Paolo Cremonesi

Impianti Informatici

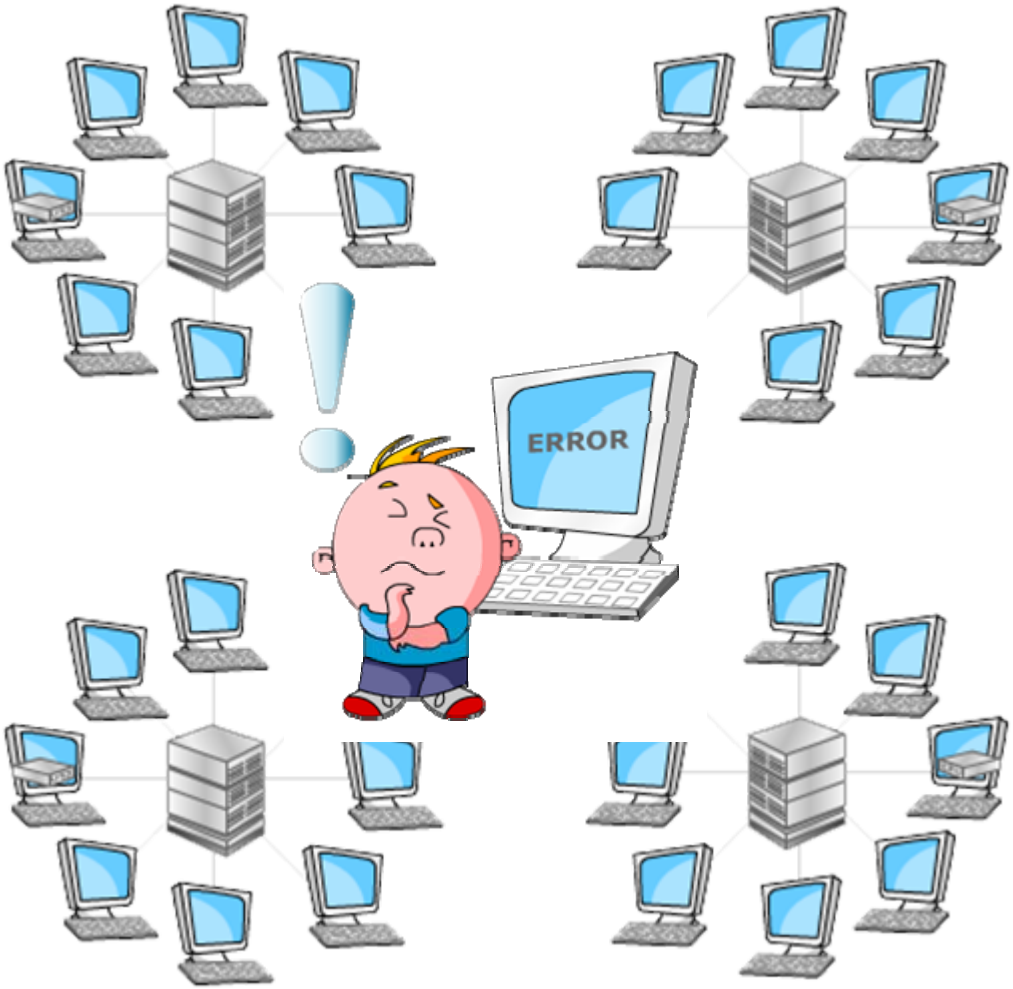
POLITECNICO DI MILANO



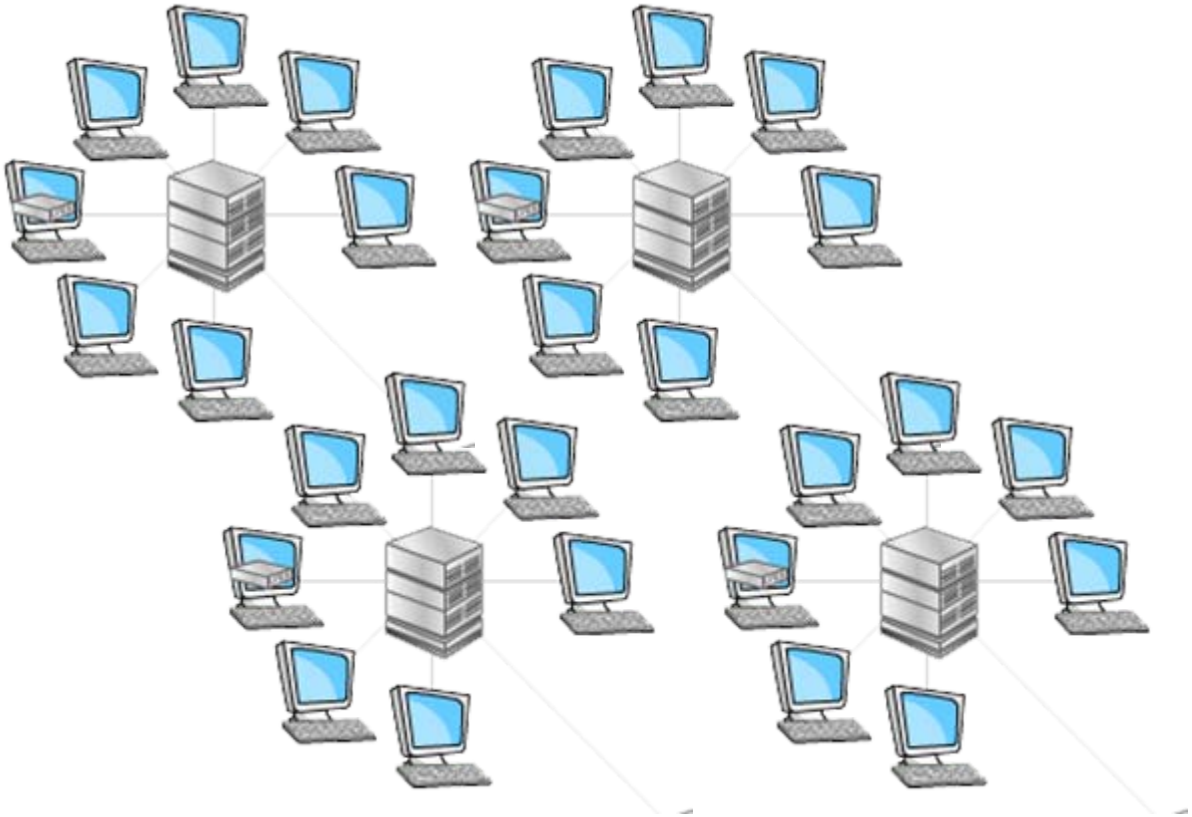


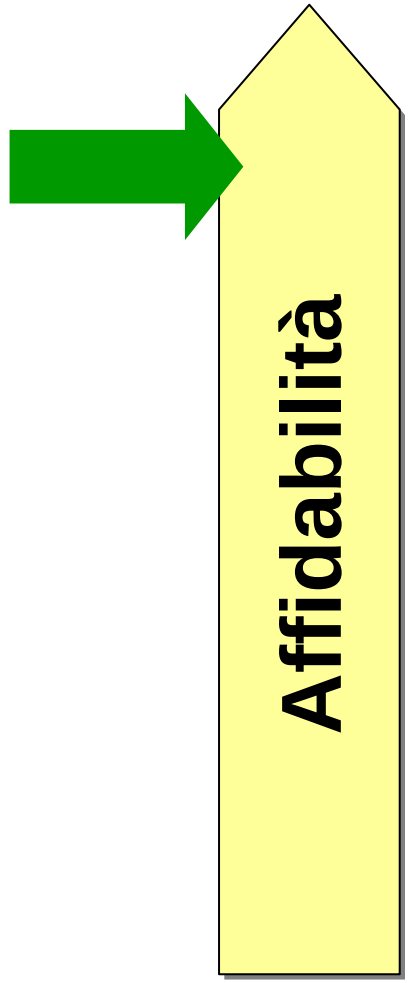
