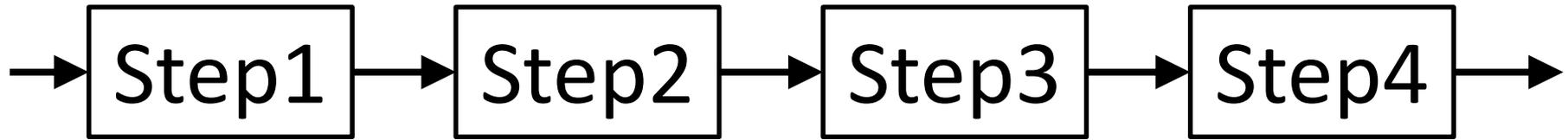


# Pipeline

- CPU Instruction pipeline
- Graphics pipeline
- Various algorithms



A step can be executed by a:

- thread
- process
- hardware element



# Without Pipeline



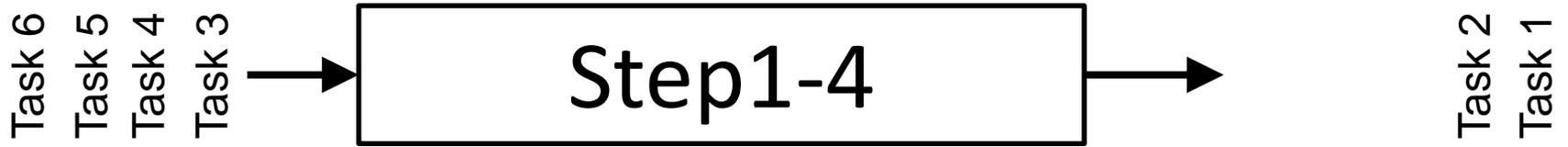


# Without Pipeline

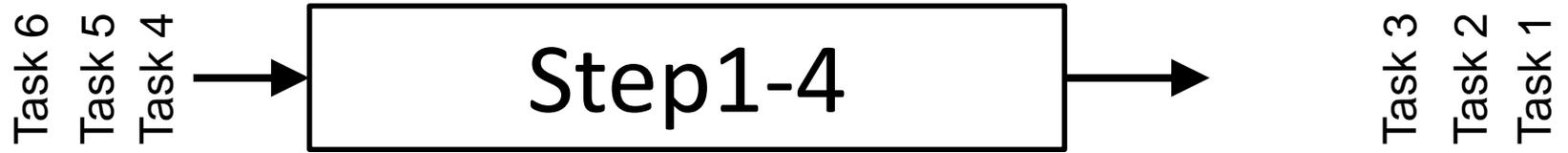




# Without Pipeline



# Without Pipeline





# Without Pipeline



# Without Pipeline

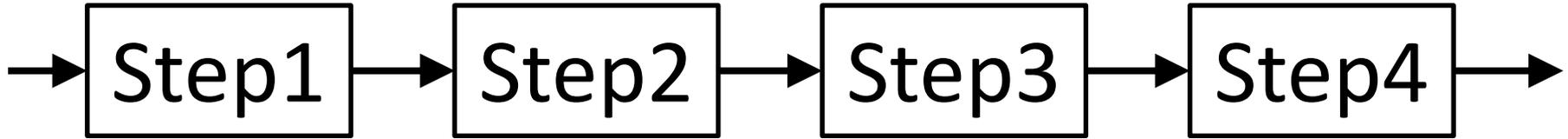


$$total\_execution\_time = task\_execution\_time * number\_of\_tasks$$



# Pipeline

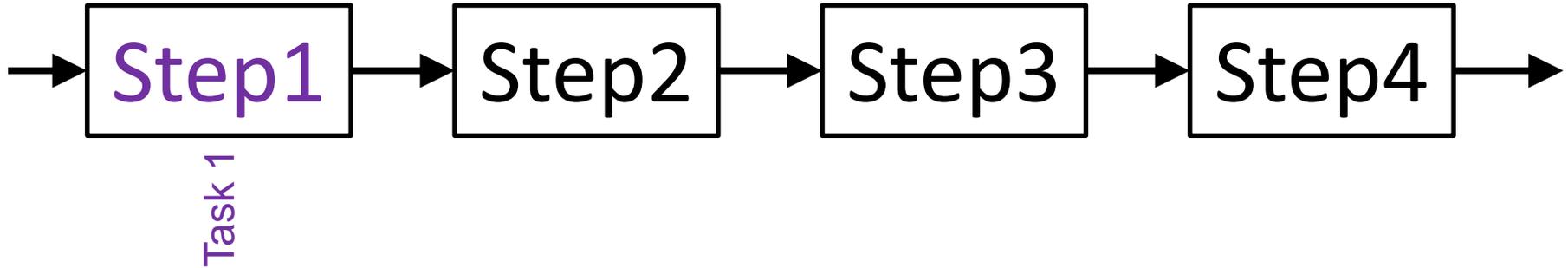
- Task 6
- Task 5
- Task 4
- Task 3
- Task 2
- Task 1





