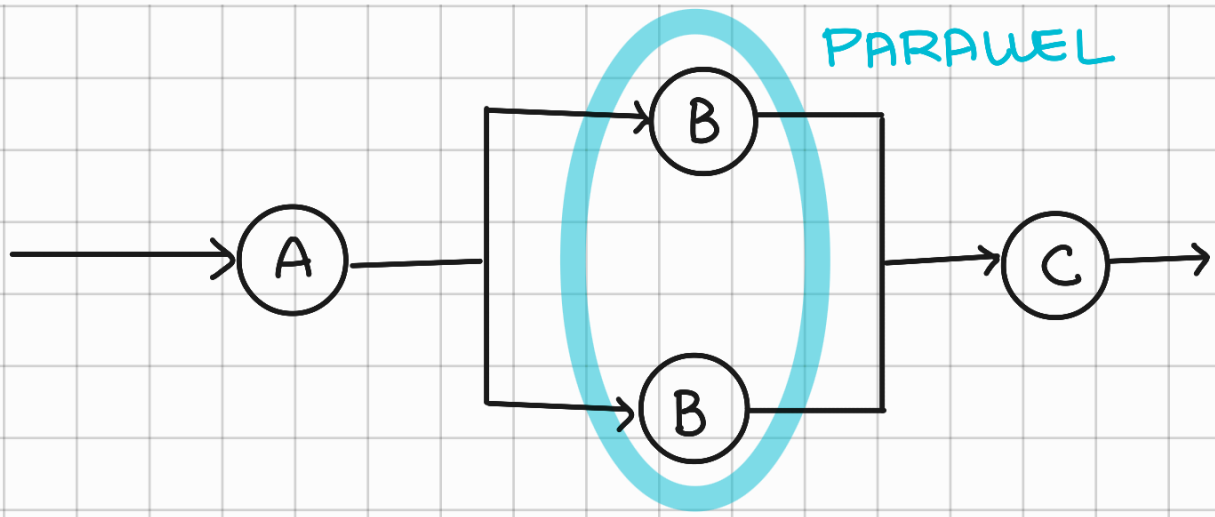
Example

A service is provided by 3 types of components (e.g., database, web server, and an application), referred to as A, B, and C. At least one instance of each component must be available to provide the service. Only one instance is deployed for components A and C, while two instances of component B are deployed.

Assuming that all failures and recoveries are independent of each other, that the failure rates of the three components A, B, and C are 0.2, 0.5, and 0.3 failures per day, respectively, and that the average time to repair components A, B, and C is 2 hours, 3 hours, and 1.5 hours, respectively, is the service available at least 98% of the time? If not, is the availability target met by adding an additional instance of one of the components?



$\lambda_A = 0.2$ $\quad MTTR_A = 2\,h$ $\quad$ 98% availability

$\lambda_B = 0.5$ $\quad MTTR_B = 3\,h$

$\lambda_C = 0.3$ $\quad MTTR_C = 1.5\,h$

$$\lambda = \frac{1}{MTBF} \qquad \mu = \frac{1}{MTTR} \qquad A = \frac{MTBF}{MTBF + MTTR}$$

$$A_{serial} = \prod A_i$$

$$A_{parallel} = 1 - \prod (1 - A_i)$$

(A) $$A_A = \frac{MTBF}{MTBF + MTTR}$$

(B) $$A_{parallel_B} = 1 - (1 - A_B)(1 - A_B)$$

$$= 1 - (1 - A_B)^2$$

© $A_C = \frac{MTBF}{MTBF + MTTR}$

$A_{TOT} = \prod A = A_A \cdot A_{parallel\ B} \cdot A_C$