Affidabilità: diagrammi a blocchi

Introduzione

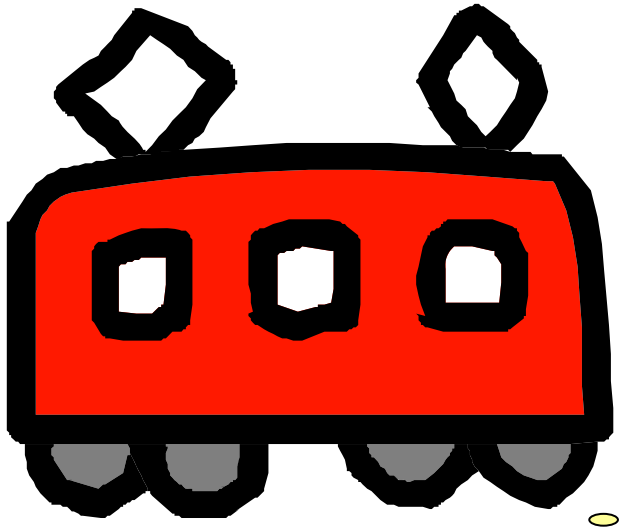


Affidabilità dei sistemi



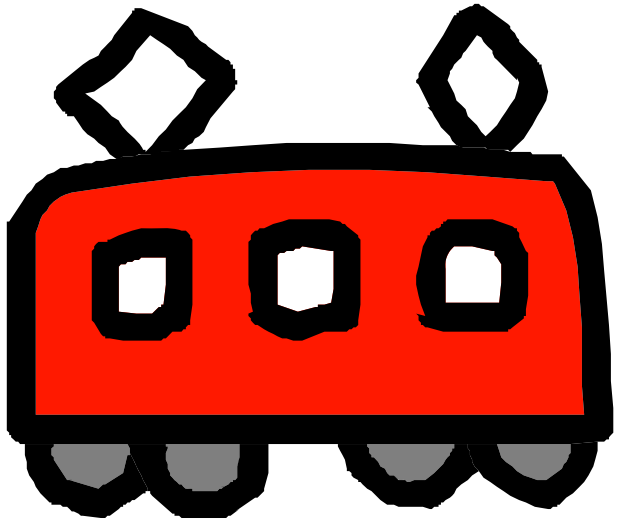


Sistemi fault-tolerant



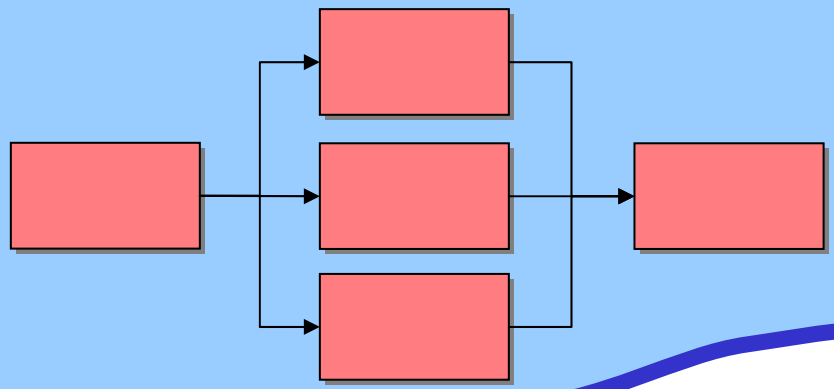
