

Introduction to HPC II

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CINECA



IT4INNOVATIONS
NATIONAL SUPERCOMPUTING
CENTER



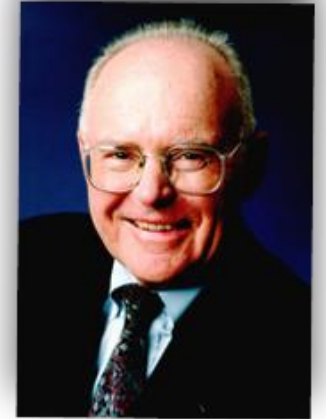
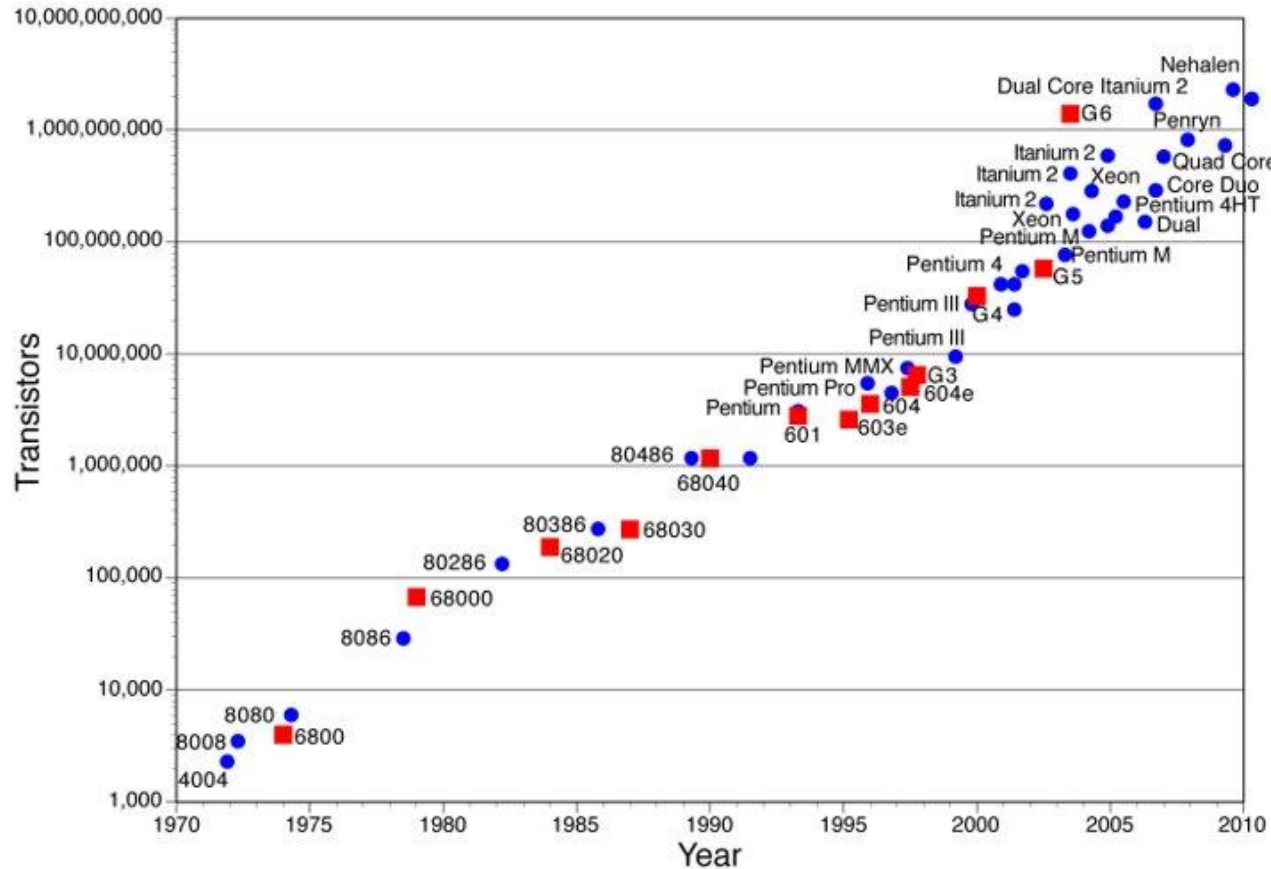
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HPC laws





Moore's law

«The number of transistors per processor will double every year and the speed will double every 18 months»

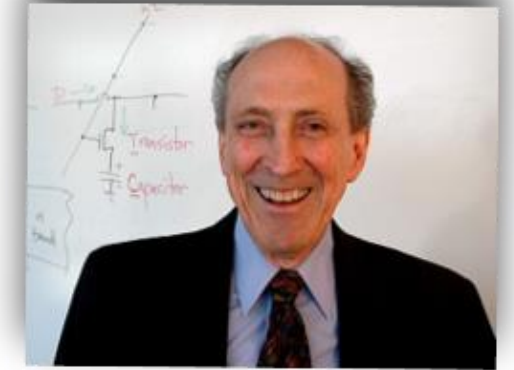
$\text{CPU}_{\text{now}} \longrightarrow \text{CPU}_{\text{next}}$

