CAPACITY PLANNING

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Student's name and surname _____

A web site is connected to a 1 Gbps **FDDI**, which is connected to an ISP through a router. The router has a latency of 50μsec/packet and connects the **FDDI** to the ISP through a line of 1,44 Gbps half duplex. The web site is realized with 4 web server connected to the FDDI (each web server is composed of one multicore CPU with 4 cores, a local main memory and one local disk - assume that the local memory contention for the cores is negligible) and with a file server (composed of 3 CPUs working in parallel and whose output is given by a voter, and of a RAID5 with 9 disks). The file server is connected to a 0,5 Gbps **Ethernet** which is connected to the FDDI with a router with a latency of 100μsec/packet. The RAID5 is connected to the CPU of the file system with a direct connection, whose delay is negligible as well as that of the voter.

The HTTP request incoming rate is 100 request/sec. The size of a request is 400 bytes and each request accesses a file with size equal to 240 Kbytes. The load is equally distributed among all web servers. Local main memories and the local disks of web servers are used for caching requested files. The local main memory of a web can host at most 5 files, and a local disk can host at most 10 files. A HTTP requests accesses the i^{th} file with distribution probability $p(i)= K/i^{\alpha}$ with $\alpha = 1$. Totally, there are 100 files and are accessed in only-read mode.

The CPU service demand for each HTTP request is 5 msec if the file is stored in the local main memory, 10 msec if the file is stored in the local disk and 30 msec in the case of miss (the file is only in the file server). The CPU service demand of the file server for each request is 10 msec, and the service time of the each single disk for 20 Kbytes is 10 msec (this value is the same either in the local disks as well as in the RAID5 disks).

Compute the average response time in case all the components are fault-free and identify the system bottleneck.

Moreover, evaluate the ***safety*** of the system hypothesizing the following parameters (the system can work even in degraded mode):

- MTTF (MTTR) for the CPU with its main memory: 3 years (1 week)
- MTTF (MTTR) for the Ethernet and the Token ring: 6 years (2 weeks)
- MTTF (MTTR) for each disk: 1 year (3 weeks)
- MTTF (MTTR) for the routers: 6 year (1 week)

Hypothesize that the coverage factor is the same for all kind of components and is equal to ***C*** either for fault identification and for fault recovery.

Finally identify all the acceptable configurations and show the methodology to evaluate the average response time given the presence of faults and reparations.