ridondanza

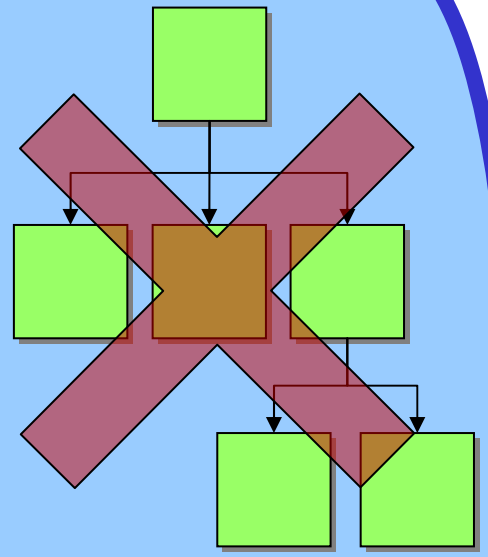
Sistemi fault-tolerant



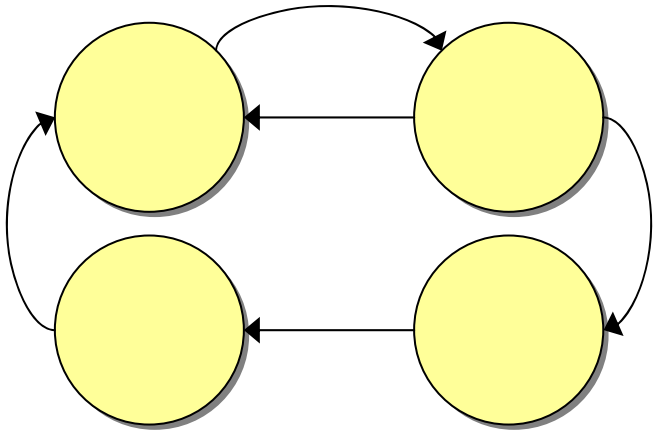
Tipi di modelli

diagrammi
a blocchi



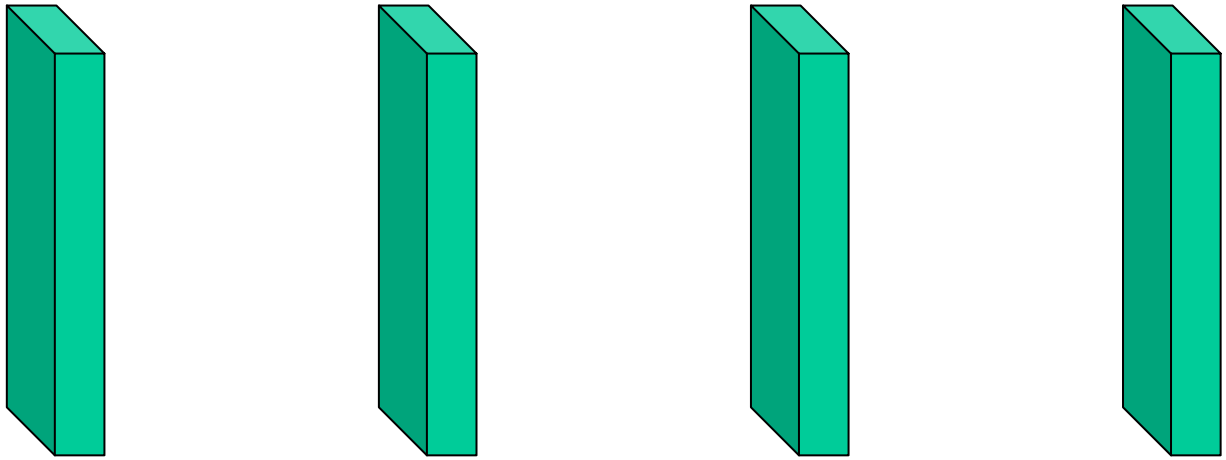


