

### Introduction to HPC II

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### Sctrain SUPERCOMPUTING KNOWLEDGE PARTNERSHIP



# HPC laws

### Moore's law



## Sctrain SUPERCOMPUTING KNOWLEDGE PARTNERSHIP



#### Moore's law

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

### Dennard's law

CPU<sub>now</sub> —> CPU<sub>next</sub>

Ideal: L(next)=L/2 V(next)=V/2  $F(next)=F^*2 P(next)=P$ 

Real: L(next)=L/2 V(next)= $^V$  F(next)=F\*2 P(next)=4\*P



#### Amdhal's law





# Parallelism



### How to build a wall?









### How to build a wall?





### How to build a house?













### Is it fine?



### Communication





#### Is it enough?

### Communication





### How to reduce building time





#### Shared vs MP





#### Message Passing + shared memory SUPERCOMPUTING Sctrain KNOWLEDGE PARTNERSHIP **7 MPI** Open**MP** - Switch

### HPC parallel process



### $T_{//} = T_{s} [(1-P)+(P/N)]+T_{sync}+T_{com}$

