1 Principles for Parallel Algorithm Design

Partition: It is of two types

- Domain Decomposition
- Functional Decomposition

Communication: Two types of Communication exists

- Global
- Local

Agglomeration: Depends on Data locality

Mapping: The main objectives in this phase are

- Minimizing communication
- Enabling Concurrency by assigning tasks
- Balance Work Load between processors

2 Runtime of a sequential program (T)

T(1) = T_{serial} + $T_{parallel}$ for 1 processors

T(P) = T_{serial} + $\frac{T_{parallel}}{P}$ for 'P' processors

where
T_{serial} = program does not benefit from parallelization
$T_{parallel}$ = program that benefits from parallelization

3 Speedup & its laws

3.1 Speedup

$$Speedup = \frac{Sequential}{Parallel}$$
$$= \frac{T(1)}{T(P)}$$

Here $T_{serial} \& T_{parallel} are absolute runtimes Let convert them to fractions of the T(1) i.e T_{parallel} = f * T(1) \& T_{serial} = (1 - f) * T(1)$

4 Isoefficiency

Let
W $\rightarrow$ problem size,
$T_0 \rightarrow$ parallel overhead
$T_1 \rightarrow$ W*t_c
where t_c = time taken for computation (or) cost of executing each operation

Total execution time spent by 'P' processors

$$P * T_{parallel} = T_1 + T_0$$
$$T_{parallel} = \frac{T_1 + T_0}{P}$$

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