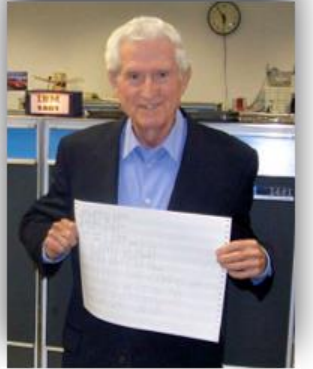
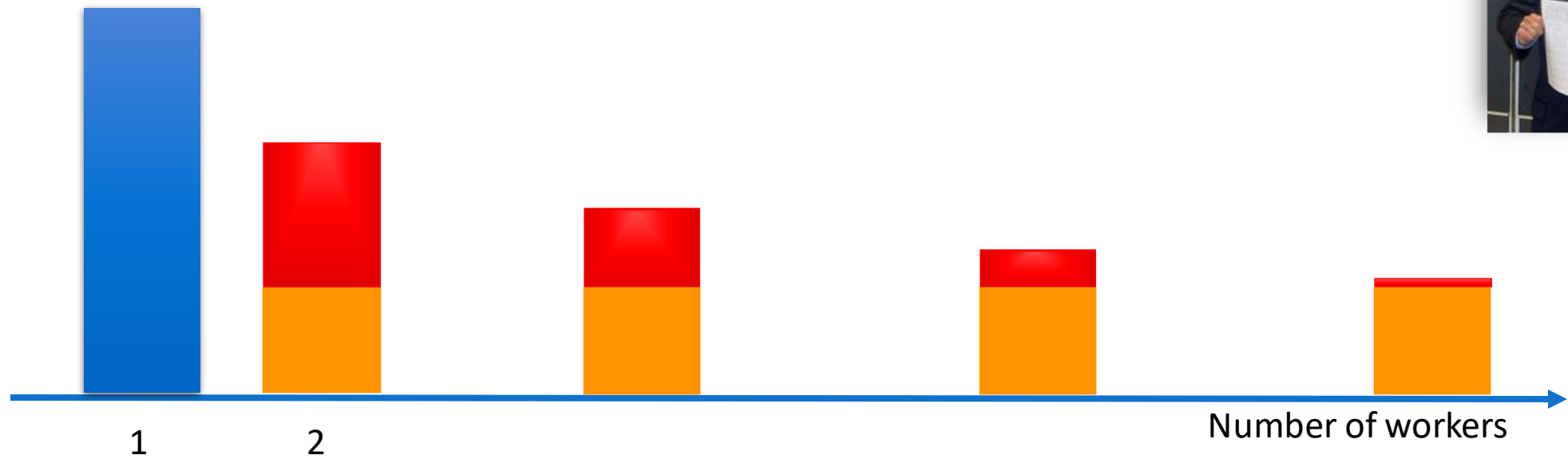
Ideal:

$$L(\text{next}) = L/2 \quad V(\text{next}) = V/2 \quad F(\text{next}) = F*2 \quad P(\text{next}) = P$$

Real:

$$L(\text{next}) = L/2 \quad V(\text{next}) = \sim V \quad F(\text{next}) = F*2 \quad P(\text{next}) = 4*P$$



