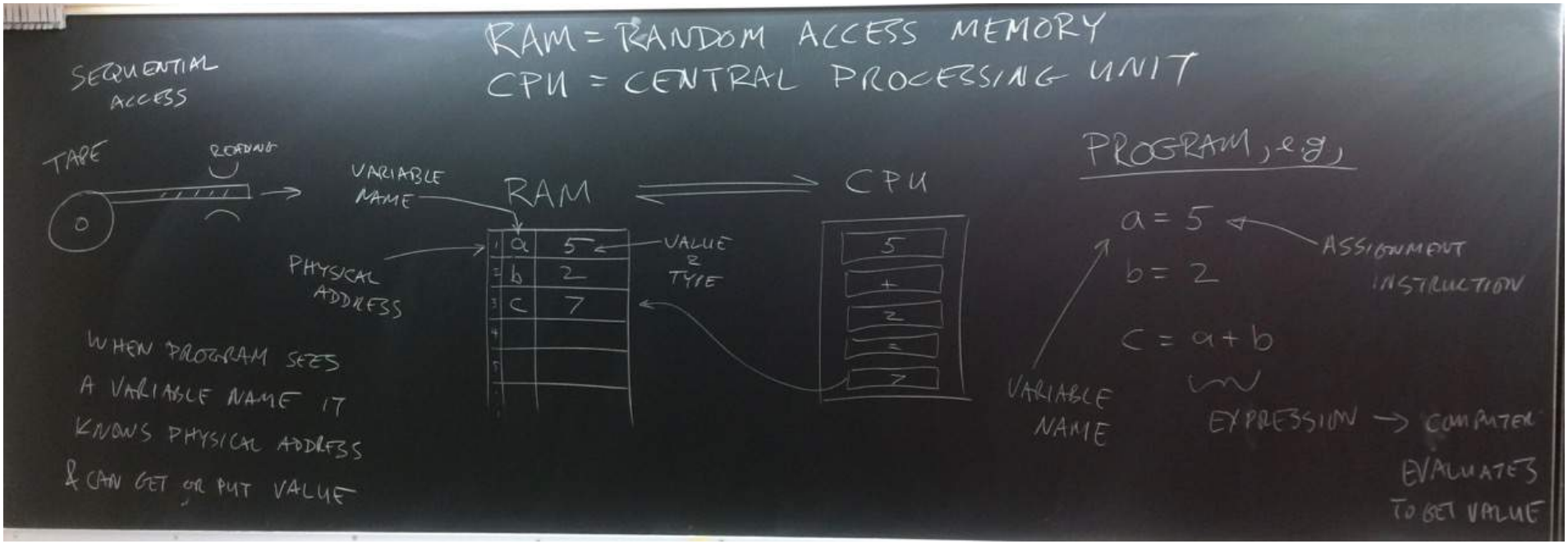
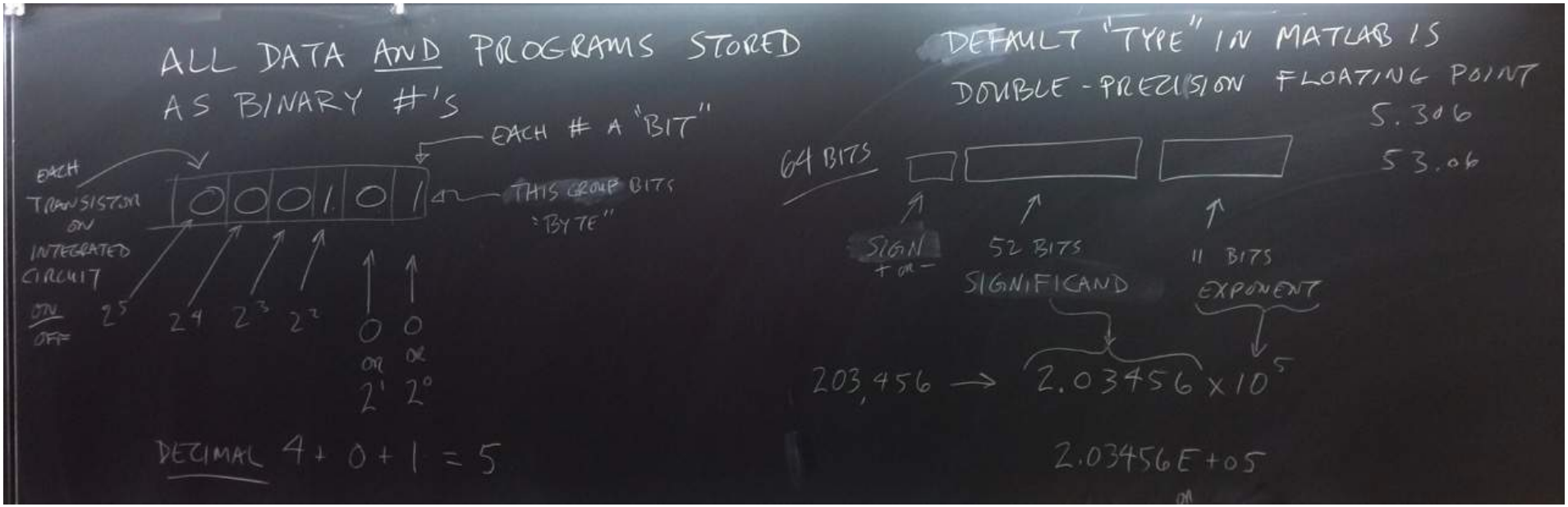