catene
di Markov



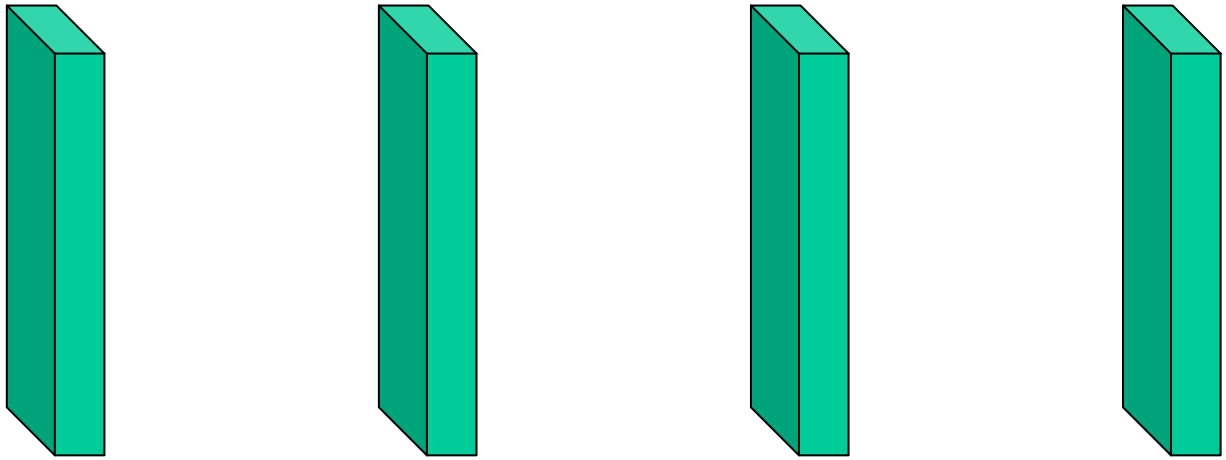
alberi di guasto

Ipotesi



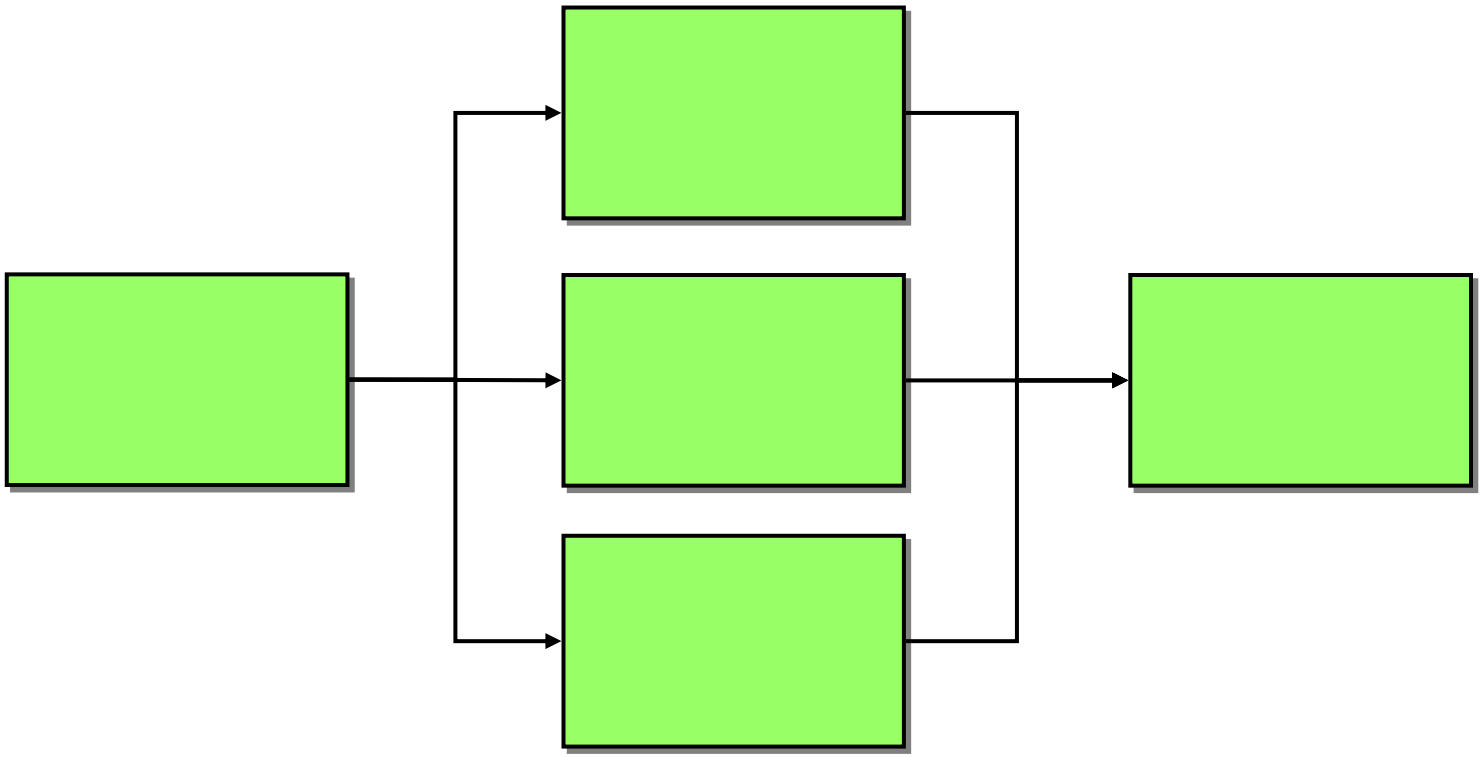
diagrammi a blocchi

Ipotesi

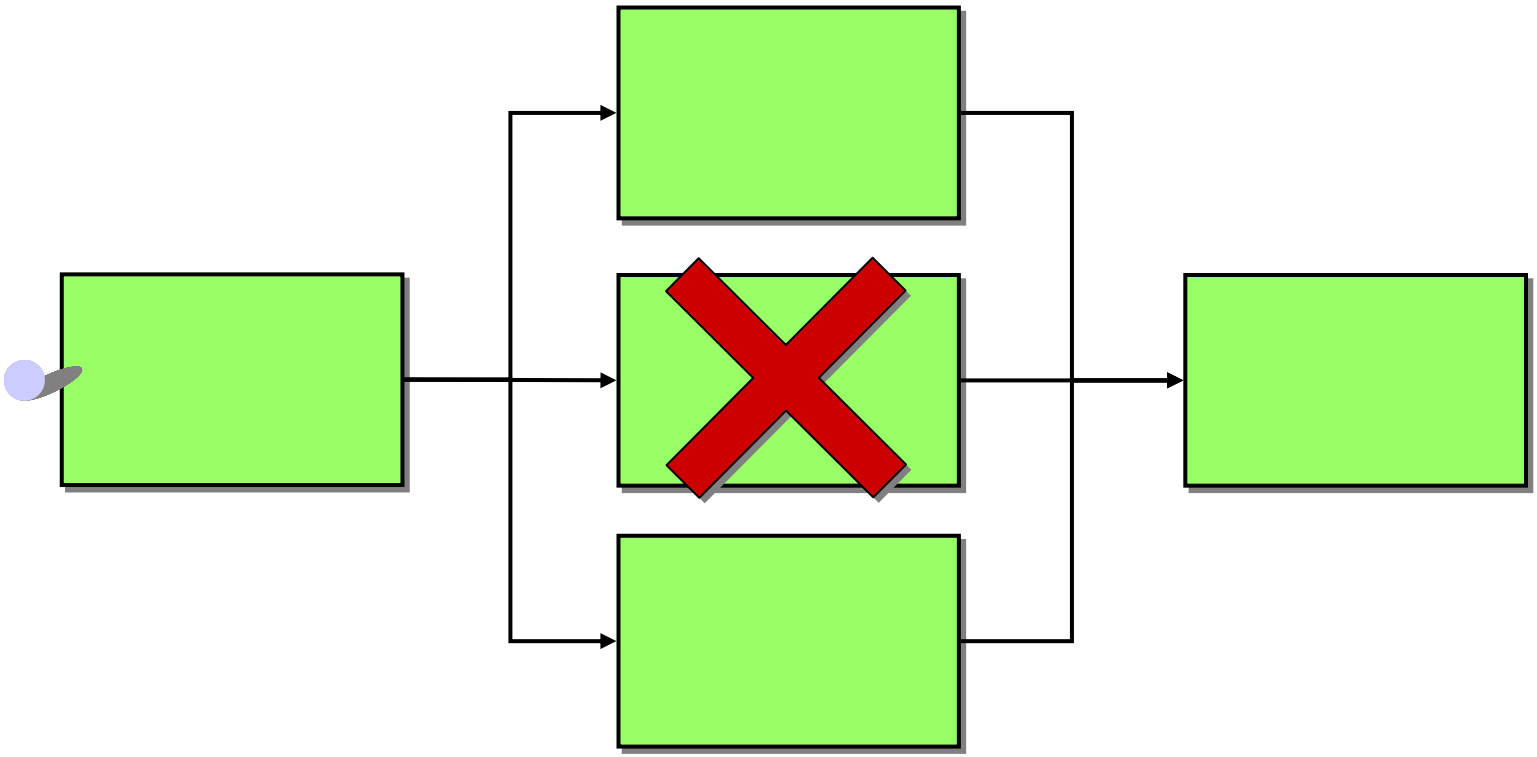