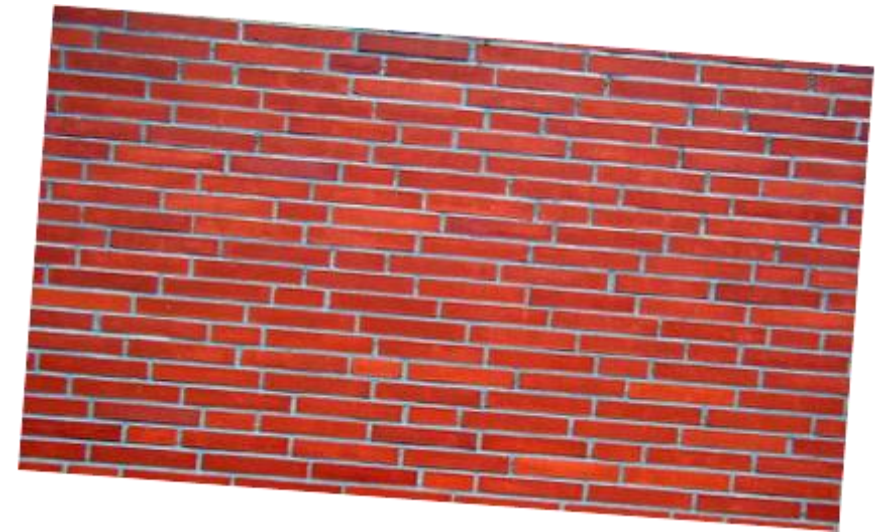


$$T_{//} = T_s [(1-P) + (P/N)]$$

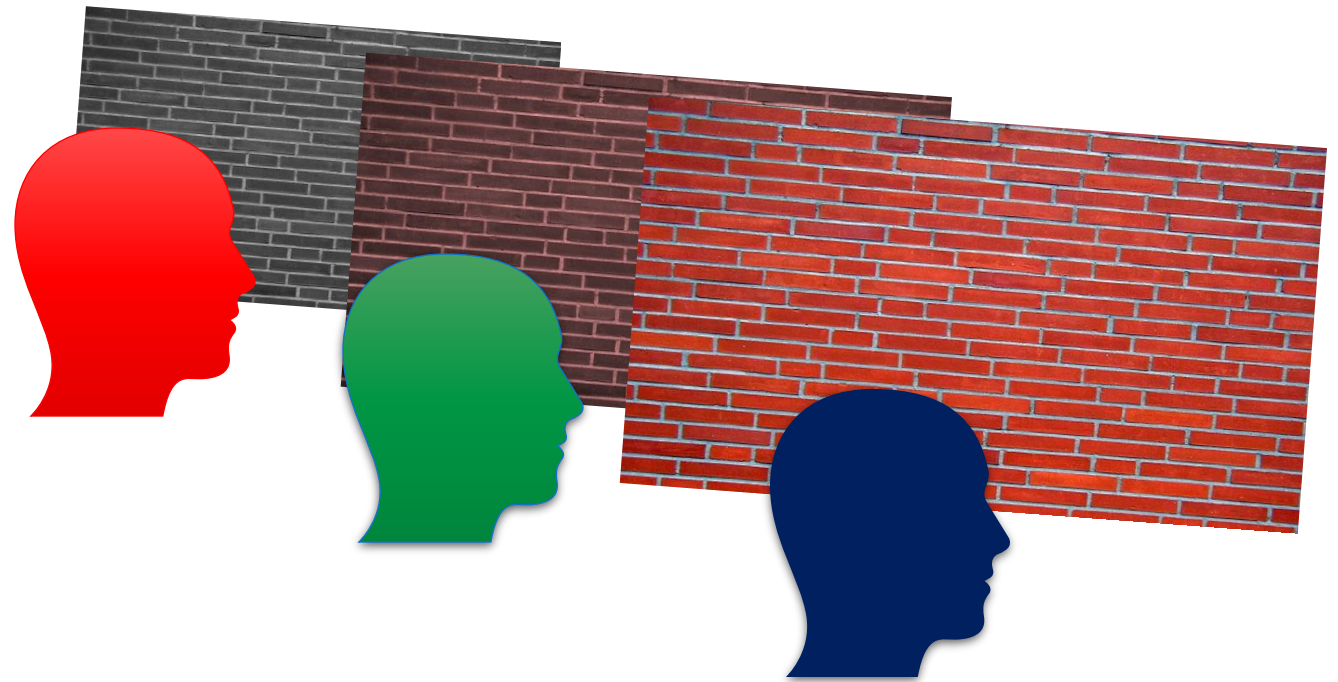
Parallelism



How to build a wall?



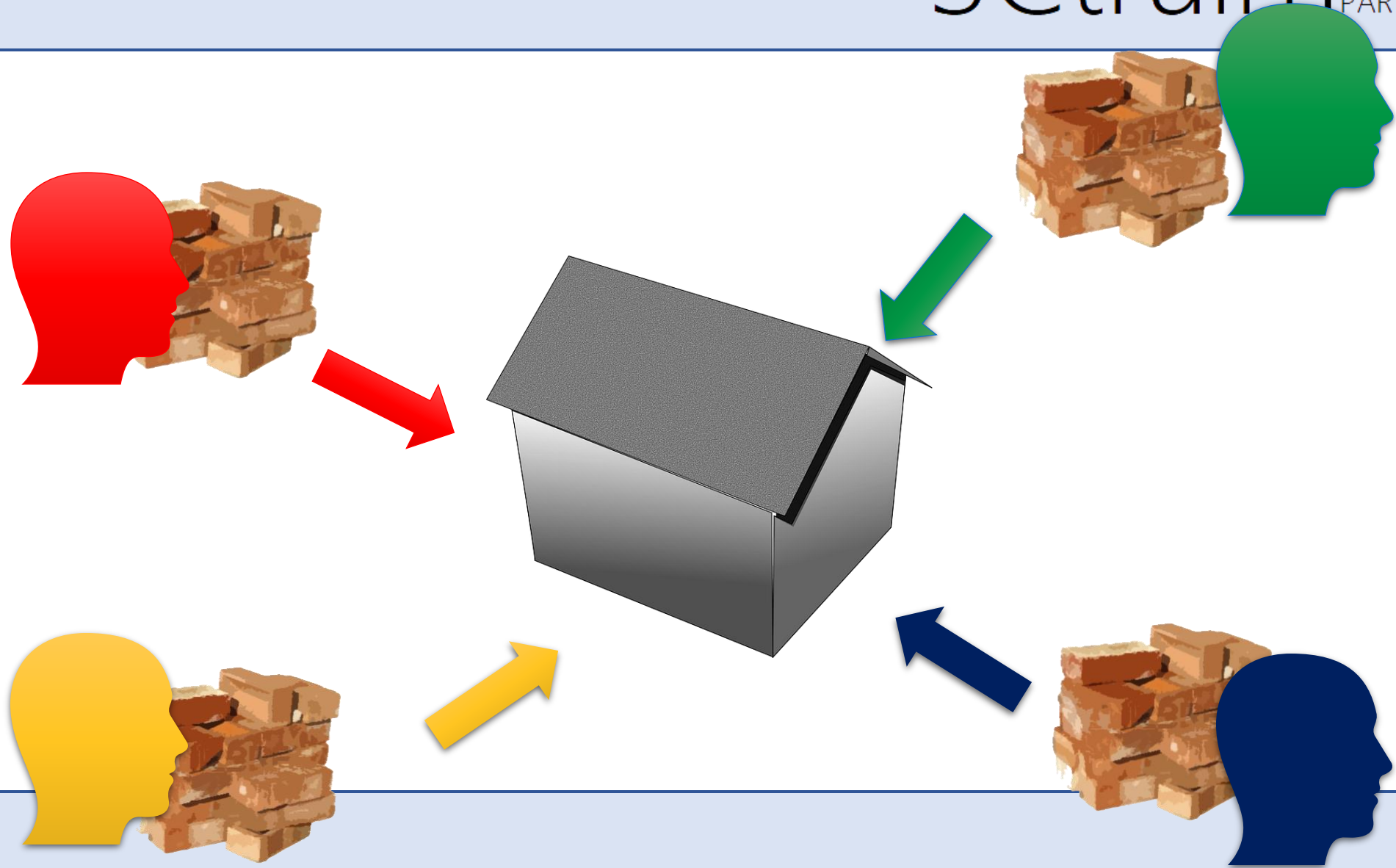
How to build a wall?



