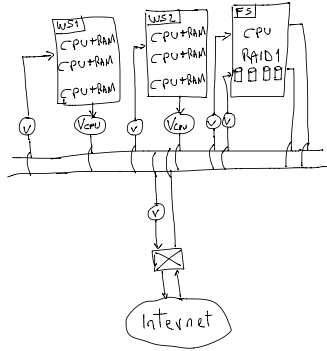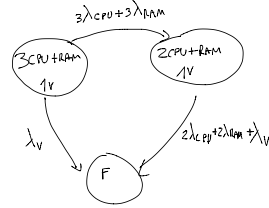# EX 1

Reliability

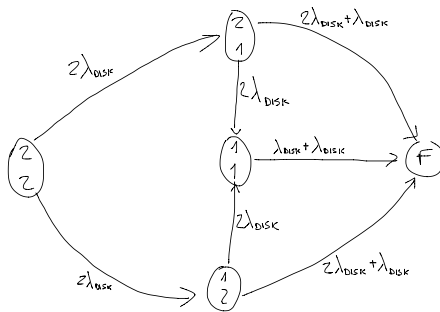**SUBSYSTEM 1:** WS1=WS2 : $(CPU+RAM)$ + VOTER-CPU
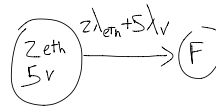

$$\begin{cases} P'_{3,1} = -\left(3\lambda_{CPU}+\lambda_{RAM}\right)P_{3,1} - \lambda_V P_{3,1} \\[4pt] P'_{2,1} = \left(3\lambda_{CPU}+\lambda_{RAM}\right)P_{3,1} - \left(2\lambda_{CPU}+\lambda_{RAM}+\lambda_V\right)P_{2,1} \\[4pt] P'_F = \lambda_V P_{3,1} + \left(2\lambda_{CPU}+\lambda_{RAM}+\lambda_V\right)P_{2,1} \\[4pt] P_{3,1}+P_{2,1}+P_F = 1 \\[4pt] P_{3,1}(0)=1 \end{cases}$$
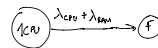
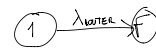$$R_{SUB1}(t) = 1 - P_F(t)$$
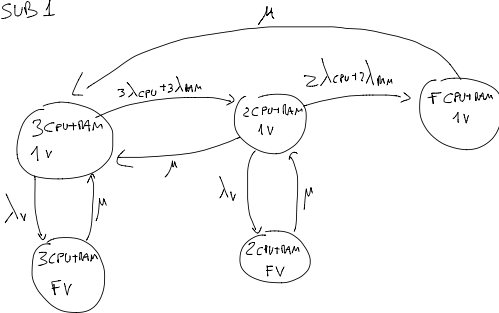
SUBSYSTEM 2: RAID

SUBSYSTEM 3: ETH+VOT

SUBS: ROUTER

SUB4: CPU-FS

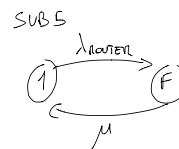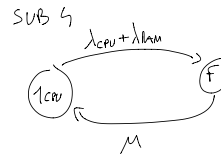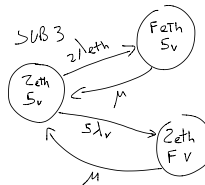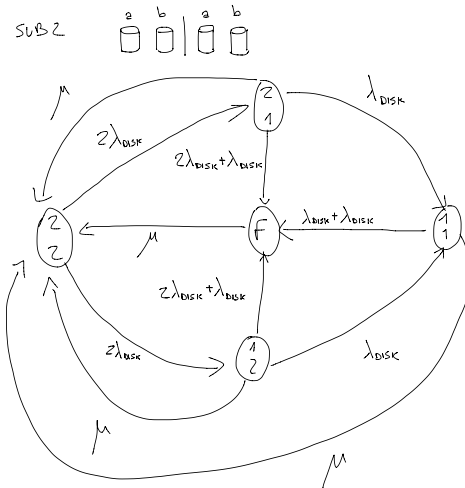$$R = \left(1-(1-R_{SUB1})^2\right)\cdot R_{SUB2}\cdot R_{SUB3}\cdot R_{SUB4}\cdot R_{SUB5}$$

Availability

SUB 1

$$\begin{cases} P'_{3,1}=0 \\ P'_{2,1}=0 \\ P'_{F,1}=0 \\ P'_{3,F}=0 \\ P'_{2,F}=0 \end{cases} \qquad A_{SUB1} = 1-\left(P'_{F,1}+P'_{3,F}+P'_{2,F}\right)$$
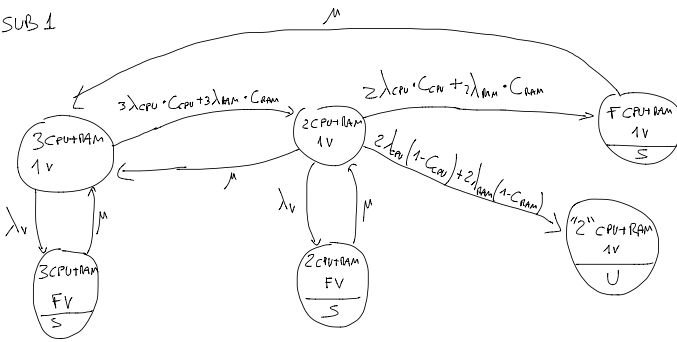
SUB2

SUB3

SUB4

SUB5

$$A = A_{SUB1}\cdot \prod_{h=1}^{5} A_{SUBh}$$

Safety

SUB 1

State diagram (SUB 1):

- $3_{CPU+RAM}\ 1V$
- $2_{CPU+RAM}\ 1V$ / S
- $F_{CPU+RAM}\ 1V$ / S
- $3_{CPU+RAM}\ FV$ / S
- $2_{CPU+RAM}\ FV$ / S
- $2''_{CPU+RAM}\ 1V$ / U

Transitions:
- μ
- $3\lambda_{CPU}\cdot C_{CPU}+3\lambda_{RAM}\cdot C_{RAM}$
- $2\lambda_{CPU}\cdot C_{CPU}+2\lambda_{RAM}\cdot C_{RAM}$
- $2\lambda_{CPU}(1-C_{CPU})+2\lambda_{RAM}(1-C_{RAM})$
- λ_V, μ

$$S_{SUB1} = 1 - P_{2,1,U}$$

$$S = S_{SUB1}\cdot \prod_{i=1}^{\varepsilon} S_{SUBi}$$