catene di Markov

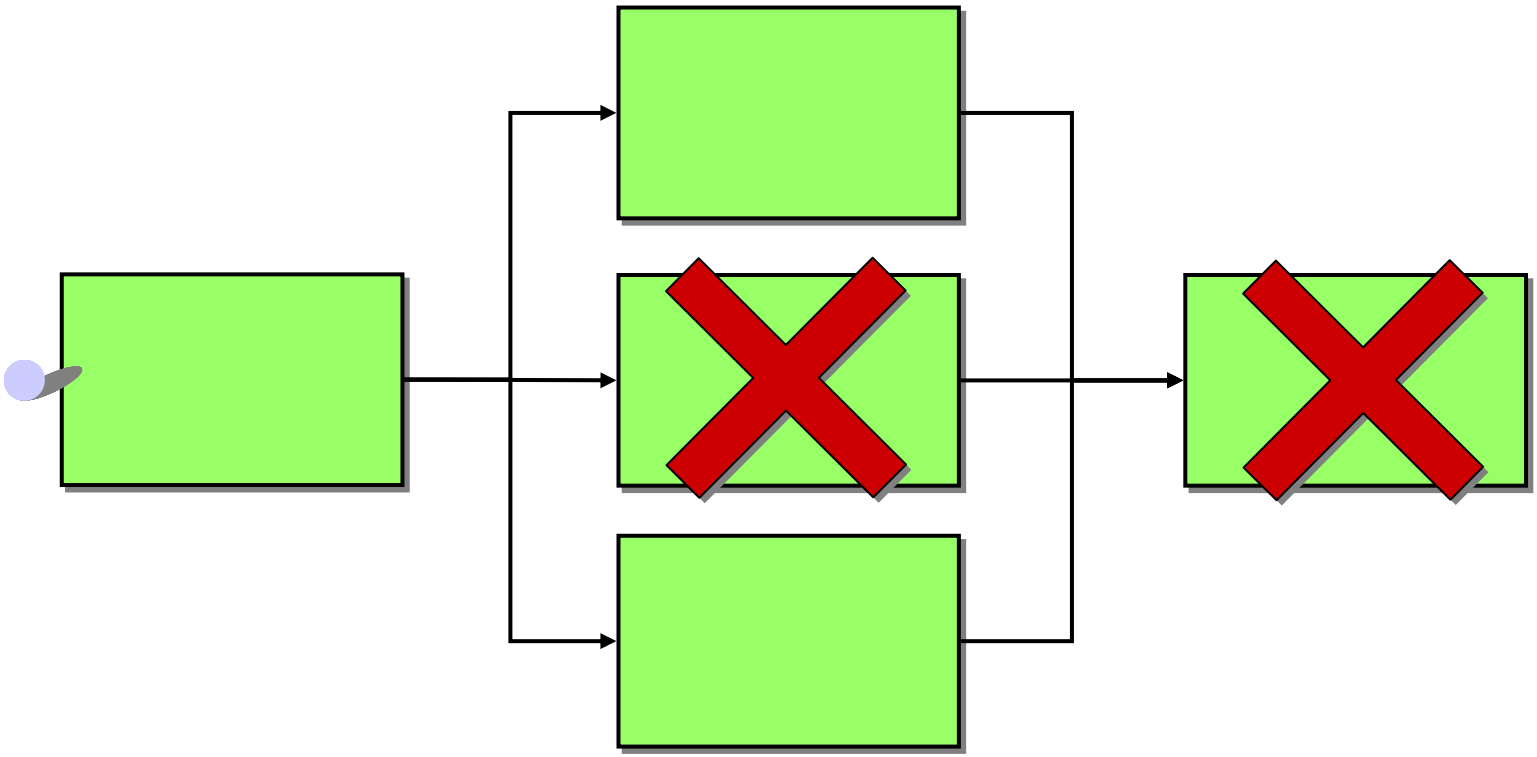
Reliability Block Diagram (RDB)



Reliability Block Diagram (RDB)

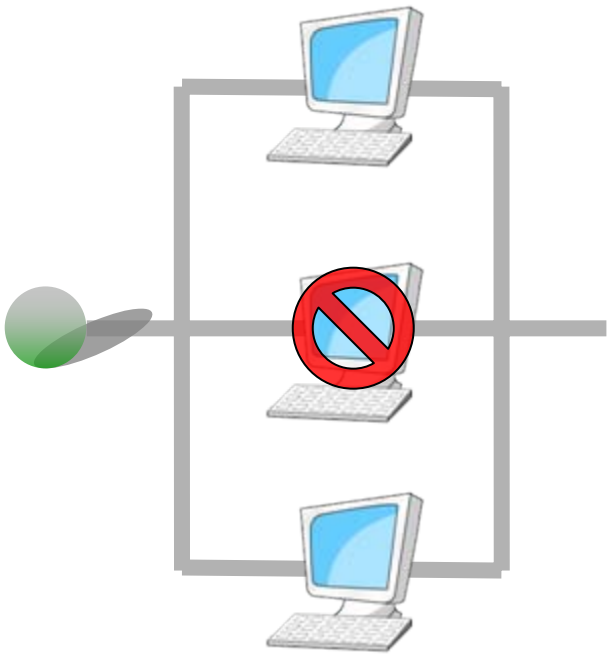


Reliability Block Diagram (RDB)