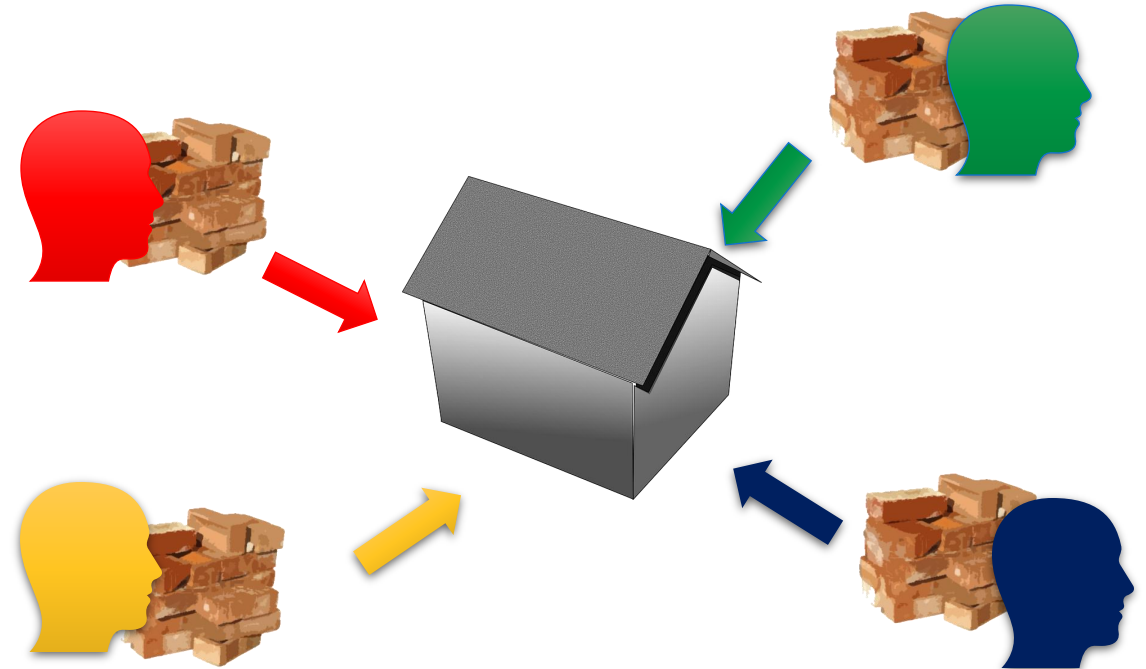
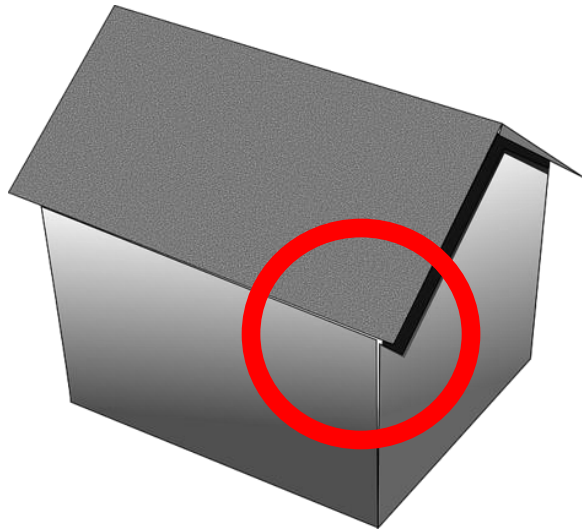
How to build a house?

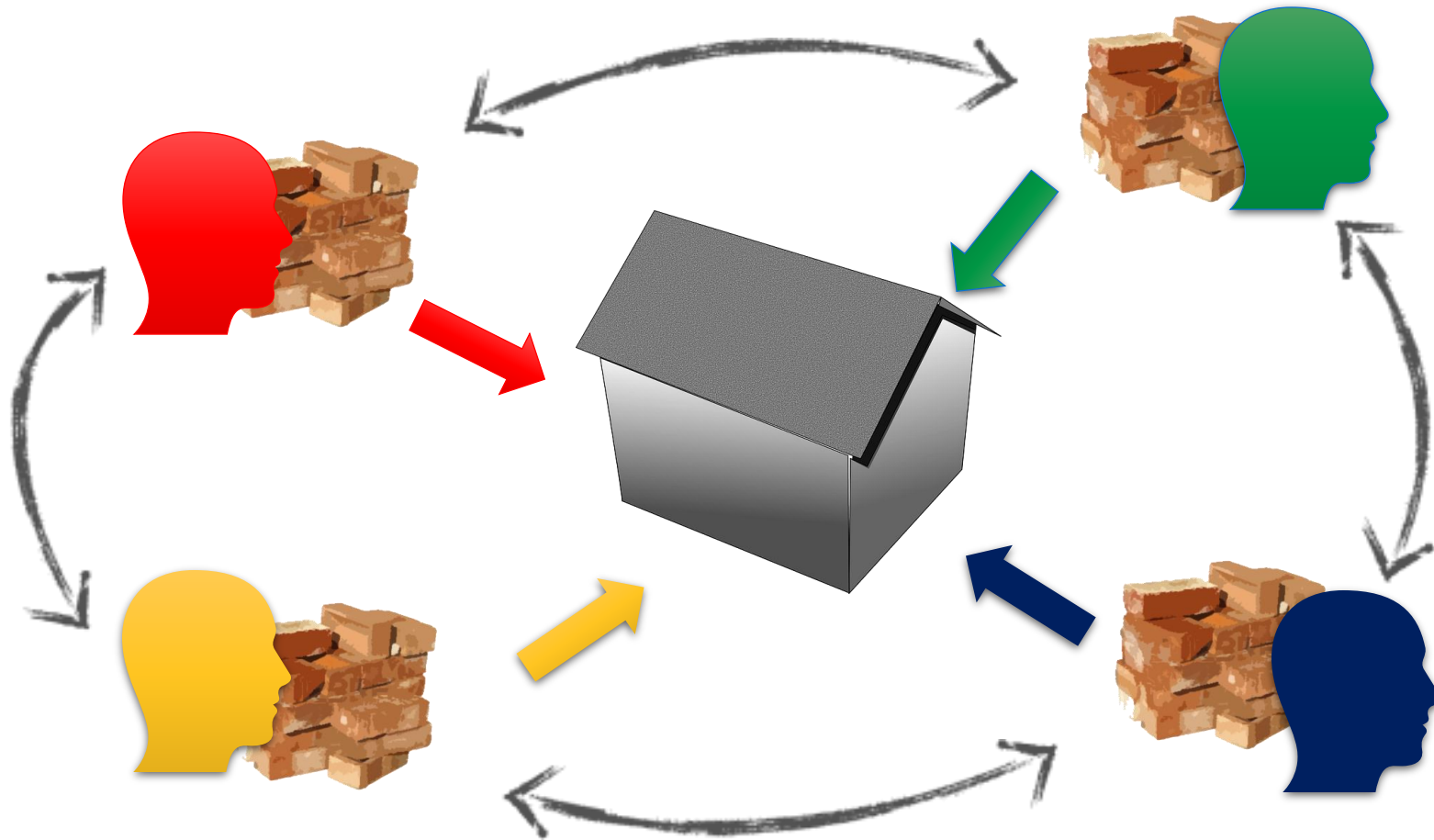


Is it fine?

