Lecture6: MOSFET

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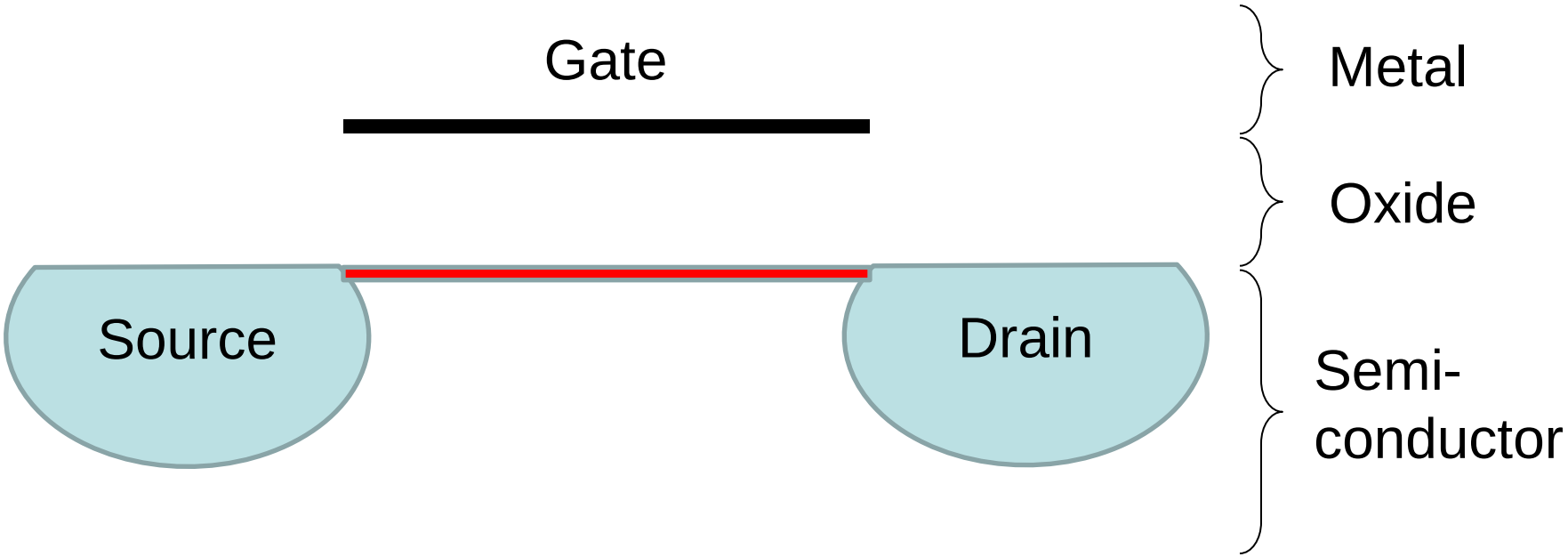
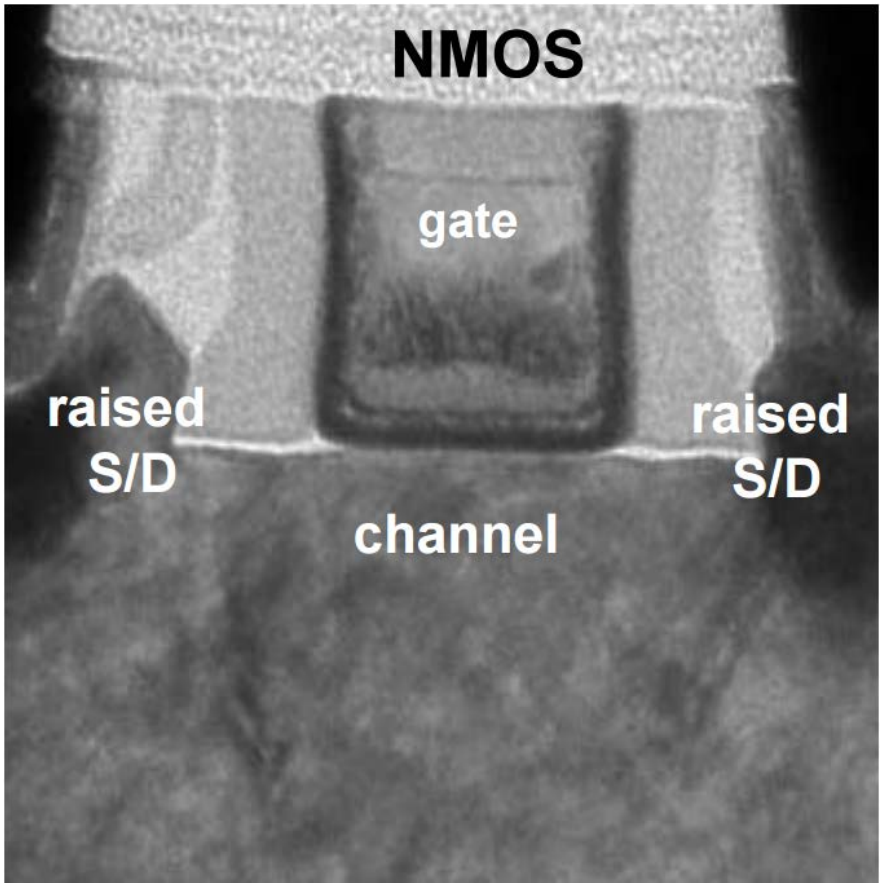
MOSFET