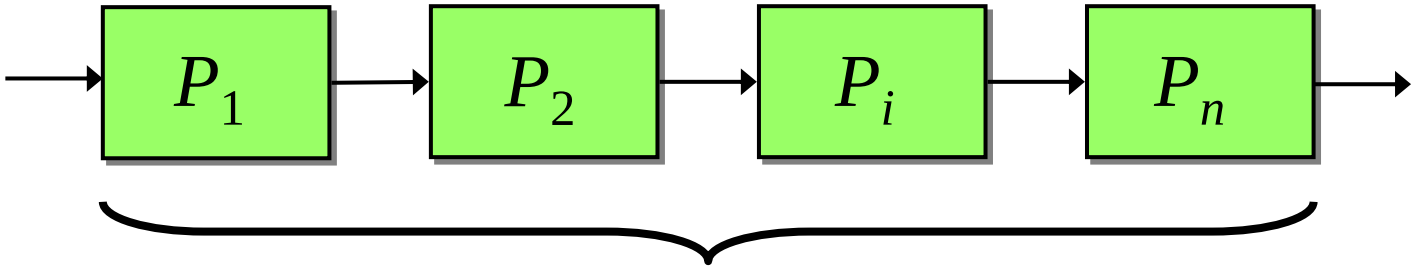
Sistemi in serie e in parallelo

parallelo



serie

Sistemi in serie



$$P_S = \prod_{i=1}^{n} P_i$$

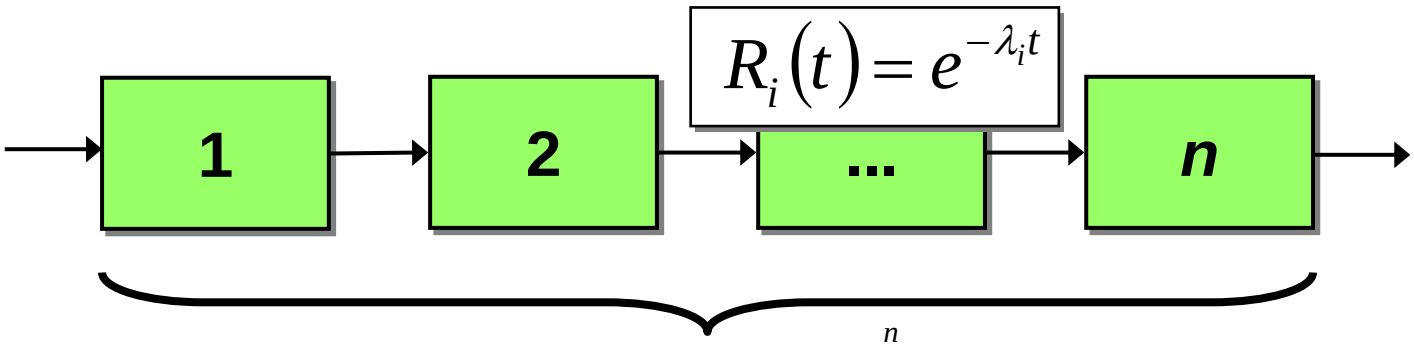
$$R_S(t) = \prod_{i=1}^{n} R_i(t)$$

sistemi non-riparabili
(guasti indipendenti)

$$A_S(t) = \prod_{i=1}^{n} A_i(t)$$

sistemi riparabili
(guasti e riparazioni indipendenti)

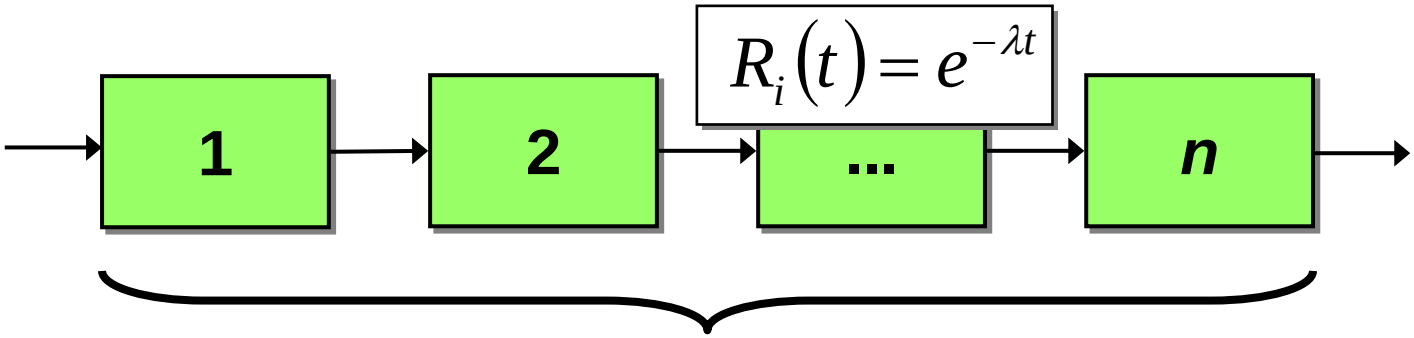
Sistemi in serie con failure-rate costante



$$R_S(t) = \prod_{i=1}^{n} e^{-\lambda_i t} = e^{-t\sum_{i=1}^{n}\lambda_i} = e^{-t\lambda_S}$$

$$\lambda_S = \sum_{i=1}^{n} \lambda_i$$

Sistemi in serie con failure-rate uguali



$$\lambda_S = n\lambda \qquad R_S(t) = e^{-t\lambda_S}$$

$$\mathrm{MTTF}_S = \frac{\mathrm{MTTF}}{n}$$

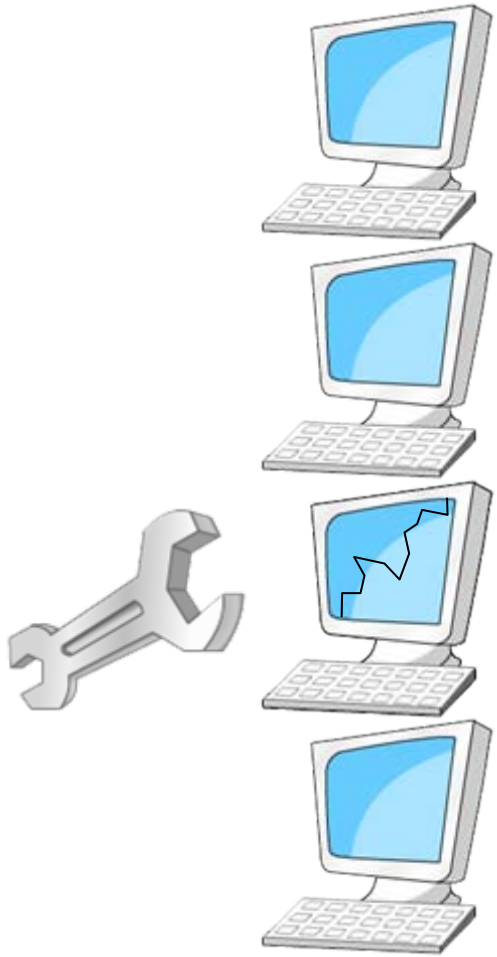
$$\mathrm{MTTF} = \frac{1}{\lambda}$$

$$\mathrm{MTTF}_S = \frac{1}{n\lambda}$$

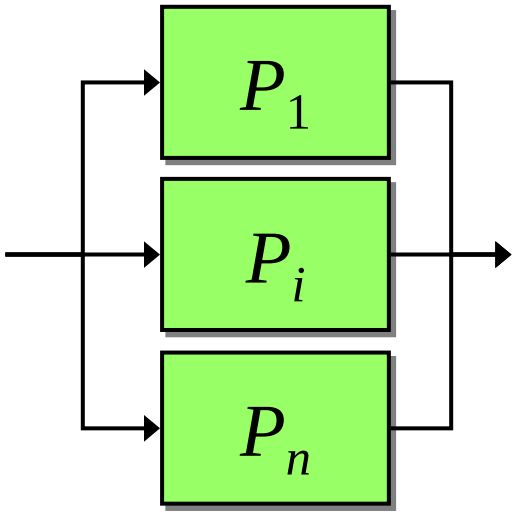
Migliorare l'affidabilità di sistemi in serie

