

CAPACITY PLANNING

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Name of the student

Exercise n. 1

Evaluate the reliability, the steady state availability and the safety of a system composed of five CPU (working in parallel and whose output is given by a voter), one RAID 1 system with eight disks, three bus system (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} , $\lambda_{\text{VOTER-CPU}}$, $\lambda_{\text{VOTER-BUS}}$, with covering factors equal to C_{CPU} , C_{DISK} , C_{BUS} , C_{KEY} , C_{MON} , C_{PRI} (the covering factor for the voters is equal to one) and with the same repair rate (μ) for all kind of components. A single "repair technician for component type" is available and the repair rate is independently by the number of fault occurrences of the same type.

N.B. Advice: evaluate each global index analyzing by single subsystem.

Exercise n. 2

Evaluate the average response time, the throughput and the probability of loss of an incoming request for a system composed of a three servers with a finite queue (at most 5 users in the system), with a finite number of users (number of users equal 7), given that the average think time for each user is 10 sec and the average service time is 5 sec, both times are exponentially distributed.

Exercise n.3

A Web site receives 100 requests per second. These requests are served by a cluster of 4 identical servers, composed only by a CPU (CPU-SERVER) with the relative main memory (RAM) acting as a file cache, and by a file server composed by a CPU (CPU-FS) and by 8 disks (all with the same data), all connected to an Ethernet with a bandwidth of 2 GB/sec. The Ethernet is connected to internet by a router (with negligible delay). The average file dimension is of 100 Kbytes, instead the requests have a dimension of 500 bytes. A workload balancer divides in equal parts the load among the servers, even for the eight disk there is a load balancer. In case of hit the request needs 5 ms of CPU, instead in case of miss the request needs of 10 msec of CPU-SERVER, 10 msec of CPU-FS and 10 msec of DISK. The probability of hit is 50%.

Every component type (CPU, DISK, Ethernet, Router) has a MTTF equal to 1.000 hours and a MTTR equal to 1 hours.

You have

- 1) To evaluate the average service time and the average throughput when all the component are fault-free.
- 2) Identify the system performance bottleneck
- 3) To show the methodology to evaluate the average service time when there is the possibility of faults and recoveries.