- Vertical structure
  - Metal-Oxide-Semiconductor
- Terminals
  - Gate, Source, Drain, (and substrate)



Actual device

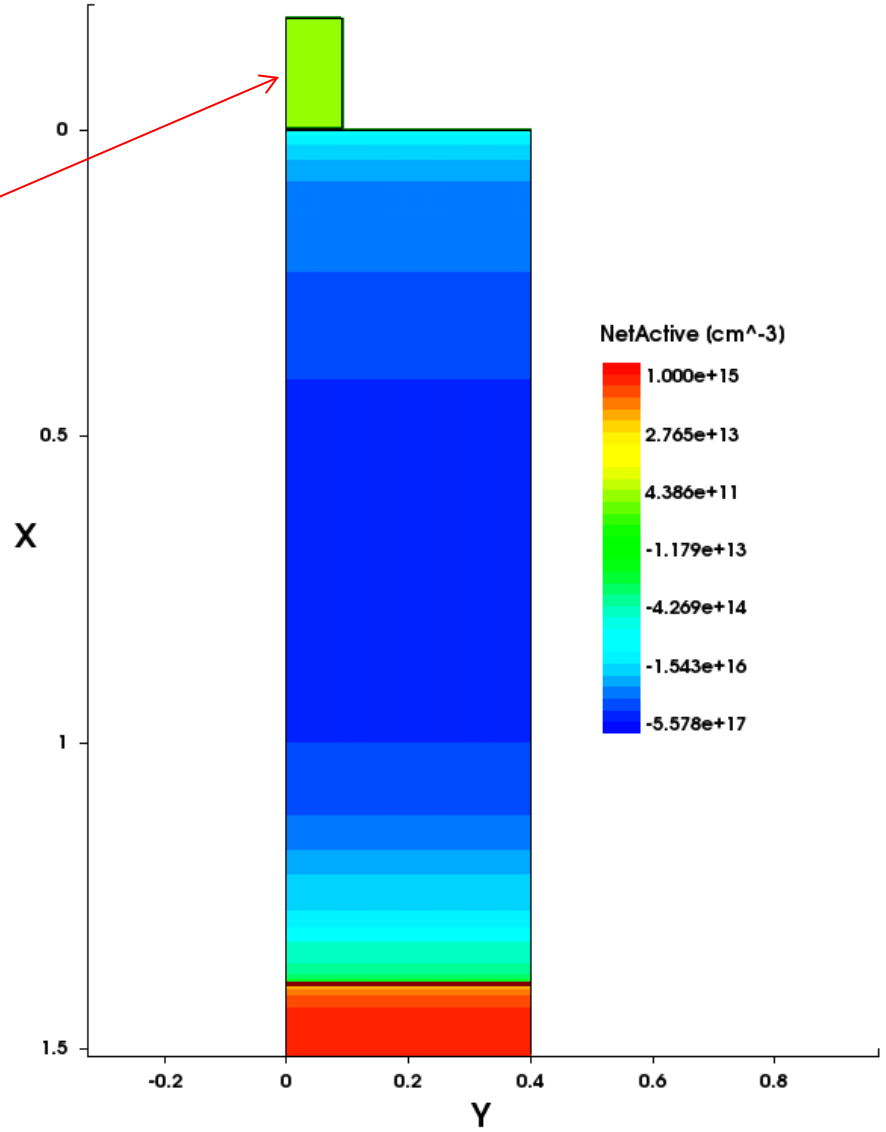
- TEM image of a MOSFET
  - 32nm node
  - (somewhat old…)



