CAPACITY PLANNING
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II GROUP

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Exercise n. 1

Evaluate the reliability and the steady state availability of a system composed of 5 CPUs (working in parallel and whose output is given by a voter), a RAID 1 system with 4 (2+2) disks, 5 bus systems (working in parallel and whose outputs are given by voters), one keyboard, one printer and one monitor, with the hypothesis that the faults happen according to an exponential distribution with rate equal to λ_{CPU}, λ_{DISK}, λ_{BUS}, λ_{KEY}, λ_{MON}, λ_{PRI}, $\lambda_{VOTER\text{-}CPU}$, $\lambda_{VOTER\text{-}BUS}$. A single repair technician for component type is available and the repair rate is equal to μ_{CPU}, μ_{DISK}, μ_{BUS}, μ_{KEY}, μ_{MON}, μ_{PRI}, the single repair technician for component type is able to repair at most 2 components at time.

Exercise n. 2

Evaluate the average response time and throughput for a system composed of 4 servers working in parallel with a finite queue (at most 6 users in the system), with a finite number of users (number of users equal to 8), given that the think time for each user is 10 sec and the service time is 3 sec, assuming that the server can be faulty and repaired, the faults happen with an exponential distribution with rate equal to λ_{server} = 1 fault/24 months and with a repair rate μ_{server} = 1 repair/24 hours.

Exercise n. 3

Design the architecture and the queuing network of a Web site composed of a cluster of 6 identical servers, each server is composed by a CPU and a RAM, working as cache- In case of miss the request is forwarded to a file system composed of 6 CPU and a RAID system composed of 2+2 disks. Each server is connected to the ISP through a router and an FDDI Lan, instead the file system is connected to an EthernetLan, the two Lans are connected through a router. A workload balancer divides in equal parts the load among the servers.

Exercise n. 4

Given the previous system (exercise 3) evaluate the service time of the two Lans (FDDI and Ethernet) for a HTTP request of 500 bytes and for a transfer file, assuming a file of 80.000 bytes.

Exercise n. 5

Given the system of Exercises n.3 and n.4, identify the system bottleneck and the maximum throughput assuming a probability of hit equal to 90% and the following service time, without considering the routers:

- CPU -hit service time: 5 msec
- CUP miss service time: 10 msec
- First Lan HTTP request service time: 2 msec
- First Lan file transfer service time: 5 msec
- CPU_FS: 20 msec
- Disk service time for 20 KB: 5 msec
- Second Lan HTTP request service time: 1 msec
- Second Lan file transfer service time: 2 msec
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