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i) Find link rate first  $\Rightarrow \frac{\text{link}}{5 \text{ mil b/s}} = \frac{375 \text{ k bits}}{5 \text{ mil b/s}} = 0.075 \text{ sec}$

Traffic intensity  $\Rightarrow \frac{\text{req. per min}}{60} \times \text{link rate} = \frac{120}{60} \times 0.075 = 0.15$   
(Sometimes TB is already given)

Average access delay  $\Rightarrow \frac{T}{(1-TB)} = \frac{0.075}{(1-0.15)} = 0.088235 \text{ seconds}$

Total access time delay  $\Rightarrow 0.088235 + 2 + 4 = 6.088235 \text{ seconds}$

ii) New Access link delay  $\Rightarrow \frac{T}{(1-TB)} = \frac{0.075}{1 - (0.4)(0.15)} = 0.07979 \text{ seconds}$

If cache miss  $\Rightarrow 0.07979 + 2 + 4 = 6.07979 \text{ seconds}$

If cache hit  $\Rightarrow (0.6)(0) + (0.4)(6.07979) = 2.431916 \text{ seconds}$

iii)  $T = \frac{375 \text{ k}}{10 \text{ mil}} = 0.0375 \text{ seconds}$

$TB = \frac{(20 \times 0.7)}{60} (0.0375) = 0.0525$

$TB = \frac{(20 \times 0.3)}{60} (0.0375) = 0.0225$

delay =  $\frac{0.0375}{1-0.0525} = 0.039578 \text{ seconds}$

delay =  $\frac{0.0375}{1-0.0225} = 0.03836$

Total time =  $0.039578 \times 0.3 + 0.03836 \times 0.7 + 6$

$= 6.0387254 \text{ seconds}$