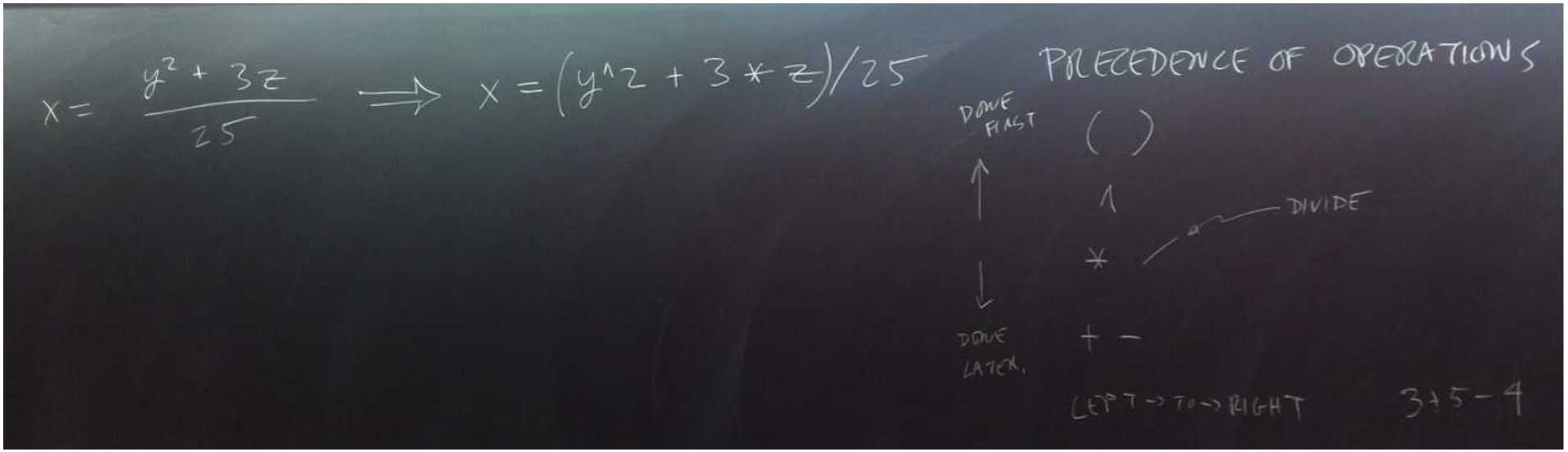

