, 'line', 'push-sum').
Time taken: 2074 ms.
finished
4> pushsumgossip:main(30000, 'line', 'push-sum').
Time taken: 3001 ms.
finished
5> pushsumgossip:main(40000, 'line', 'push-sum').
Time taken: 4062 ms.
finished
6> pushsumgossip:main(50000, 'line', 'push-sum').
Time taken: 5427 ms.
finished
7> pushsumgossip:main(60000, 'line', 'push-sum').
Time taken: 6424 ms.
finished
8> pushsumgossip:main(70000, 'line', 'push-sum').
Time taken: 7561 ms.
finished
9> pushsumgossip:main(80000, 'line', 'push-sum').
Time taken: 8821 ms.
finished
10> pushsumgossip:main(90000, 'line', 'push-sum').
Time taken: 10561 ms.
finished
11> pushsumgossip:main(100000, 'line', 'push-sum').
Time taken: 9741 ms.
finished
12> █
```

```
[ru5hl1@f3d0ra Erlang]$ erl
Erlang/OTP 24 [erts-12.3.2.4] [source] [64-bit] [smp:8:8] [ds:8:8:10] [async-threads:1] [jit]

Eshell V12.3.2.4 (abort with ^G)
1> pushsumgossip:main(1000, '2D', 'push-sum').
Time taken: 57 ms.
finished
2> pushsumgossip:main(10000, '2D', 'push-sum').
Time taken: 824 ms.
finished
3> pushsumgossip:main(20000, '2D', 'push-sum').
Time taken: 2084 ms.
finished
4> pushsumgossip:main(30000, '2D', 'push-sum').
Time taken: 3233 ms.
finished
5> pushsumgossip:main(40000, '2D', 'push-sum').
Time taken: 3392 ms.
finished
6> pushsumgossip:main(50000, '2D', 'push-sum').
Time taken: 4936 ms.
finished
7> pushsumgossip:main(60000, '2D', 'push-sum').
Time taken: 5544 ms.
finished
8> pushsumgossip:main(70000, '2D', 'push-sum').
Time taken: 6622 ms.
finished
9> pushsumgossip:main(80000, '2D', 'push-sum').
Time taken: 8176 ms.
finished
10> pushsumgossip:main(90000, '2D', 'push-sum').
Time taken: 10436 ms.
finished
11> pushsumgossip:main(100000, '2D', 'push-sum').
Time taken: 9703 ms.
finished
12>
```

```
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Erlang/OTP 24 [erts-12.3.2.4] [source] [64-bit] [smp:8:8] [ds:8:8:10] [async-threads:1] [jit]

Eshell V12.3.2.4 (abort with ^G)
1> pushsumgossip:main(1000, 'imp3D', 'push-sum').
Time taken: 114 ms.
finished
2> pushsumgossip:main(10000, 'imp3D', 'push-sum').
Time taken: 682 ms.
finished
3> pushsumgossip:main(20000, 'imp3D', 'push-sum').
Time taken: 1635 ms.
finished
4> pushsumgossip:main(30000, 'imp3D', 'push-sum').
Time taken: 2803 ms.
finished
5> pushsumgossip:main(40000, 'imp3D', 'push-sum').
Time taken: 3429 ms.
finished
6> pushsumgossip:main(50000, 'imp3D', 'push-sum').
Time taken: 5240 ms.
finished
7> pushsumgossip:main(60000, 'imp3D', 'push-sum').
Time taken: 5469 ms.
finished
8> pushsumgossip:main(70000, 'imp3D', 'push-sum').
Time taken: 7584 ms.
finished
9> pushsumgossip:main(80000, 'imp3D', 'push-sum').
Time taken: 8971 ms.
finished
10> pushsumgossip:main(90000, 'imp3D', 'push-sum').
Time taken: 9343 ms.
finished
11> pushsumgossip:main(100000, 'imp3D', 'push-sum').
Time taken: 11745 ms.
finished
12> █
```

If we have n nodes, the time taken for the protocol to complete should be $n/10$ ms, which matches in the majority of the cases.

Graphs