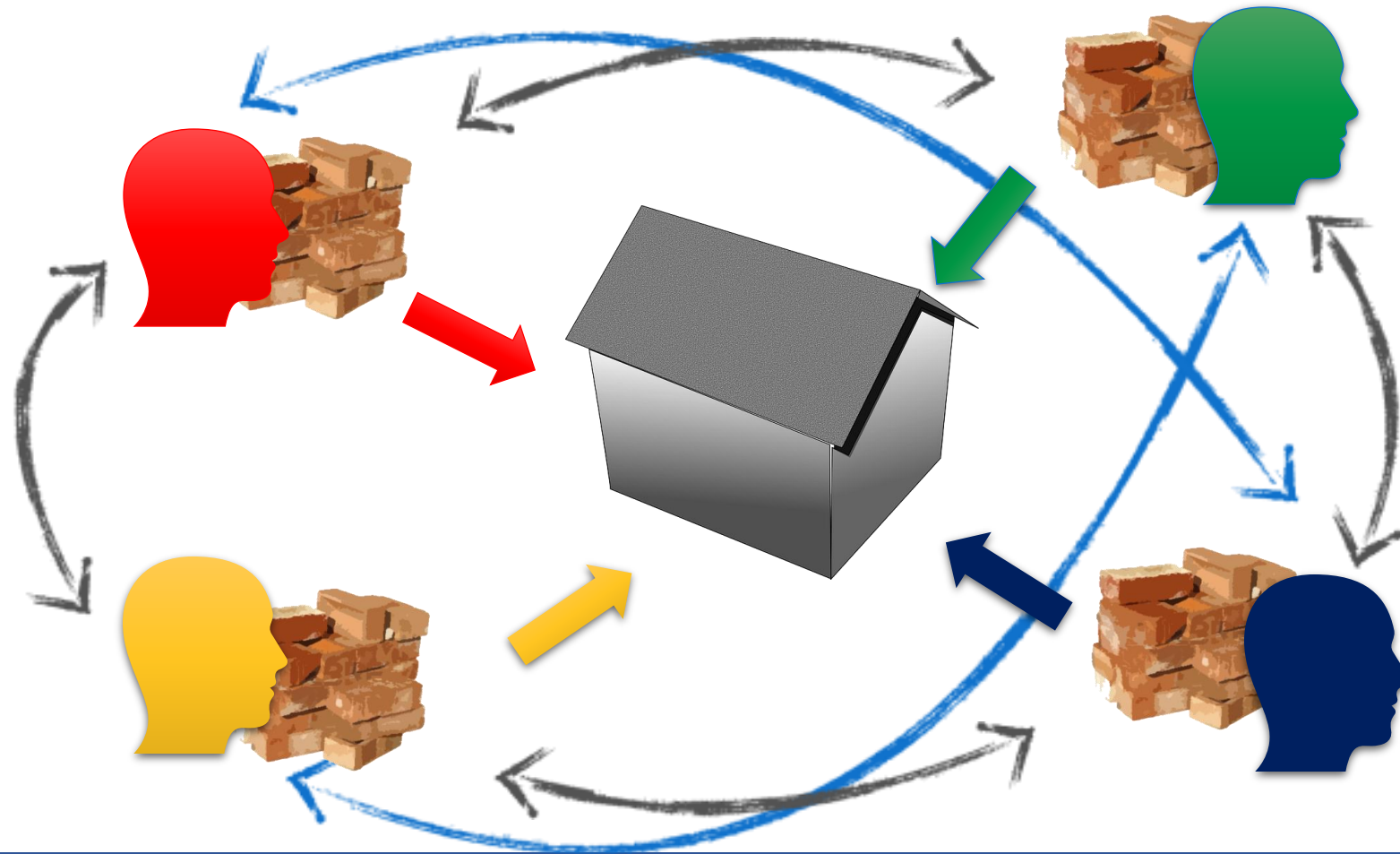


Is it fine?