(Packan et al., IEDM 2009)

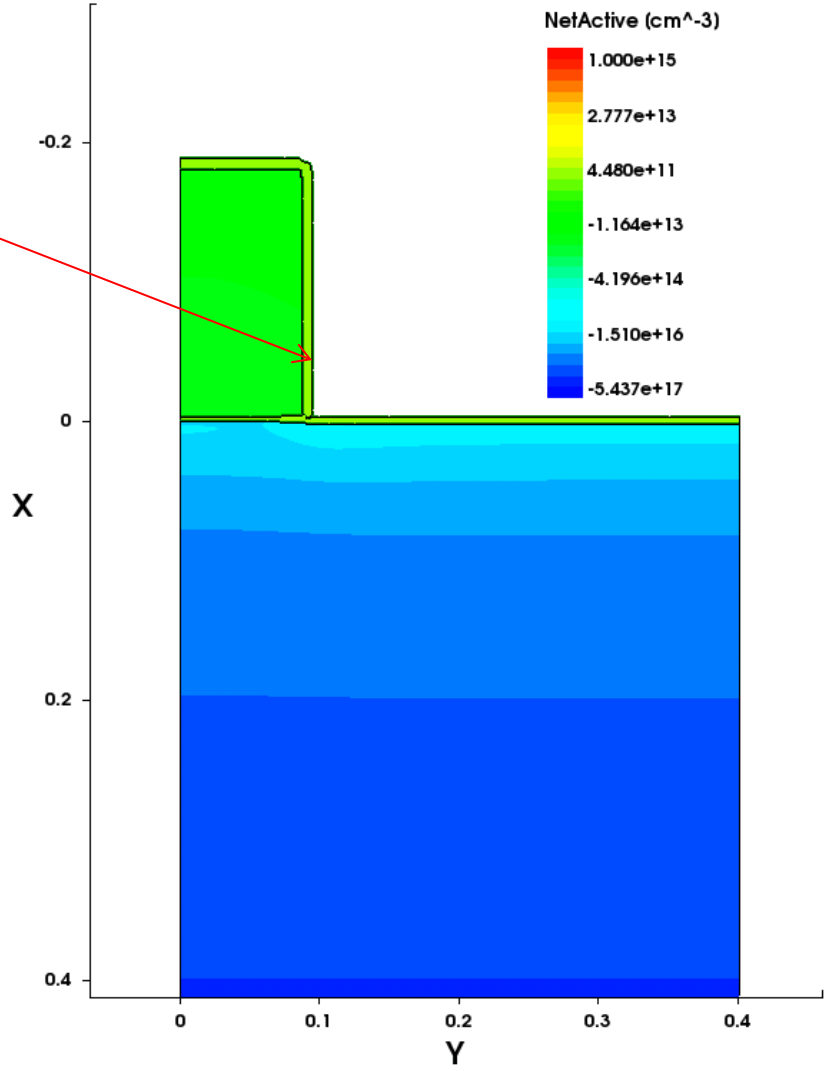
How to fabricate it (1/6)

- 0.18 μm NMOSFET
  - P-well formation
  - Gate oxidation
  - Gate definition
  - (Half structure is shown.)



