Parallel & Distributed Computing
Lecture Week 4
Amdahl's Law

Farhad M. Riaz

Farhad.Muhammad@numl.edu.pk

Department of Computer Science
NUML, Islamabad

Amdahl's Law

- Theoretical speedup calculations

$$S_{\text{latency}}(s) = \frac{1}{(1-p) + \frac{p}{s}}$$

where

S_{latency} is the theoretical speedup of the execution of the whole task;

s is the speedup of the part of the task that benefits from improved system resources;

p is the proportion of execution time that the part benefiting from improved resources originally occupied.

Example 1

- If 30% of the execution time may be the subject of a speedup, *p* will be 0.3; if the improvement makes the affected part twice as fast, *s* will be 2. Amdahl's law states that the overall speedup of applying the improvement will be?

Example 2

- Assume that we are given a serial task which is split into four consecutive parts, whose percentages of execution time are $p1 = 0.11$, $p2 = 0.18$, $p3 = 0.23$, and $p4 = 0.48$ respectively. Then we are told that the 1st part is not sped up, so $s1 = 1$, while the 2nd part is sped up 5 times, so $s2 = 5$, the 3rd part is sped up 20 times, so $s3 = 20$, and the 4th part is sped up 1.6 times, so $s4 = 1.6$. By using Amdahl's law, the overall speedup is?