# Pipeline

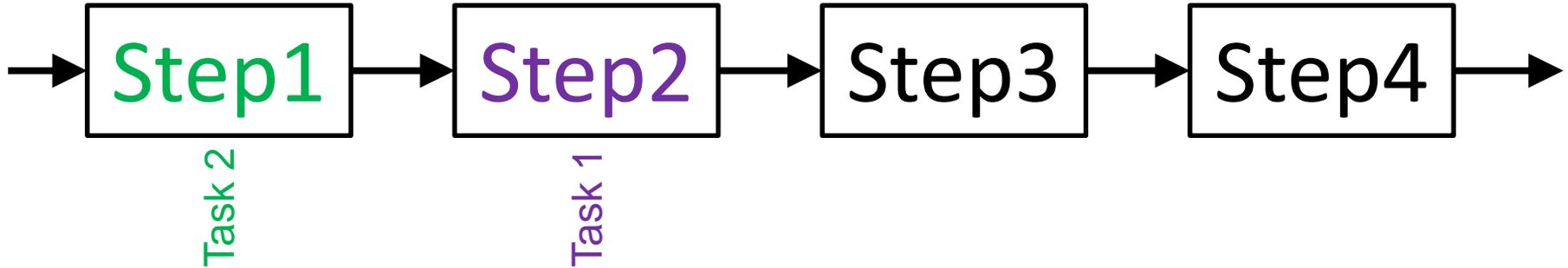
- Task 6
- Task 5
- Task 4
- Task 3
- Task 2