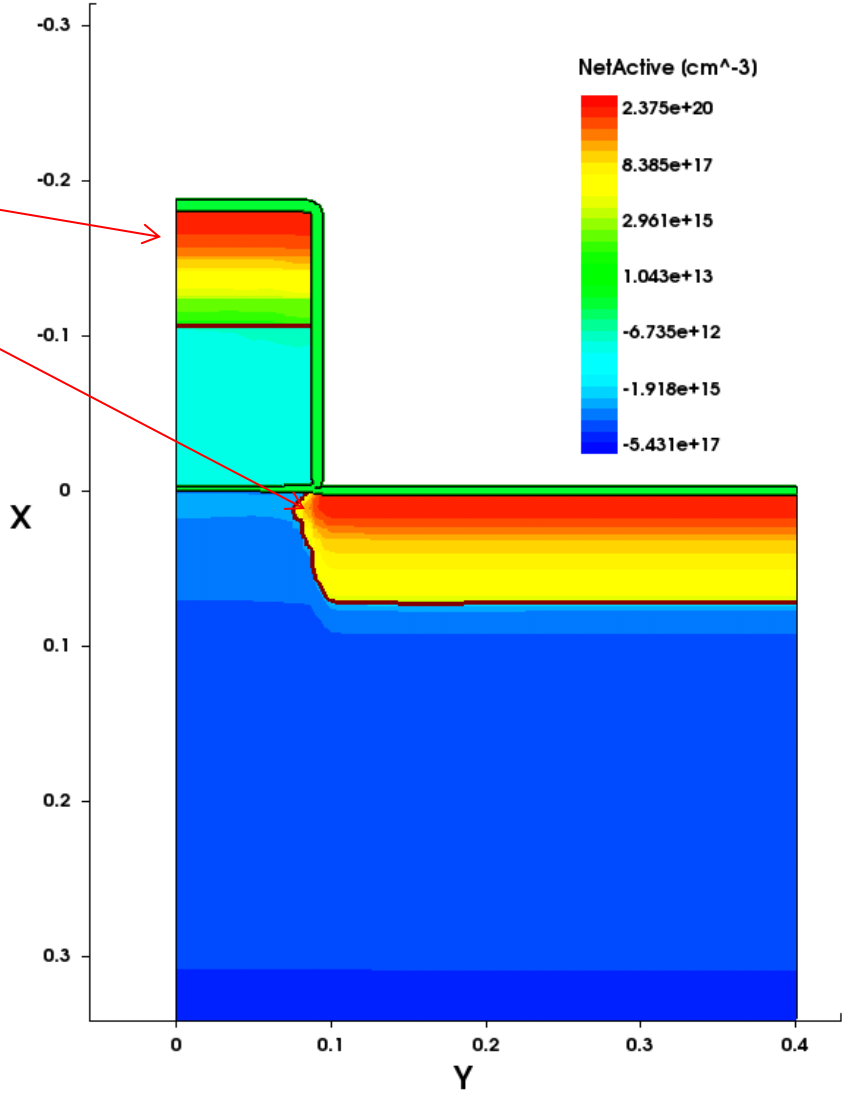
How to fabricate it (2/6)

