6.897
L17.1
Apr. 28, 2003

External-memory sorting

- $\Theta(\frac{N}{B} \log_{M/B} \frac{N}{B})$ memory transfers in comparison model [Aggarwal & Vitter 1988]
- $\Theta(\min\{\frac{N}{B} \log_{M/B} \frac{N}{B}, N\})$ just to permute elements according to given permutation, in indivisible model [same ref] (more general)

OPEN: can you sort or permute faster if elements are divisible e.g. integers?

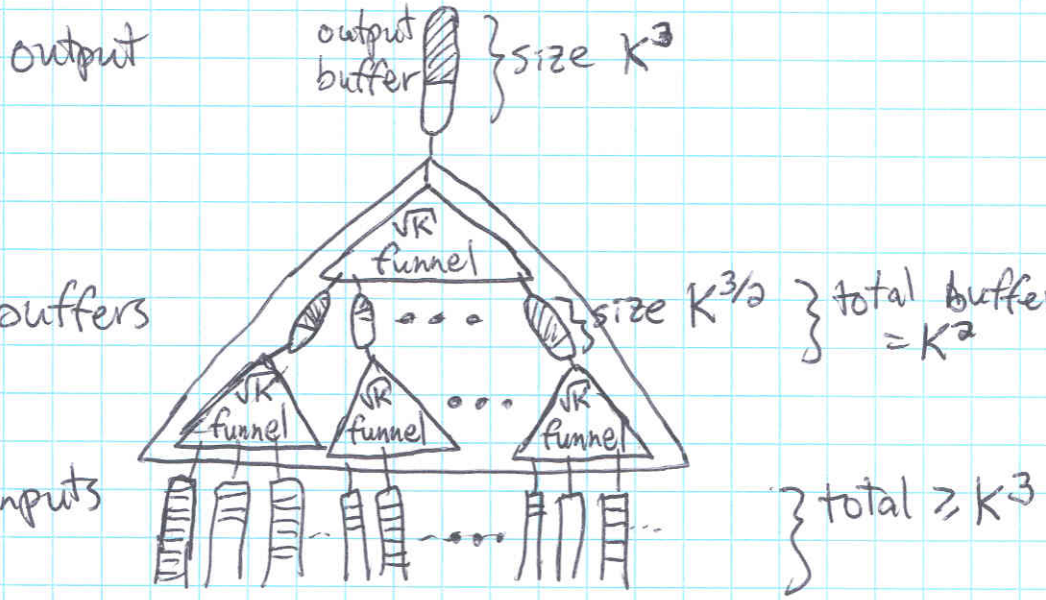
Cache-oblivious sorting

[Frigo, Leiserson, Prokop, Ramachandran 1999]
[Brodal, Fagerberg – ICALP 2002]

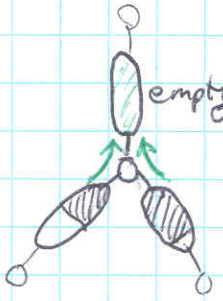
- need an additional assumption: [Brodal, Fagerberg – STOC 2003]

Tall-cache assumption: $M = \Omega(B^{1+\gamma})$ for some (known) $\gamma > 0$
e.g. $M = \Omega(B^2)$. [cache taller than it is wide]

K-funnel: merges K sorted lists of total size $\geq K^3$ using $O(\frac{K^3}{B} \log_{M/B} \frac{K^3}{B} + K)$ memory transfers



- recursive layout: each △ stored in consecutive chunk of memory
- to fill a buffer (entirely):
  - merge the two children buffers as long as both nonempty
  - child buffer empties ⇒ recursively fill it
  - leaf reads directly from input lists



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