analisi di sensitività

$$\frac{\partial R_S}{\partial R_i} = R_S \cdot R_i$$



Sistemi in parallelo



$$P_S = \prod_{i=1}^{n} P_i$$

$$F_S(t) = \prod_{i=1}^{n} F_i(t)$$

sistemi non-riparabili

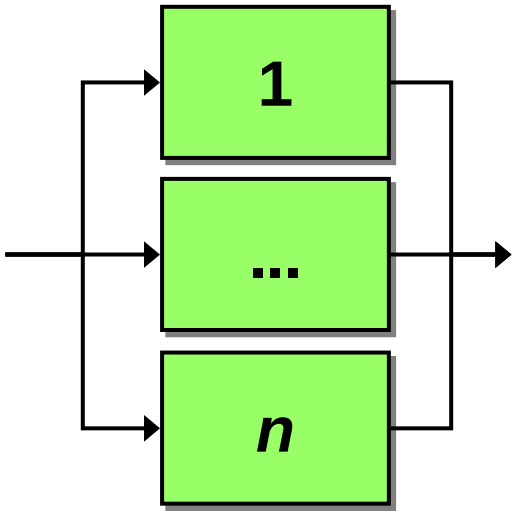
(guasti indipendenti)

$$U_S(t) = \prod_{i=1}^{n} U_i(t)$$

sistemi riparabili

(guasti e riparazioni indipendenti)

Sistemi in parallelo



$$R_S(t) = 1 - \prod_{i=1}^{n} [1 - R_i(t)]$$

sistemi non-riparabili

(guasti indipendenti)

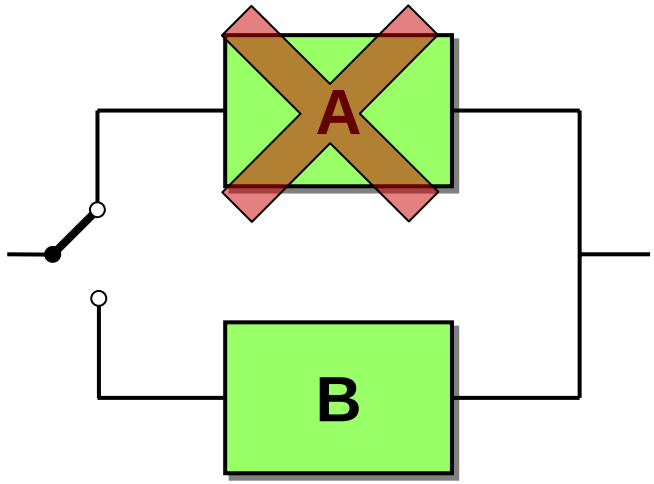
$$A_S(t) = 1 - \prod_{i=1}^{n} [1 - A_i(t)]$$

sistemi riparabili

(guasti e riparazioni indipendenti)

Sistemi in stand-by

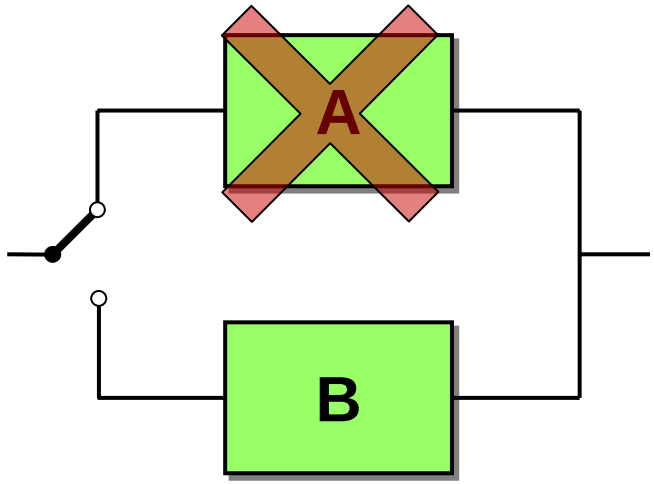
- Il componente B non si usura fino a che rimane in stand-by
- L'interruttore agisce istantaneamente in caso di guasto
- L'interruttore non si guasta mai

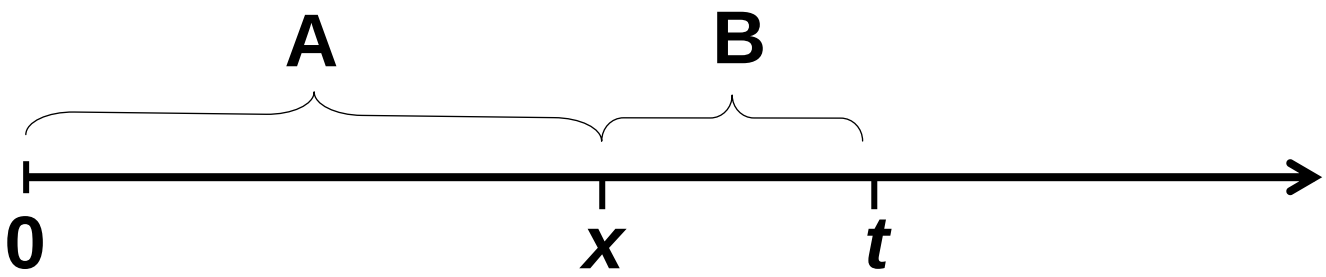


Sistemi in stand-by

Il sistema funziona nell'intervallo di tempo 0 — *t* se

a) Il componente A non si è guastato in *0 — t*
b) Il componente A si è guastato nell'istante *x<t* , e il componente B non si è guastato da *x* a *t*





