Performance Evaluation of Computer Systems
Part B

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The Intranet of a medium scale company consists of three servers, namely A, B and C, which represent the web server of the clients, the application server and the database server, respectively. The intranet is modelled by an open queueing network. In order to evaluate the performance of the system a 10 minutes monitoring phase has been performed. The following data have been collected:

C_B	Server B number of completions	150
C_C	Server C number of completions	300

C	Network (intranet) completions	100

B_B	Server B busy time	300s
B_C	Server C busy time	100s

It is also known that the maximum throughput achievable by the intranet is 0.2 trans/sec.

Compute:

a) (1 pt) the service demands of all the servers and determine the server which should be upgraded to achieve the maximum gain of the network performance

b) (1 pt) the utilizations of all the servers

c) (1 pt) the number of visits at server B

d) (1 pt) the residence time of server A and the number of requests in A

e) (3 pt) the minimum number of identical web servers to put in parallel such that the residence time at the web server layer is less than 18 seconds. Assume that incoming requests are uniformly distributed across the web servers.

Consider the closed queueing network composed of servers A, B and C and a delay with Z=10s and the same service demands of the open queueing network without considering the servers added at point e).

f) (2 pt) Represent the asymptotic bound X(N) and R(N) on system throughput and response time varying the population size N

g) (2 pt) What is the maximum value of N which guarantees that the response time is less than 40 sec?

h) (4 pt) Compute the exact value of the system throughput and response time when it is N=3.

Soluzioni:

1) Db=300/100=3; Dc=100/100;
Dato che Xmax<min {1/Db, 1/Dc} ne segue che Dmax=Da=5, bottleneck a.

b) Ua= 5*100/600=0.833; Ub= 3/6=0.5; Uc= 1/6=0.1667;

c) Vb=Cb/C= 150/100=1.5

d) Ra=Da/(1-Ua)=30 sec, Qa=Ua/(1-Ua)=5

e) Si ha che Da/(1-Da lambda/n) <18, sse n>18 lambda Da /(18 -Da) = 15/13 => n=2

f) bounds

g) massimo=40/D=40/9=> N=4

h)
X(1)=0.11111, R(1)=9
X(2)=0.15517, R(2)=12.88888
X(3)=0.17575, R(3)=17.06896