- 0.18 μm NMOSFET
  - Gate re-oxidation



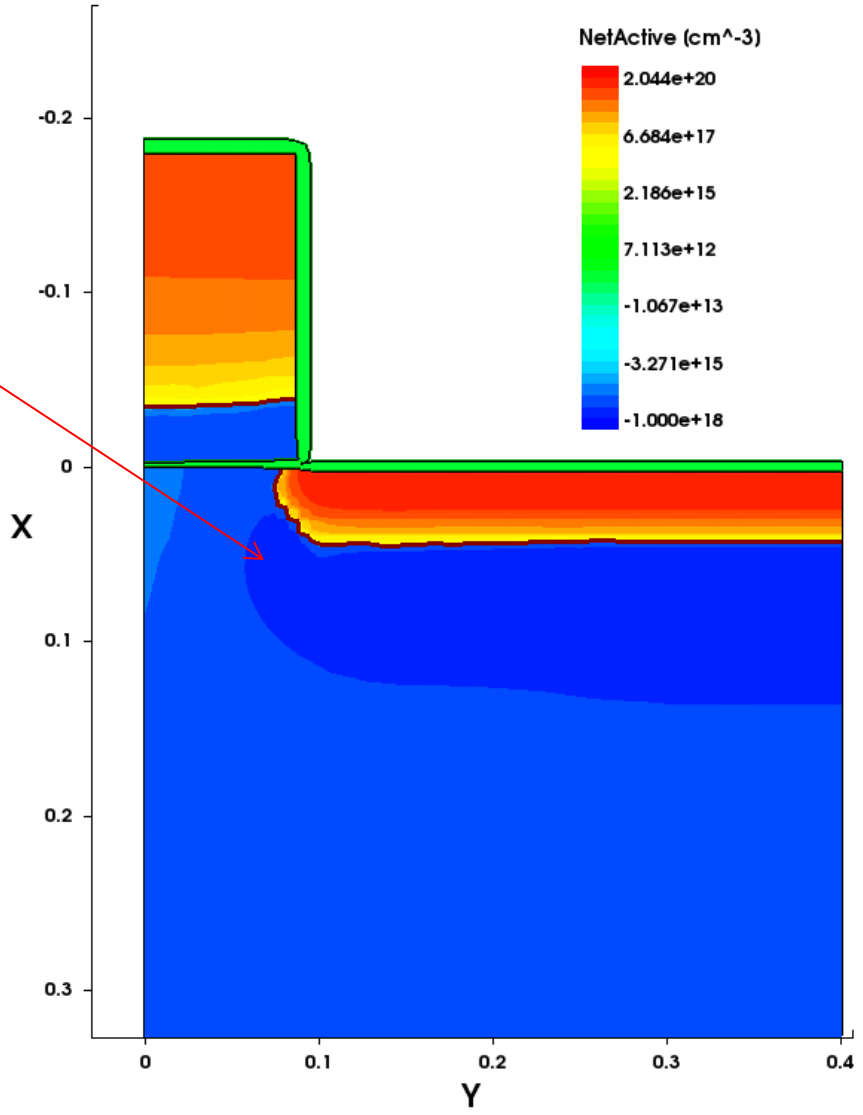
How to fabricate it (3/6)