RAM = RANDOM ACCESS MEMORY
CPU = CENTRAL PROCESSING UNIT
SEQUENTIAL ACCESS
TAPE
READING
VARIABLE NAME
RAM
CPU
PHYSICAL ADDRESS
VALUE & TYPE
WHEN PROGRAM SEES A VARIABLE NAME IT KNOWS PHYSICAL ADDRESS & CAN GET OR PUT VALUE
PROGRAM, e.g.
a = 5
ASSIGNMENT INSTRUCTION
b = 2
c = a + b
EXPRESSION → COMPUTER EVALUATES TO GET VALUE
VARIABLE NAME


ALL DATA AND PROGRAMS STORED AS BINARY #'S
EACH # A "BIT"
EACH TRANSISTOR ON INTEGRATED CIRCUIT
ON
OFF
0 0 0 1 0 1
THIS GROUP BITS "BYTE"
2^5 2^4 2^3 2^2 0 or 2^1 0 or 2^0
DECIMAL 4 + 0 + 1 = 5
DEFAULT "TYPE" IN MATLAB IS DOUBLE-PRECISION FLOATING POINT
5.306
53.06
64 BITS
SIGN + OR −
52 BITS SIGNIFICAND
11 BITS EXPONENT
203,456 → 2.03456×10^5
2.03456E+05


$x = \frac{y^2 + 3z}{25} \Longrightarrow x = (y\hat{}2 + 3 * z)/25$
PRECEDENCE OF OPERATIONS
DONE FIRST
( )
^
*
DIVIDE
+ −
DONE LATER.
LEFT -> TO -> RIGHT
3+5-4

Each binary digit or "bit" of information is stored as the binary state of a small physical memory device. For example, the on-or-off state of a transistor could represent 1-or-0. Here is a cartoon from ReactorLab.net, Resources, Matlab, More Notes, Intro to Computing.

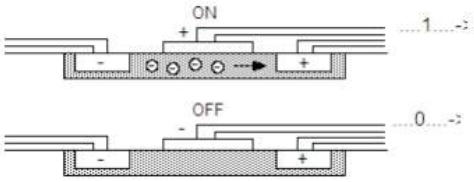
http://reactorlab.net/resources/matlab/more-notes/

Physical representations of BITS

Value of a **BIT**, **0** or **1**, can be represented **physically** as:

Switch: OFF or ON

transistor in CPU and RAM:



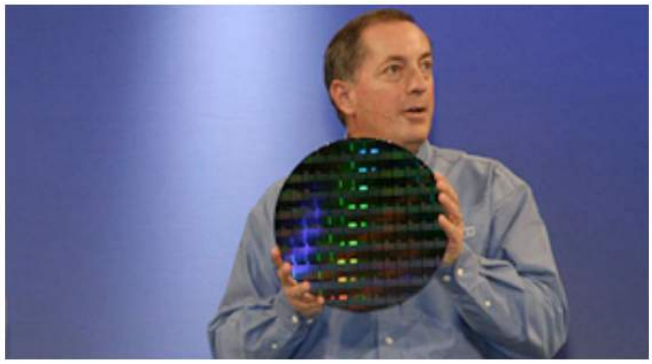
The circles with minus signs in them in the top figure represent electrons flowing in the silicon material on top of which the transistor is formed. The other plus and minus signs represent electrical voltages. Notice especially the plus sign near "ON" in the top figure and the minus sign near "OFF" in the lower figure.

See other figures in the notes for other methods of storing bits.

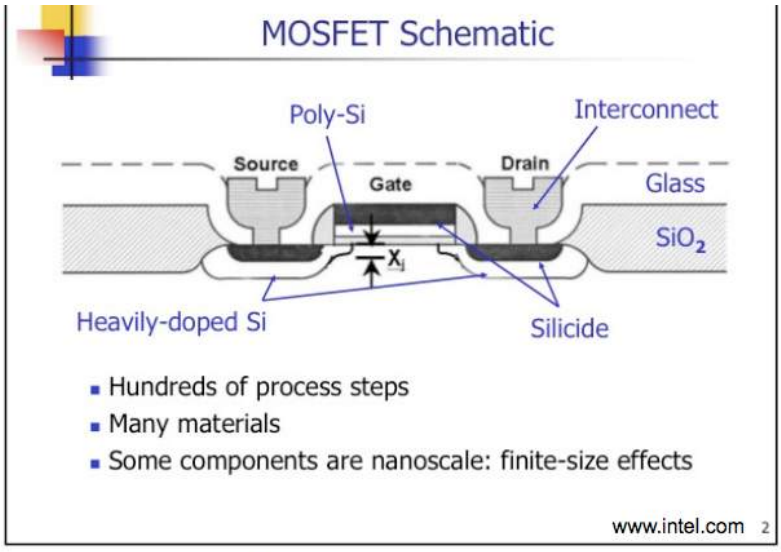
Slides below are posted at ReactorLab.net, Resources, Grad CRE Notes, Chemical Vapor Deposition (CVD), Intro to CVD – general overview in photos (CRE = Chemical Reaction Engineering)