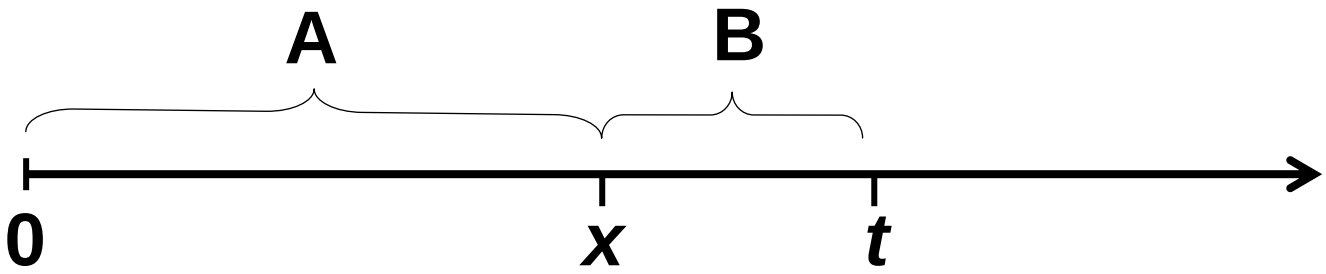
Sistemi in stand-by

$$R_S(t) = P_a(t) + P_b(t)$$

$$P_a(t) = R_A(t)$$

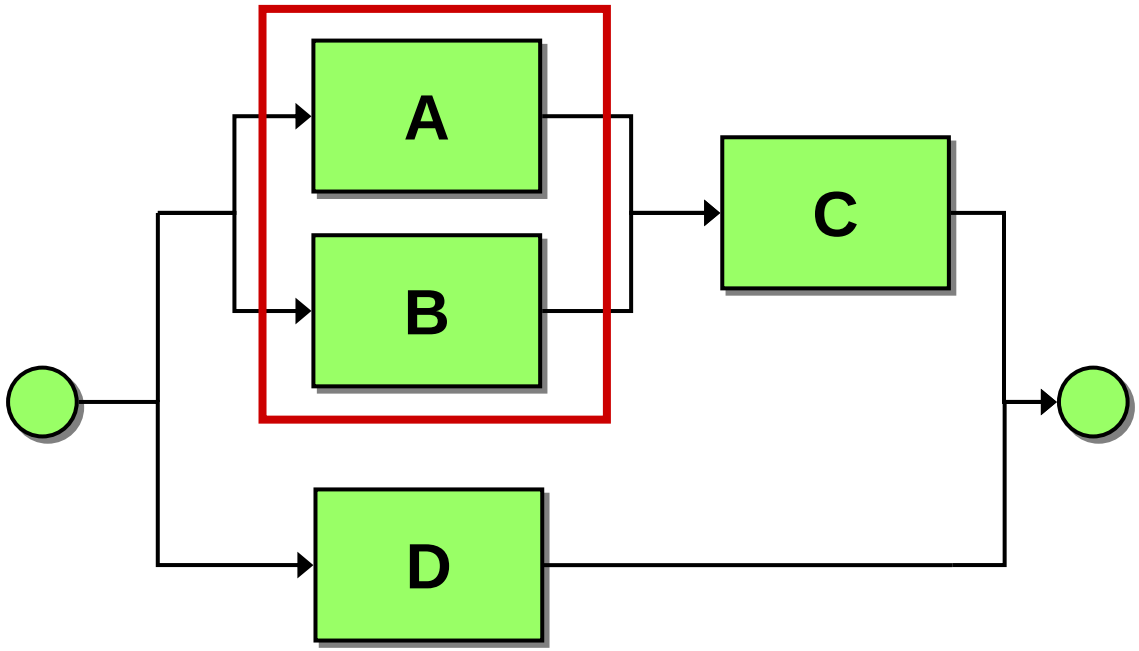
$$P_b(t) = \int_0^t R_B(t-x) f_A(x) \mathrm{d}x$$

$$R_S(t) = R_A(t) + \int_0^t R_B(t-x) f_A(x) \mathrm{d}x$$

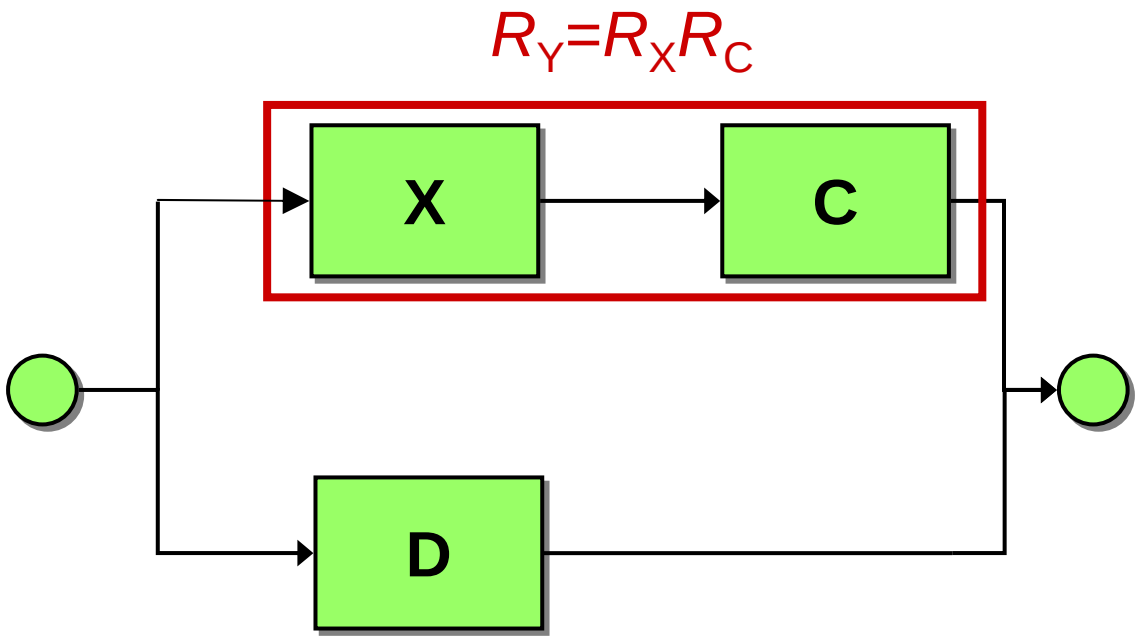


Sistemi serie/parallelo

$$R_X = 1 - (1 - R_A)(1 - R_B)$$



Sistemi serie/parallelo



Sistemi serie/parallelo

$$R_S = 1 - (1 - R_Y)(1 - R_D)$$