- 0.18 μm NMOSFET
  - LDD implant



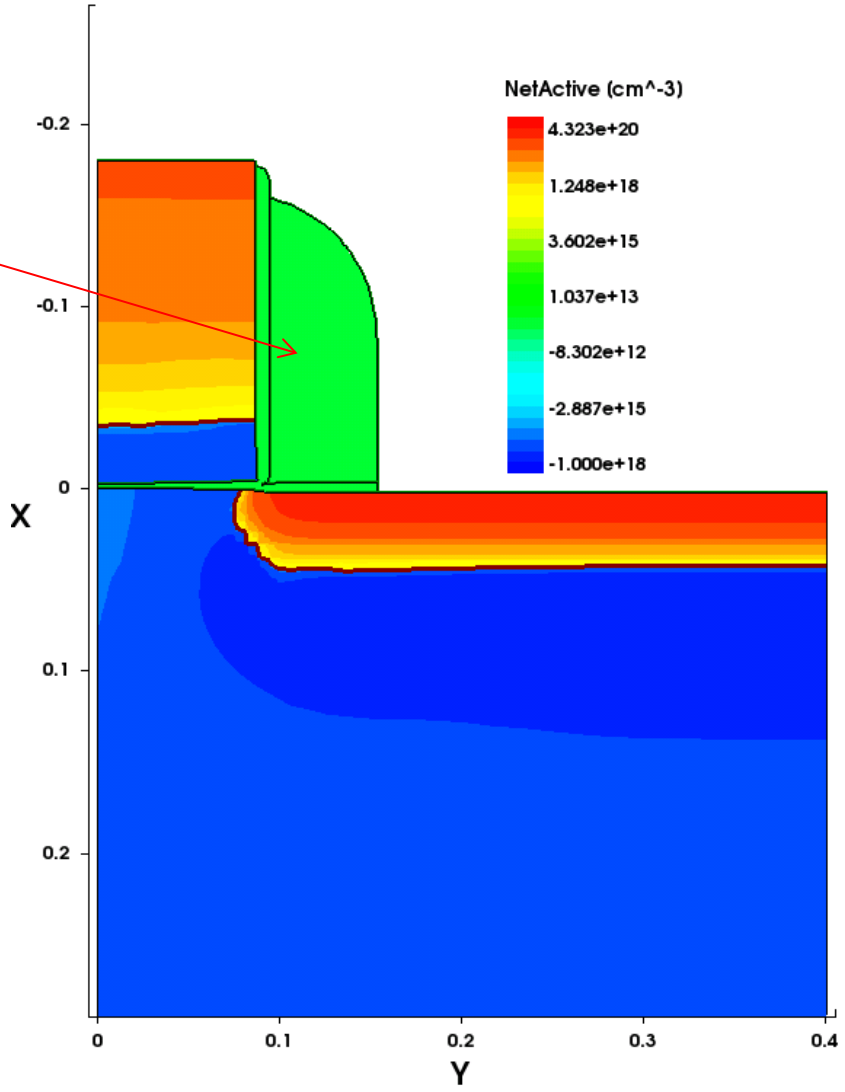
How to fabricate it (4/6)

- 0.18 μm NMOSFET
  - Halo implant



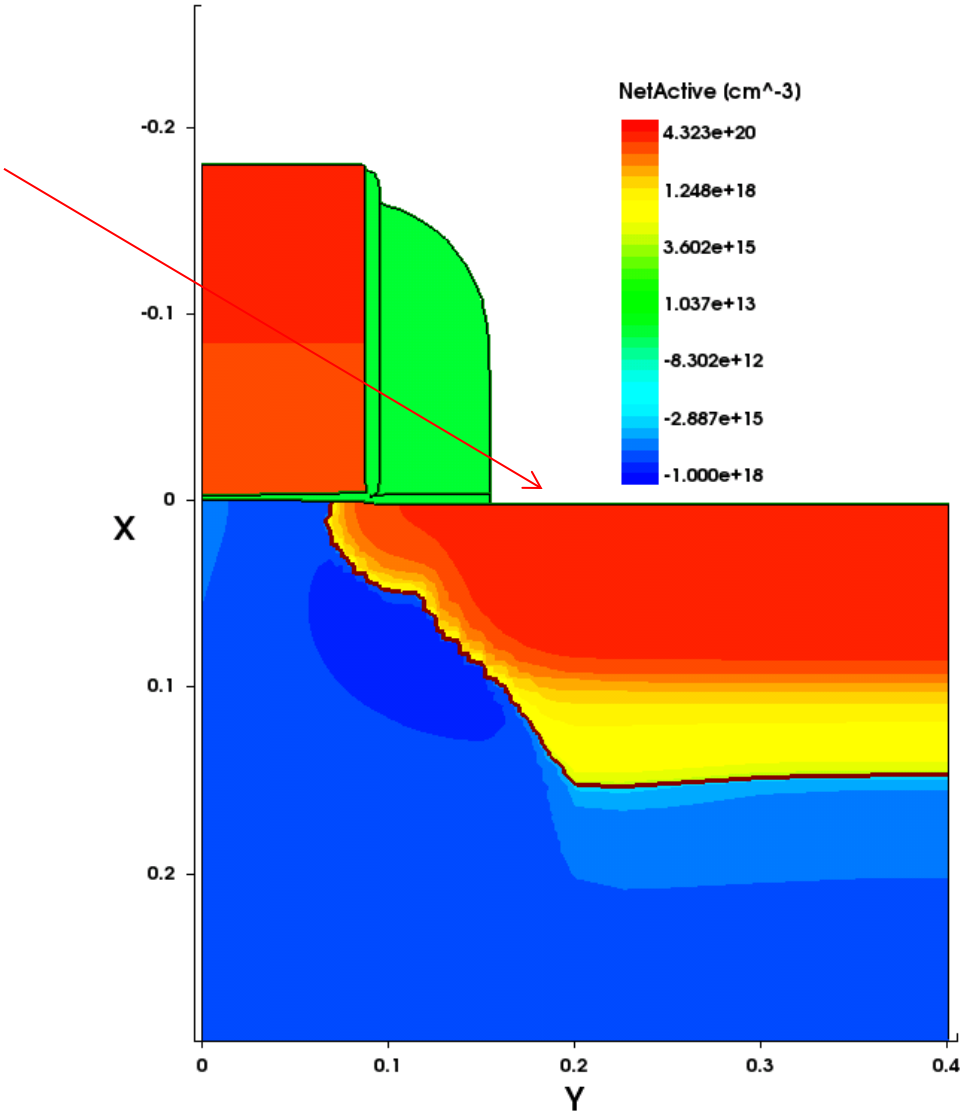
How to fabricate it (5/6)