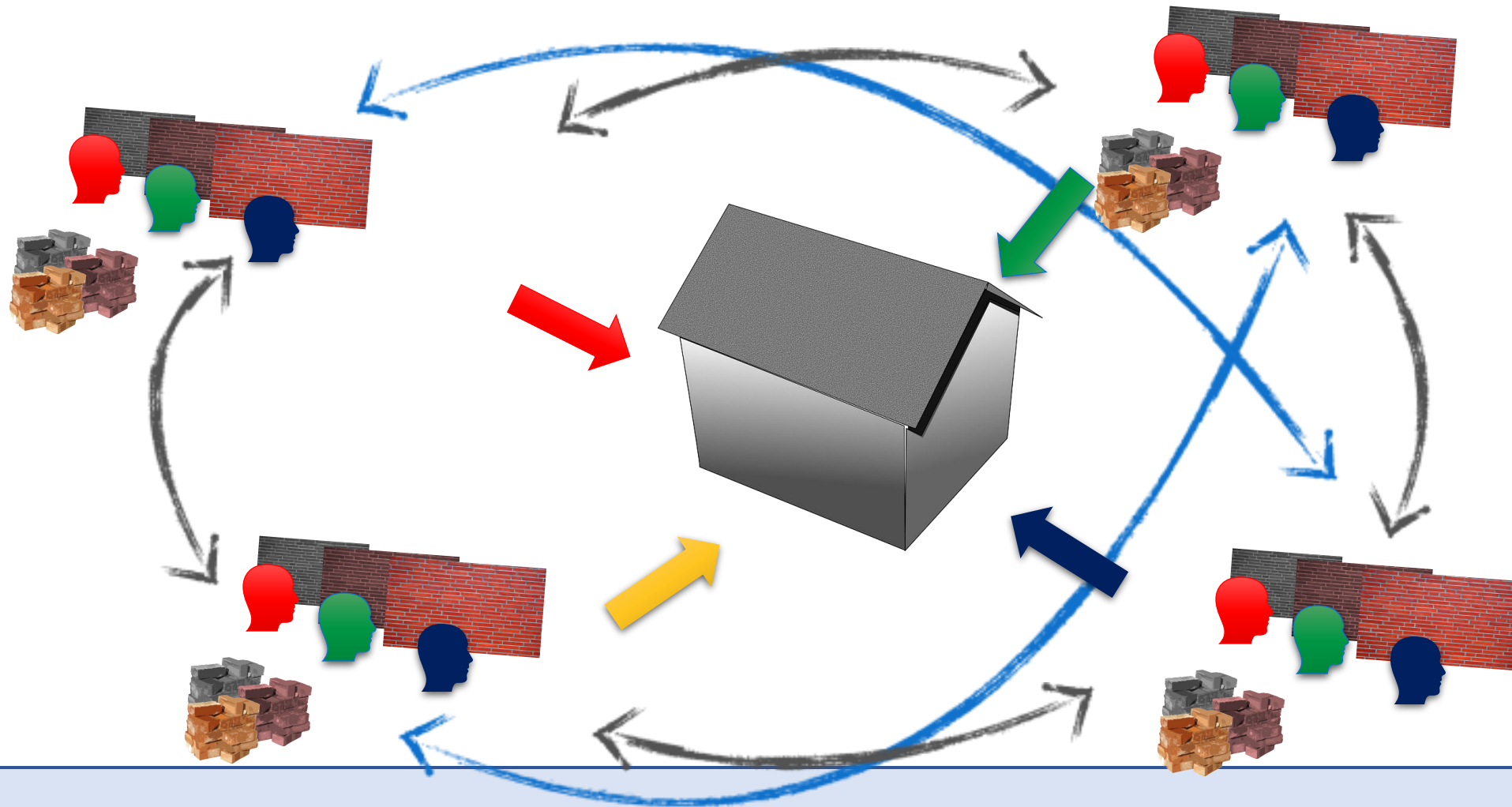




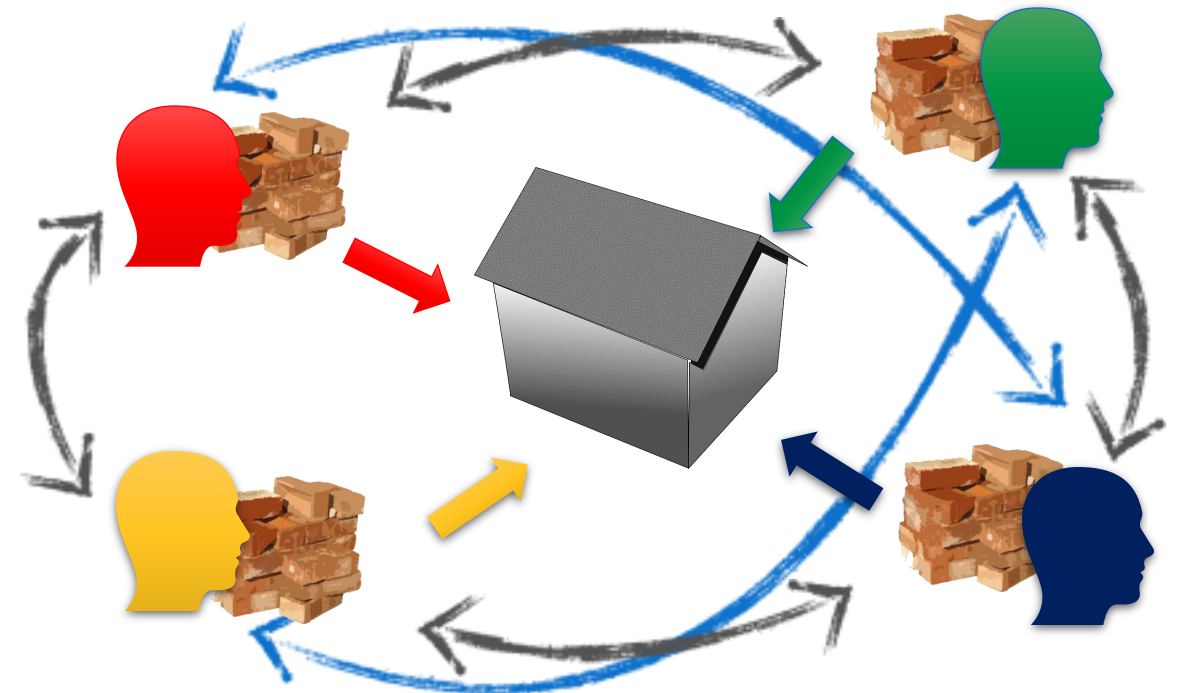
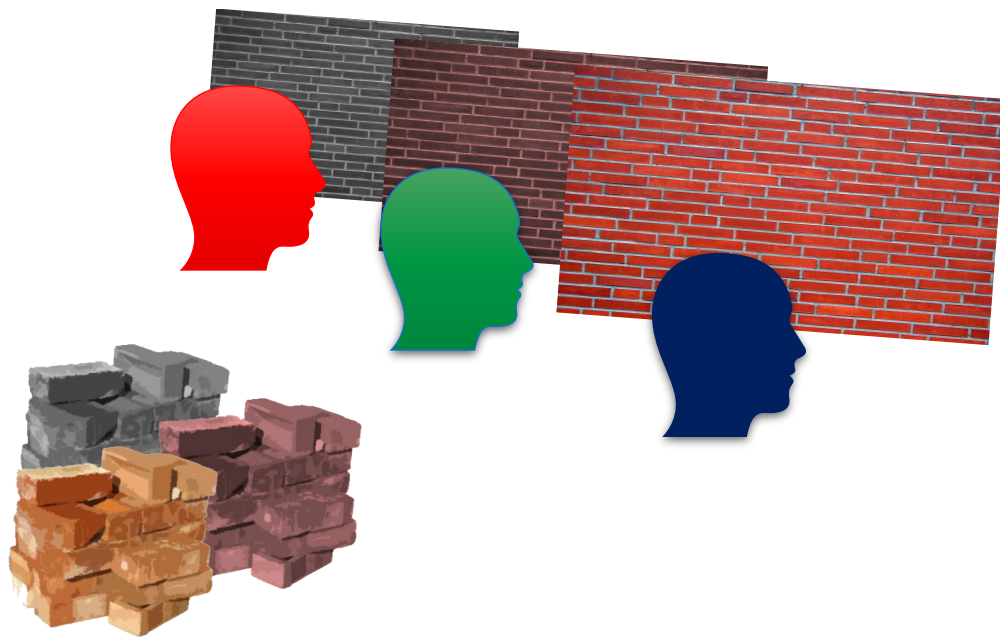
Is it enough?