http://reactorlab.net/resources/grad-cre-notes/

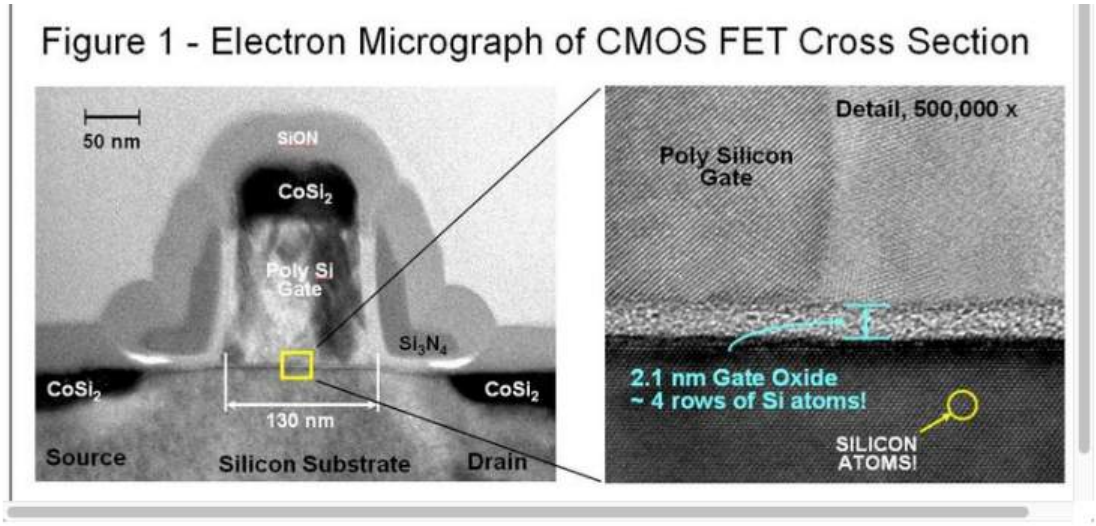
Intro to Chemical Vapor Deposition (CVD) in Semiconductor Fabrication



Paul Otellini, Intel CEO and President (ca. 2012) is holding a 300 mm-diameter wafer of single-crystal Si that has been patterned with hundreds of identical integrated circuits. CVD is one process used in the production of the circuits.



This is an enlarged cross section of a transistor circuit as a thin pattern of materials on the surface of a wafer. The horizontal dimension is on the order of 100's of nm. To the bottom is the bulk of the Si wafer. Layers such as SiO2 and polycrystalline Si are grown on the wafer and then patterned by photolithography. See Intel's From Sand to Silicon, The Making of a Chip <http://newsroom.intel.com/docs/DOC-2476>. Paper, colored ink and printing are to magazines as are Si wafers, elements such as B and P, and photolithography are to integrated circuits.



This is an enlarged cross section of a transistor circuit as a thin pattern of materials on the surface of a wafer. The horizontal dimension is on the order of 100's of nm. To the bottom is the bulk of the Si wafer. Layers such as SiO2 and polycrystalline Si are grown on the wafer and then patterned by photolithography. See Intel's From Sand to Silicon, The Making of a Chip <http://newsroom.intel.com/docs/DOC-2476>. Paper, colored ink and printing are to magazines as are Si wafers, elements such as B and P, and photolithography are to integrated circuits.