- 0.18 μm NMOSFET
  - Nitride spacer



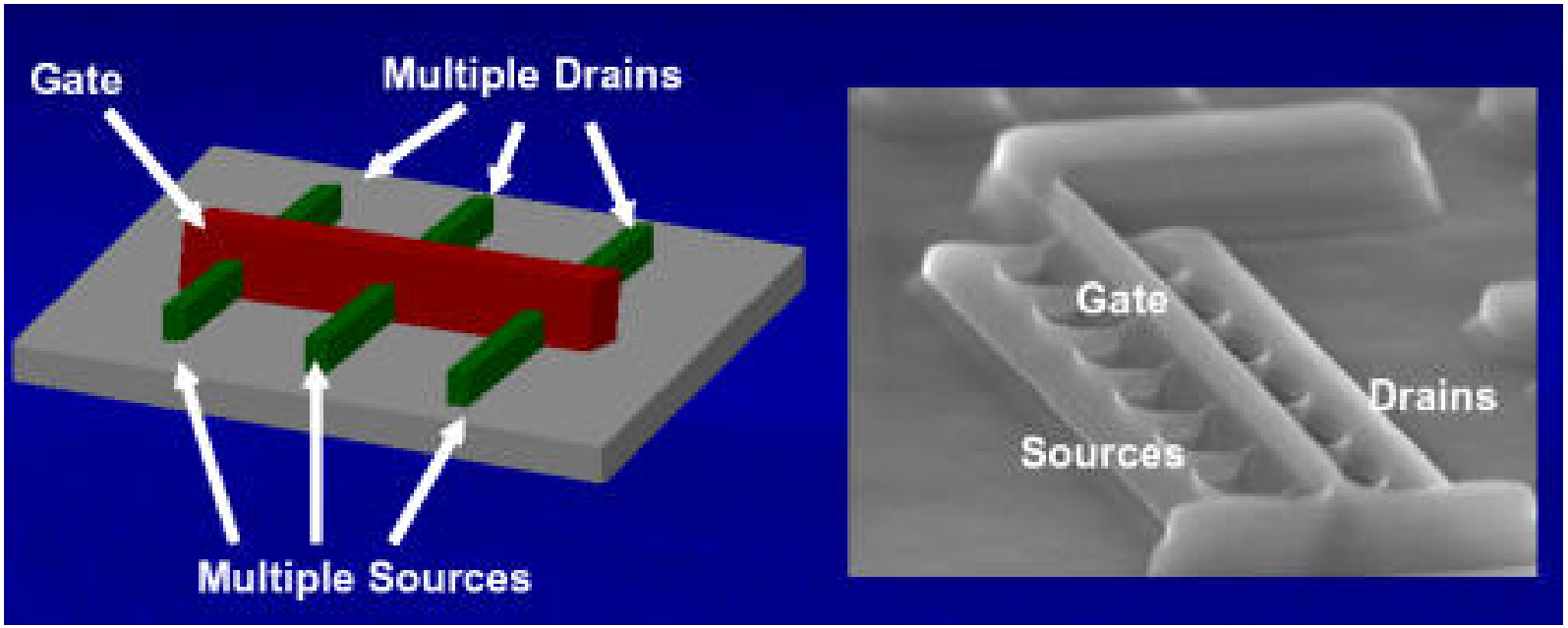
How to fabricate it (6/6)

