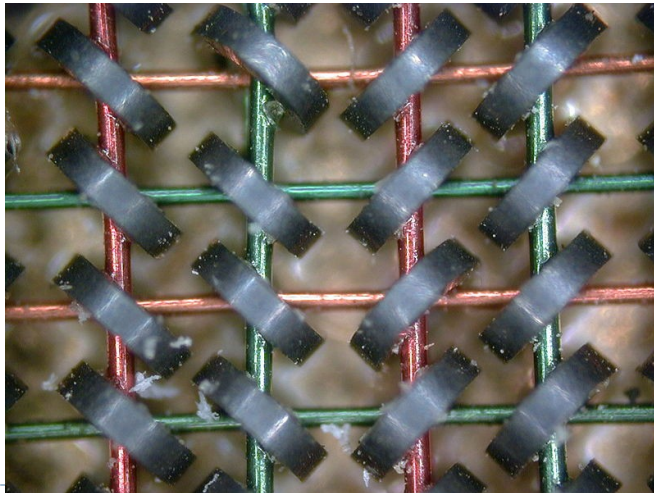
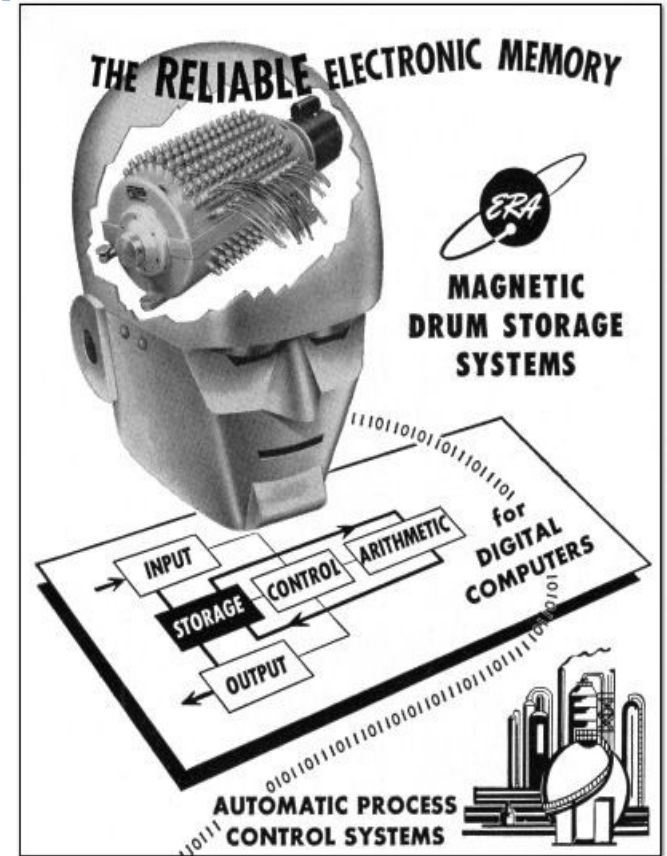


Review of
The Structure of the
“THE”-Multiprogramming System

Edsger W. Dijkstra
Technological University, Eindhoven, The Netherlands
Communications of the ACM, 11(5):341--346, 1968

Presented by Nathan Collins
CS 533, Winter 2011, PSU

Once Upon a Time ...



Theme

Abstraction Is Good

Abstraction in THE

- ▶ R & D philosophy
- ▶ Layered architecture
- ▶ Processes
- ▶ Virtual memory

R & D Philosophy

- ▶ Innovation
- ▶ Abstraction
- ▶ Meta cognition

Layered Architecture

Level 4 - User Programs
Level 3 - I/O
Level 2 - Message Interpreter
Level 1 - Pager
Level 0 - Scheduler

“[...] and at level 5 the operator (not implemented by us).”

Process Abstraction

- ▶ Virtual computers
- ▶ Don't care about speed, just progress
- ▶ Mutex and condition synchronization

Virtual Memory

- ▶ Above level 2 all addresses are virtual
- ▶ Page (“segment”) based
- ▶ LRU swapping to drum
- ▶ Software based

Verification of THE

- ▶ Proof of “harmonious cooperation”
- ▶ Exhaustive testing of implementation

Harmonious Cooperation

- ▶ Layers delegate to lower layers
- ▶ Requests cause finitely many delegations
- ▶ All requests complete

Exhaustive Testing

- ▶ One layer at a time
- ▶ All “relevant” cases considered

Other References

- ▶ **Images:** <http://www.science.uva.nl/museum/X1.html>,
http://www.vintagecomputing.com/wp-content/images/retroscan/era_drum_memo
, http://today.slac.stanford.edu/images/2008/Magnetic_core-lg.jpg
- ▶ **Slides: Rachel Cool's from last year's class:**
<http://web.cecs.pdx.edu/~walpole/class/cs533/winter2010/home.html>
- ▶ *Operating System Concepts* by Abraham Silberschatz and James L. Peterson (7th Ed.)
- ▶ **Wikipedia:**
https://secure.wikimedia.org/wikipedia/en/wiki/THE_multiprogramming_system