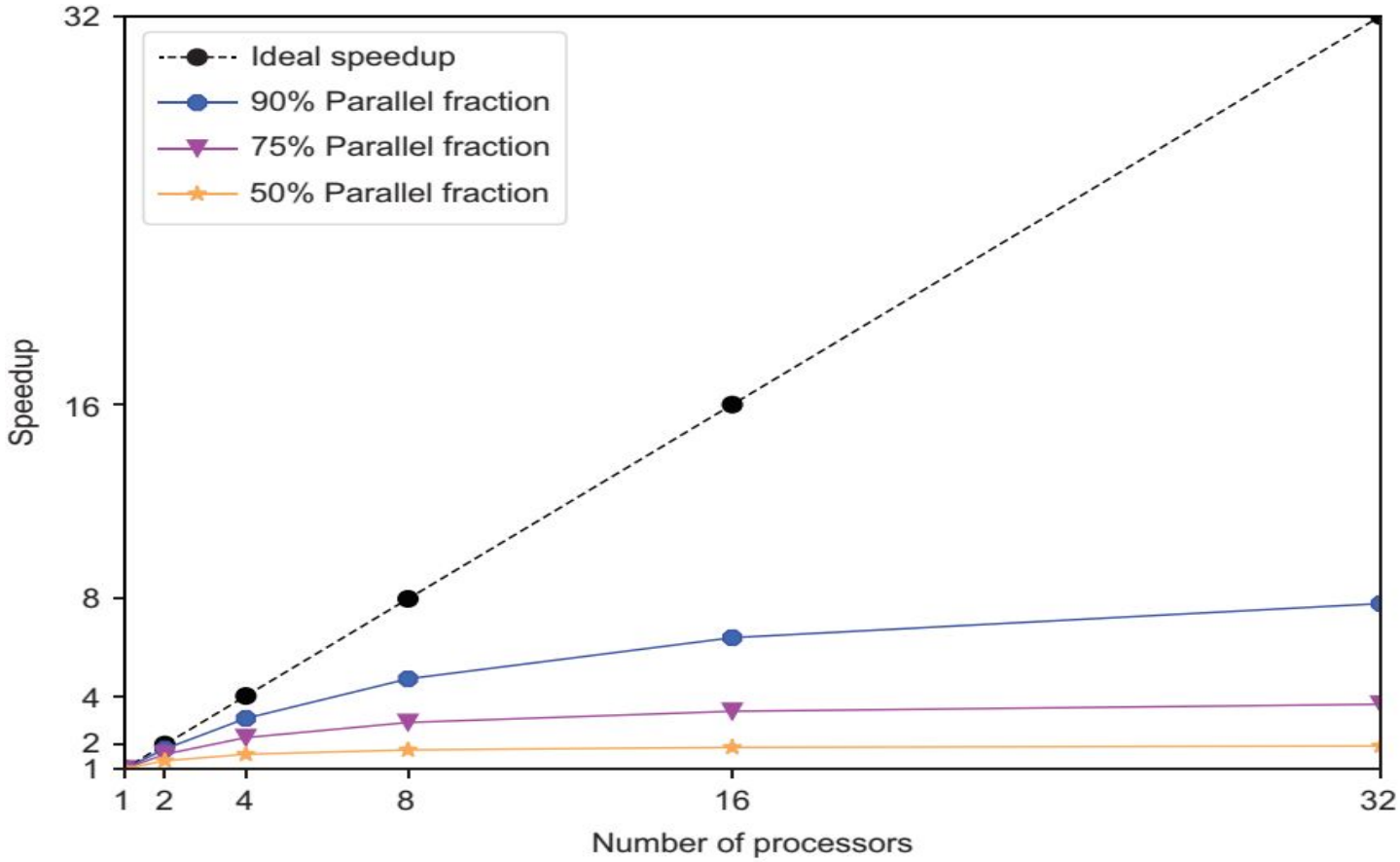
Amdahl's Law

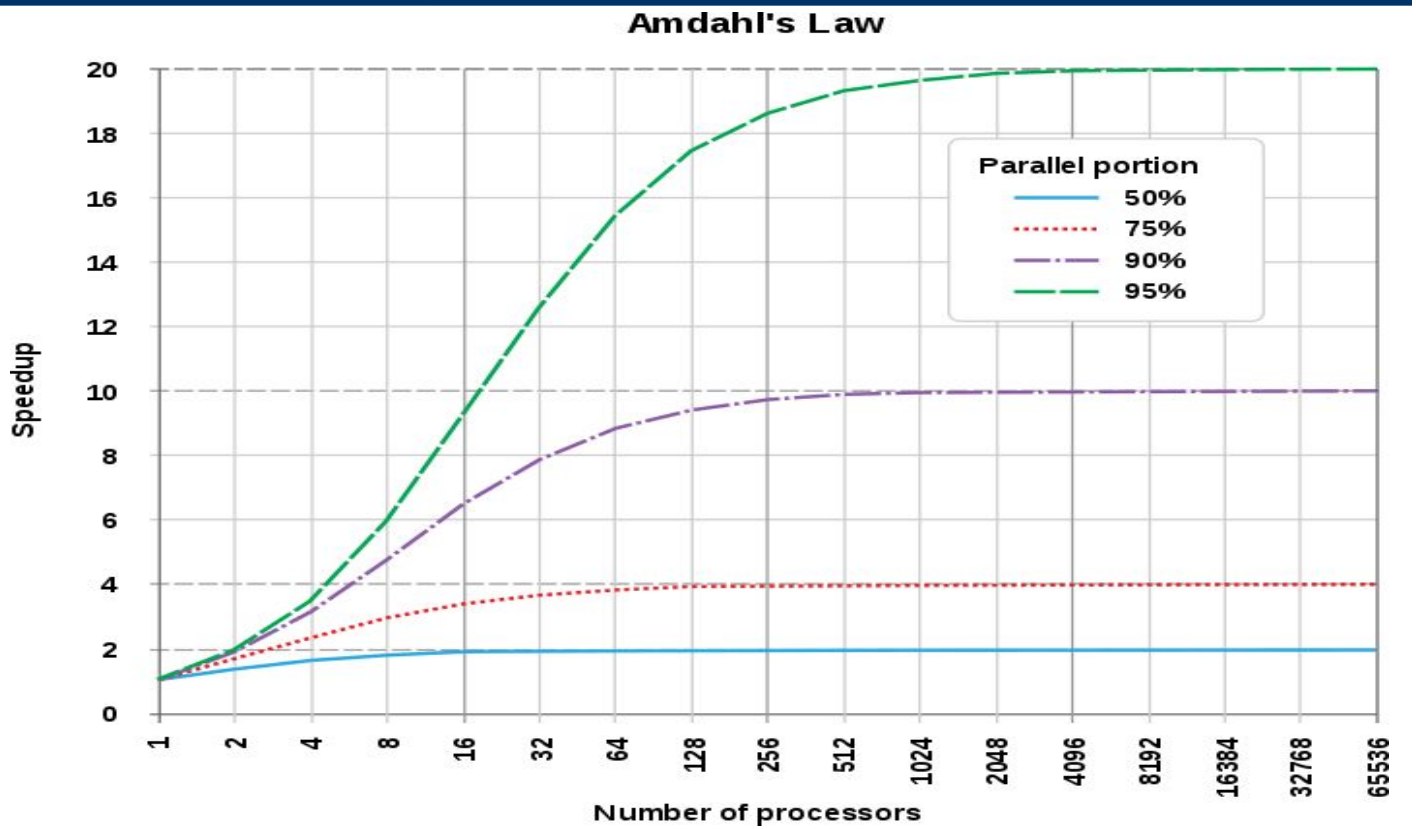
Two independent parts A B

Original process

Make B 5x faster

Make A 2x faster


Ideal speedup
90% Parallel fraction
75% Parallel fraction
50% Parallel fraction
Speedup
32
16
8
4
2
1
1
2
4
8
16
32
Number of processors


Amdahl's Law
Speedup
Number of processors
Parallel portion
50%
75%
90%
95%
0
2
4
6
8
10
12
14
16
18
20
1
2
4
8
16
32
64
128
256
512
1024
2048
4096
8192
16384
32768
65536