How to reduce building time

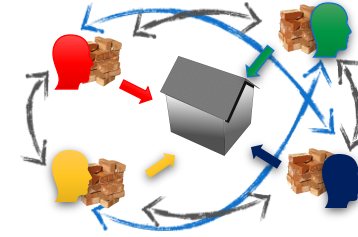
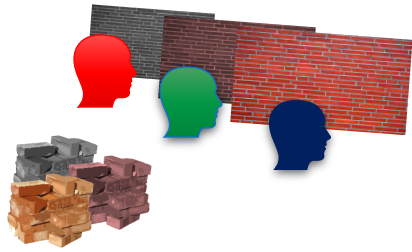


SHARED MEMORY

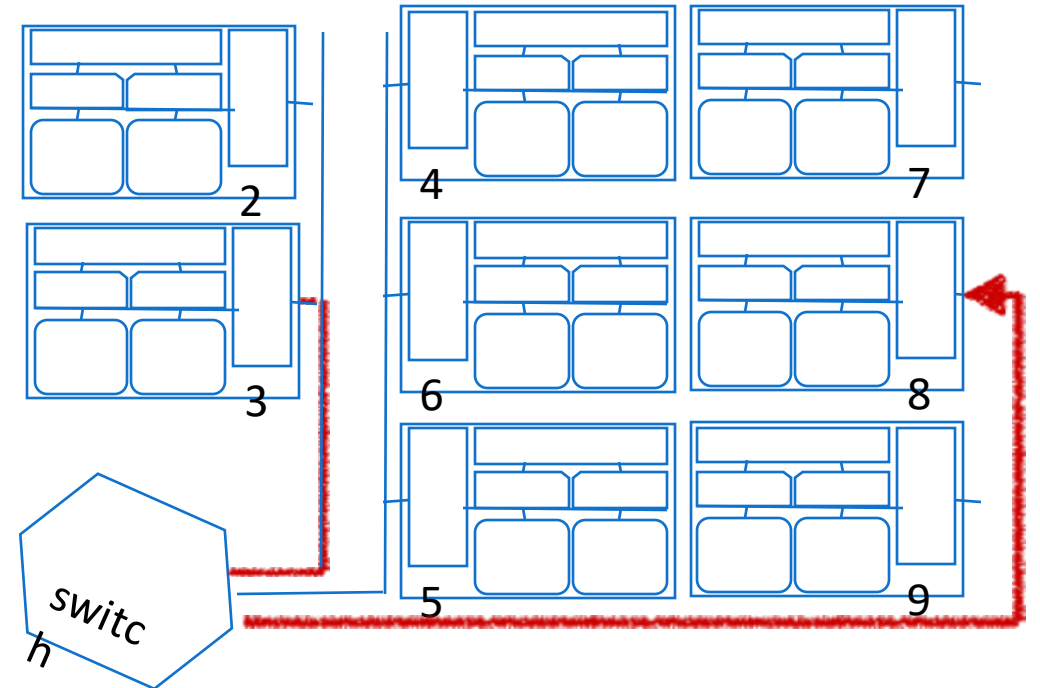
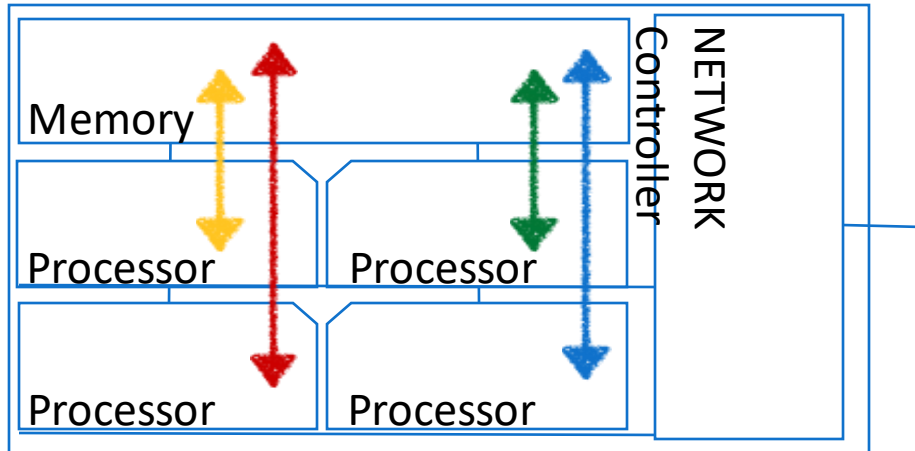