- 0.18 μm NMOSFET
  - Source/drain implant



Top view

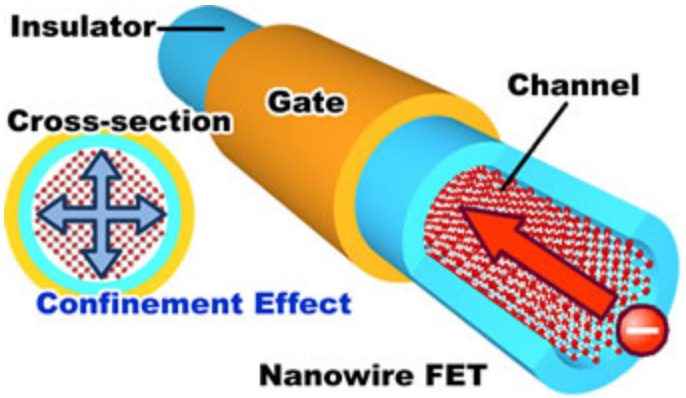
- TEM image of a MOSFET
  - 22nm node
  - (a few years ago…)



(Wikipedia)

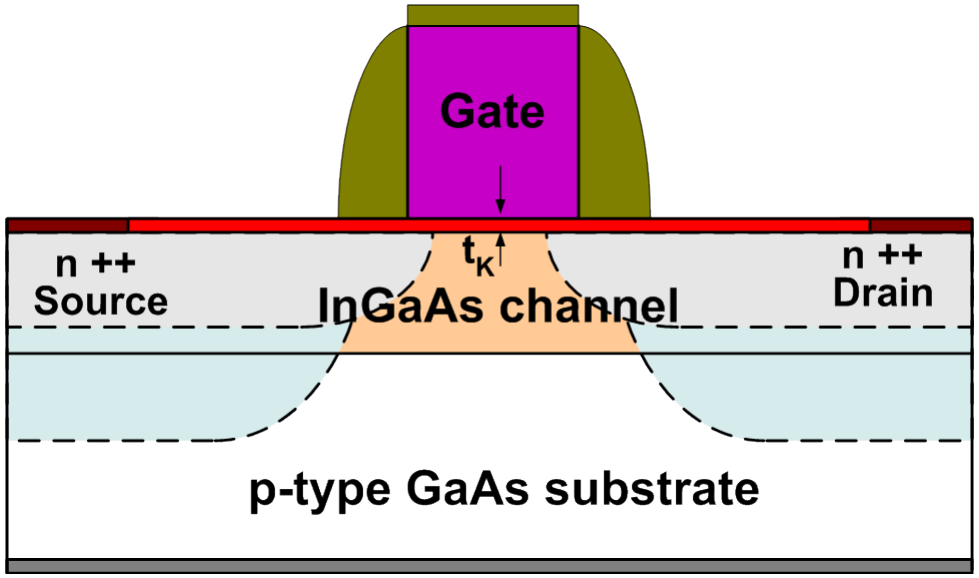
Future

- Nanowire?



(Google images)

- III-V?



(Google images)

Other application

- Up to now, we have seen the MOSFET used for the logic application.
  - CMOS RF

- However,
  - NAND Flash memory
  - Power device
  - Various sensors