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CMSC-611[ACA] Home-Work 4

1. Worst-case remote connection cost for 64 processors.
    a. 64 processors arranged a as a ring: largest number of communication hops = 32 communication cost = (100 + 10*32) ns = 420 ns.
    b. 64 processors arranged as 8x8 processor grid: largest number of communication hops = 14 communication cost = (100 + 10*14) ns = 240 ns.
    c. 64 processors arranged as a hypercube: largest number of hops = 6 ($\log_2 64$) communication cost = (100 + 10*6) ns = 160 ns.

2. Overall power infrastructure efficiency improvements after using per server battery backup.

    Calculating efficiency prior to UPS:

    99.7% * 98% * 98% * 99% = 94.70%

    A facility wide UPS is 92% efficient

    So, total efficiency is 94.70% * 92% = 87.21%

    A battery is 99.99% efficient

    94.70% * 99.99% = 94.78% efficient

    Overall efficiency improvements from using per-server battery backup is 7.57%

3. Given: Cluster of server cost $2000 each

    Annual failure rate 5%

    Replacement parts cost 10% of the server

    100$/ hr. for a service technician

    we obtain a $300 cost for fixing each server

    With a 5% failure rate, there is $15 annual maintenance cost per server.