

Instructions

Print this out, grab scissors and glue.

Then give all of that to your (or someone else's) kids*. After a couple of iterations, fancy SRE flash cards should magically appear on your desk.

*Danger! Make sure kids RTFM on scissors.

**Power of Two
1 KB?**

$$1 \text{ KB} = 2^{10} \text{ bytes}$$

**Power of Two
64 KB?**

$$64 \text{ KB} = 2^{16} \text{ bytes}$$

**Power of Two
1 MB?**

$$1 \text{ MB} = 2^{20} \text{ bytes}$$

**Power of Two
1 GB?**

$$1 \text{ GB} = 2^{30} \text{ bytes}$$

**Power of Two
4 GB?**

$$4 \text{ GB} = 2^{32} \text{ bytes}$$

**Power of Two
1 TB?**

1 TB = 2^{40} bytes

**Time
L1 Cache Reference**

0.5 ns

**Time
Branch Mispredict**

5 ns

**Time
L2 Cache Reference**

**7 ns
(14x L1)**

**Time
Mutex lock/unlock**

100 ns

| | |
|--|-------------------------------------|
| Time Main Memory Reference | 100 ns (20x L2, 200x L1) |
| Time Compress 1 KB with Zippy | 10,000 ns 10 us |
| Time Send 1 KB over Gbit network | 10,000 ns 10 us |
| Time Read 4 KB randomly from SSD | 150,000 ns 150 us |
| Time Read 1 MB sequentially from memory | 150,000 ns 150 us |

| | |
|--|--|
| Time Read 1 MB sequentially from memory | 250,000 ns 250 us |
| Time Round trip within same datacenter | 500,000 ns 500 us |
| Time Read 1 MB sequentially from SSD | 1 ms (4x memory) |
| Time Disk seek | 10 ms (20x data center roundtrip) |
| Time Read 1 MB sequentially from Gbit network | 10 ms (40x memory, 10x SSD) |

| | |
|--|---|
| Time Read 1 MB sequentially from disk | 30 ms (120x memory, 30x SSD) |
| Time Round trip CA-AMS-CA | 150 ms |
| Power of ten? ns / us / ms | ns = 10⁻⁹ s us = 10⁻⁶ s ms = 10⁻³ s |
| Speed Read sequentially from disk | 30 MB/s |
| Speed Read sequentially from Gbit network | 100 MB/s |

**Speed
Read sequentially
from SSD**

1 GB/s

**Speed
Read sequentially
from memory**

4 GB/s

**Speed
World-wide round trips
per second?**

**6-7 world-wide round trips
per second**

**Speed
Round trips within
same data center
per second?**

**2,000 round trips within
same data center
per second**