Topics Covered in Lecture 28

8-October-2002

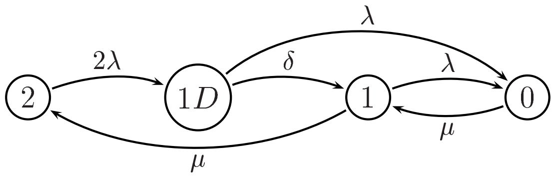
- 

Figure 8.28. Two-component system with fault detection delay

For the above model first consider

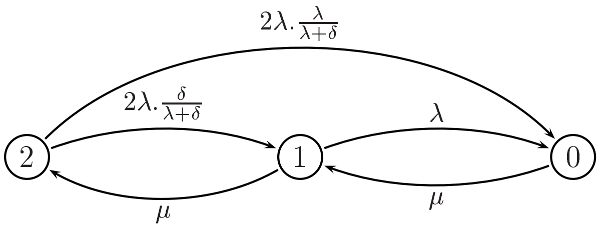
$$\lambda_{eq} = \lambda \left(\frac{2\pi_2}{\pi_2 + \pi_1} + \frac{\pi_1}{\pi_2 + \pi_1} \right)$$

$$\mu_{eq} = \left(\frac{\delta \pi_{1D}}{\pi_{1D} + \pi_0} + \frac{\mu \pi_0}{\pi_{1D} + \pi_0} \right)$$

Since π_2 is most likely to be quite a bit larger than π_1 so $\lambda_{eq} \approx 2\lambda$. Similary since π_{1D} is likely to be quite a bit larger than π_0 and so also $\delta >> \mu$, we can approximate $\mu_{eq} \approx \delta$.
Hence a good approximation to the unavailability is

$$\frac{2\lambda}{2\lambda + \delta} \text{ or even } \frac{2\lambda}{\delta}$$

This makes sense since approximate expected number of faults in an interval of duration T is $2\lambda T$ and per fault most likely we pay a down-time of $1/\delta$.
Another approximation is obtained by taking state $1D$ as a branch point



Observe that $1D$ may not always be a down state, so use a threshold. Remind them about 10sec delay allowed by telecom companies.

- For the example of Fig 8.30, we now introduce imperfect coverage. In this case

$$\lambda_{eq} = \frac{\lambda\pi_1 + 2\lambda(1-c)\pi_2}{\pi_1 + \pi_2}$$

$$\mu_{eq} = \frac{\beta\pi_{1c} + \mu\pi_0}{\pi_{1c} + \pi_0}$$

So, if $(1-c)$ is large enough then $\lambda_{eq} \approx 2\lambda(1-c)$, $\mu_{eq} \approx \beta$ and unavailability is $\approx \frac{2\lambda(1-c)}{\beta+2\lambda(1-c)}$ or even simpler $\frac{2\lambda(1-c)}{\beta}$.
In any case, the coverage factor has quite a bit of influence on system availability.

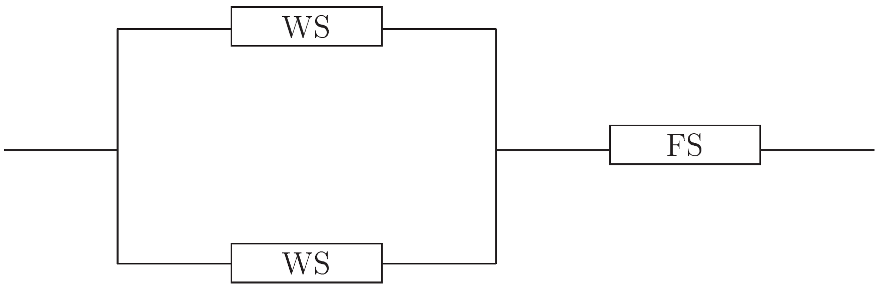
- Next we combine both the delay of detection and imperfect coverage together into a single model.

$$\lambda_{eq} = \frac{2\lambda\pi_2 + \lambda\pi_1}{\pi_2 + \pi_1} \approx 2\lambda$$

$$\begin{aligned} \mu_{eq} &= \frac{\delta c\pi_{1D} + \beta\pi_{1C} + \mu\pi_0}{\pi_{1D} + \pi_{1C} + \pi_0} \\ &\approx \frac{\delta c\pi_{1D} + \beta\pi_{1C}}{\pi_{1D} + \pi_{1C}} \\ &\approx \delta c \end{aligned}$$

$$U \approx \frac{2\lambda}{2\lambda + \delta c} \approx \frac{2\lambda}{\delta c}$$

- Next we return to WFS problem



Consider several cases

- No repair dependence
- Repair dependence only within a subsystem
- Repair dependence across the whole System
  - Priority to FS
  - Priority to WS
  - FCFS