# Pipeline

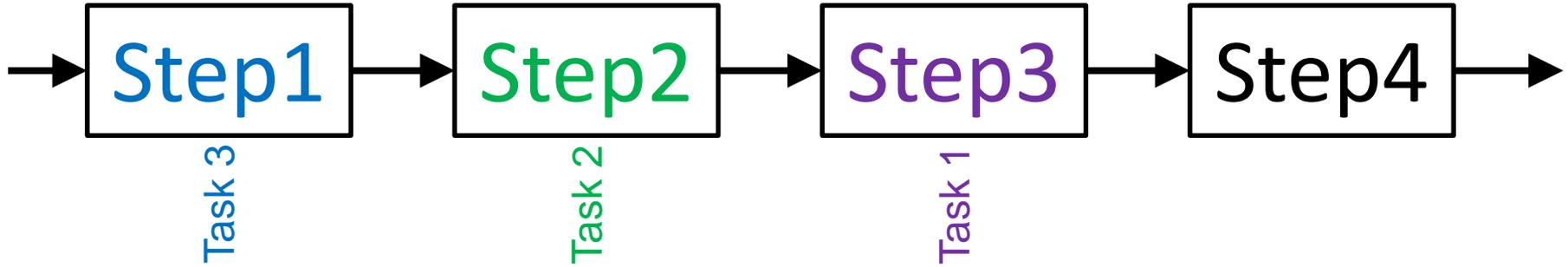
- Task 6
- Task 5
- Task 4
- Task 3





# Pipeline

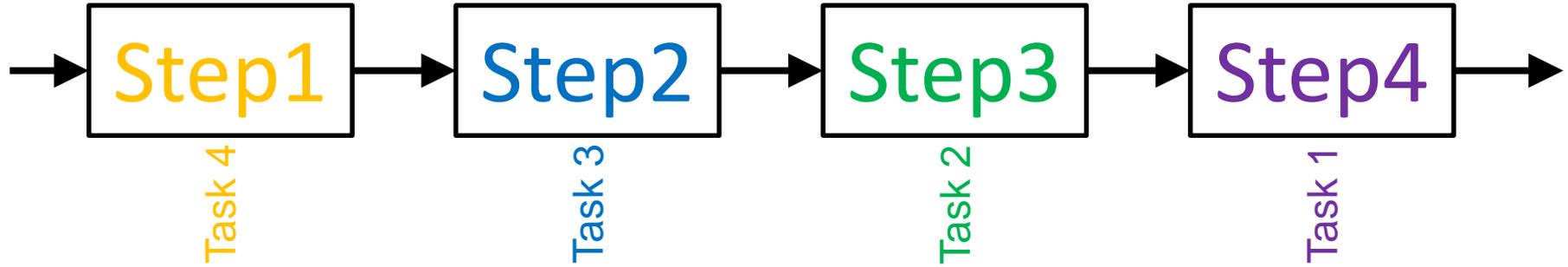
Task 6  
Task 5  
Task 4





# Pipeline

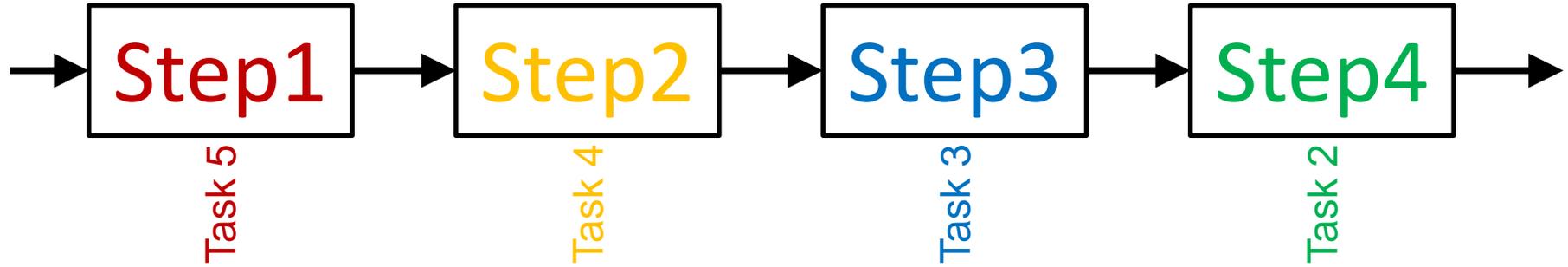
Task 6  
Task 5





# Pipeline

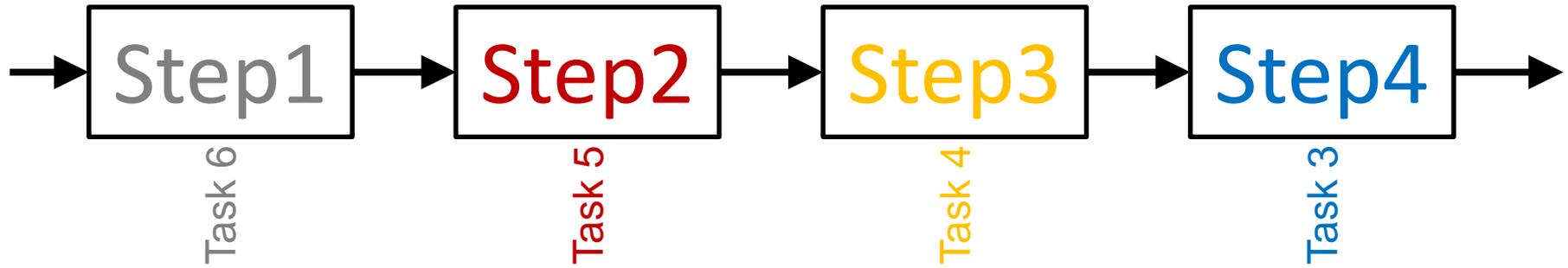
Task 6



Task 1



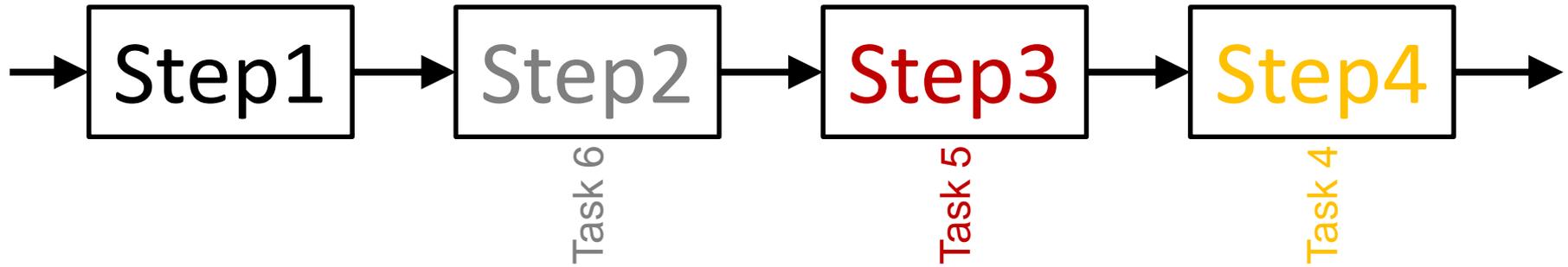
# Pipeline



Task 2  
Task 1



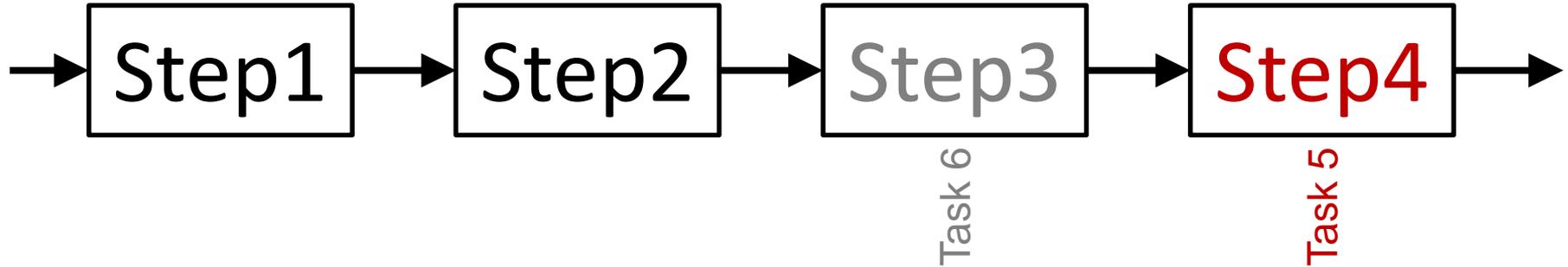