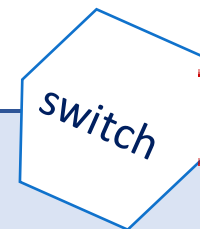
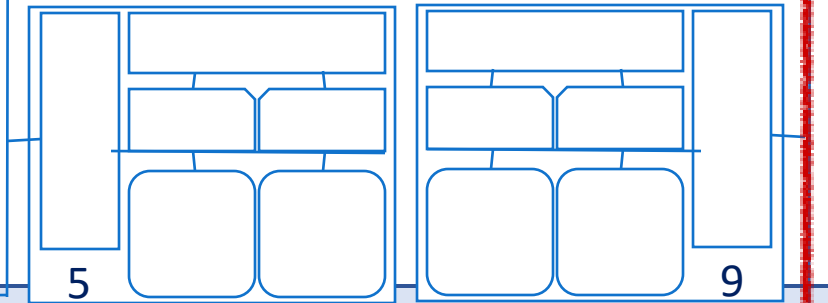
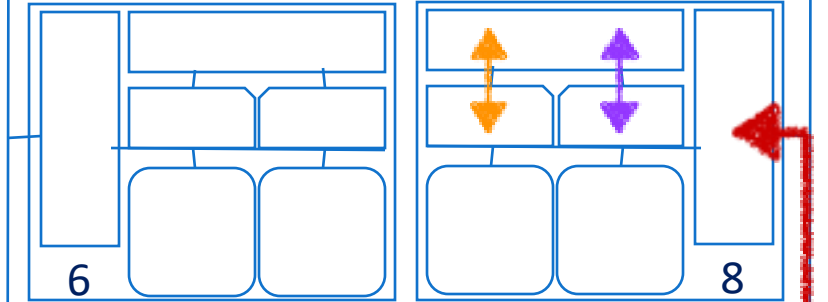
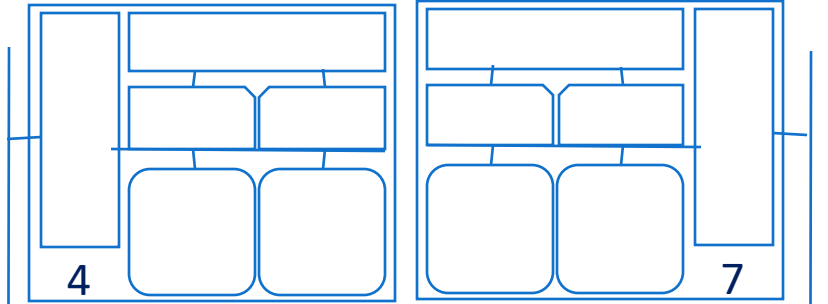
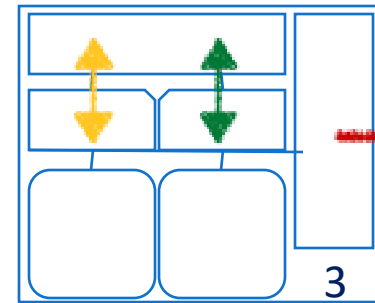
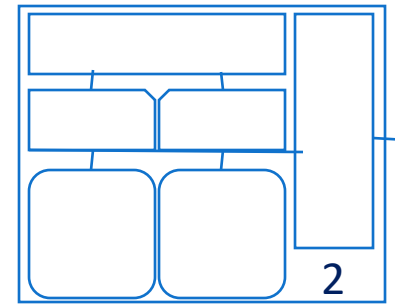
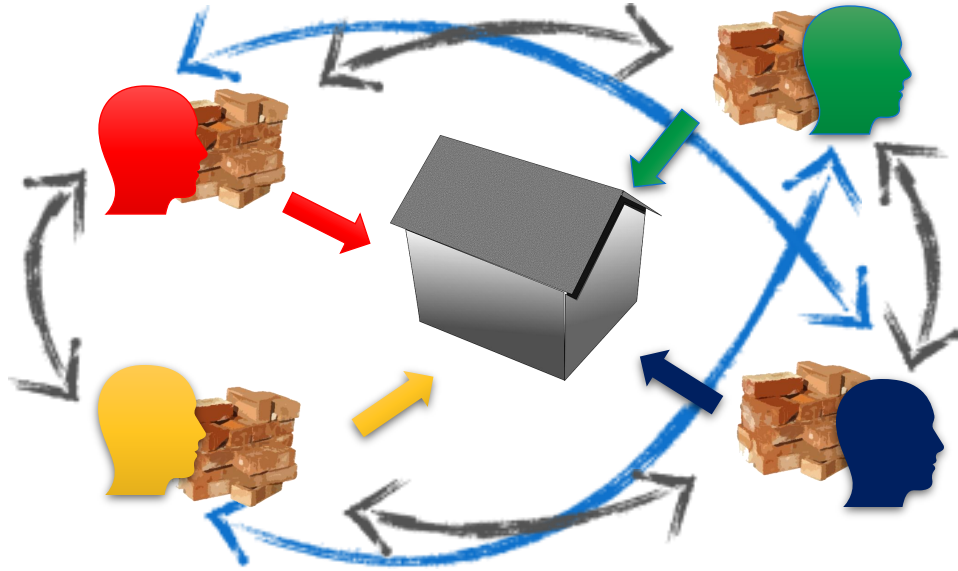
MESSAGE PASSING

OpenMP



MPI





$$T_{//} = T_s [(1-P) + (P/N)] + T_{\text{sync}} + T_{\text{com}}$$

