ZKM-Z1

1) ALOHA

$N = 100$

$\Lambda = 10$ okv./s

$L = 1000$ bita

b) $G = \Lambda \cdot P$

$P = \frac{L}{R} + T_{max} = \frac{10^4}{10^6} + 0.2 \cdot 10^{-} = 1.2 \cdot 10^{-3}$ s

$G = 10 \cdot 1.2 \cdot 10^{-} = 0.012$

c) $S = G \cdot e^{-2G} = 0.0117$

d) $N_p = e^{2G-1} = 0.024$

$N_p + 1 = 1.024$

e) $k = 9$

, ovo ne idetu jer smo ga u P stavili

$T = \underbrace{(e^{2G} - 1)}_{N_r} \cdot (P + \overline{B}) + P + T_{max} = 1.544 \cdot 10^{-3}$ s

2.) Slotted Aloha

$N = 100$

$\lambda = 100$ okvira/s

$R = 1$ Mbit/s

$L = 1000$ bita

a) $P = \frac{L}{R} = 10^{-3}$ s ✓

$P/2 = 0.5 \cdot 10^{-3}$ s → srjednje u spremniku

b) $T_{max} = 200\,\mu$s $\qquad G = \lambda \cdot P = 0.1$

$k = 9$

$T_{odgode} = P + rP + (k-1)P/2 =$

$= rP + \frac{k+1}{2} P$

$r = \left\lceil \frac{2T}{P} \right\rceil = \lceil 0.4 \rceil = 1$

$T_0 = 6 \cdot 10^{-3}$ s

$N_r \cdot T_0 = (e^G - 1) \cdot T_0 = 0.631 \cdot 10^{-3}$ s

c) $\tau_{SR} = 100\,\mu s$ (slijedeće kašnj.)

$T_{uk} = \frac{3\tau}{2} + N_r \cdot T_{odg} + \tau_{ST} = 2.231 \cdot 10^{-3}\,s$

(ili P (ne vidi) — ne koristi se formula $\frac{\tau_{max}}{3}$ jer nam je zadano τ_{ST} direktno)

d) $S = G \cdot e^{-G} = 0.0905$

$P = e^{-G} = 0.905$

e) $S_{max} = G_{max} \cdot e^{-G_{max}} = e^{-1} = 0.368$ ✓

$S_{max} = M \cdot \lambda_{max} \cdot P = 0.1 \cdot \lambda_{max}$

$\lambda_{max} = \frac{S_{max}}{0.1} = 3.679$ obr./s ✓

(10)

3.) M = 20 stanica ✓

$E = 2\ bit/s/Hz$

$B = 5\ MHz$ $\quad R = B \cdot E = 10\ Mbit/s$

$L = 1000$ bita

$\lambda = 100$ okv/s

$\tau = 10\ \mu s$

a) $S = M \cdot \lambda \cdot \overline{X} = M \cdot \lambda \cdot \frac{L}{R} = 0.2$

b) $\lambda_{max} = \frac{1}{M\overline{X}} = 500$ okv./s

c) $\overline{T_c} = M \cdot \overline{X} + \frac{M\overline{X} \cdot S}{2(1-S)} = 2.25 \cdot 10^{-3}$ s

$T_{uk} = T + \tau = 2.26 \cdot 10^{-3}$ s //

d) $T_{TDMA} = \frac{M\overline{X}}{2(1-S)} + \overline{X} = 1.35 \cdot 10^{-3}$ s

$T_{uk} = T + \tau = 1.36 \cdot 10^{-3}$ s //

e) $T_{FCA} = \overline{X} + \frac{S(\overline{X})}{2(1-S)} = 0.1125 \cdot 10^{-3}$ s

$T_{uk} = T + \tau = 0.1225 \cdot 10^{-3}$ s

S → mijek mora biti < 1 ?

4.) CSMA / CD

$M = 20$

$R = 20$ Mbit/s

$L = 1000$ bita

$\tau_{max} = 10\ \mu s$

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a) min. vrij. potrebno za razr. kolizije $\forall$ stan.

$t_{kolizije} = 2 \cdot \tau_{max}\ min = 53\ \mu s$

$\lambda_{min} = \frac{1}{\nu_{max}}$

$\nu_{max} = \left(1 - \frac{1}{N}\right)^{N-1} = 0.377$

b) $t_{v\,min} = \frac{L}{R} + \tau_m + 2 \cdot \tau_m \cdot \lambda_{min} = 163\ \mu s$

c) $\lambda_{max} = \frac{1}{t_{v\,min}} \approx 6135$ okv./s

d) $p = 0.5$

$\mu = 20 \cdot 0.5\ (1 - 0.5)^{\overbrace{N-1}^{19}} = 0.019 \cdot 10^{-3}$

$t_v = \frac{L}{R} + \tau_m + 2\tau_m \cdot \frac{1}{\nu} = 1.048626$ s

c) $\lambda = s = \frac{P}{\frac{L}{R}} = \frac{P \cdot \frac{1}{1 \cdot \frac{2}{}}}{L} = 6083 \text{ ok./s}$

$a = \frac{\frac{T}{L}}{m} = 0.1$

$s = \frac{\frac{1}{L}}{R} = \frac{R}{L} = 10^4 \text{ okula/s} \Rightarrow$ to je teoretski max

↓

onda ovo max

(1 stanica 1 za drugom šalje okire