# Pipeline



Task 3  
Task 2  
Task 1



# Pipeline

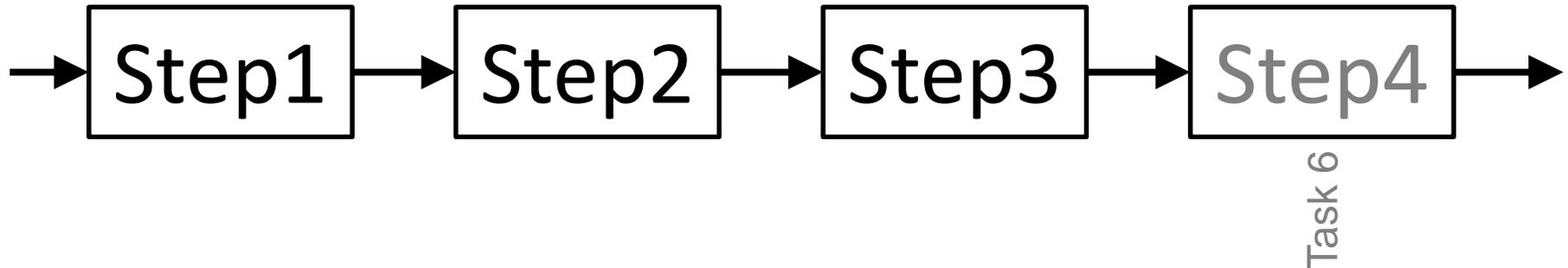


- Task 4
- Task 3
- Task 2
- Task 1



# Pipeline

Ideal:  $step\_execution\_time = \frac{task\_execution\_time}{number\_of\_steps}$



**After**  $number\_of\_steps$  tasks:

$$total\_execution\_time = number\_of\_tasks * step\_execution\_time$$

One task finishes at every “step tick”

Task 5  
Task 4  
Task 3  
Task 2  
Task 1