Circuit Analysis Tools (CAT)

Developing tools that keep pace with Moore's Law scaling

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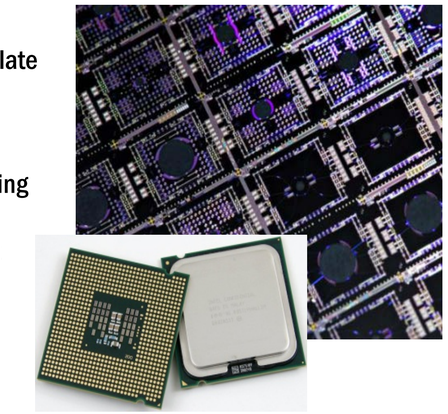
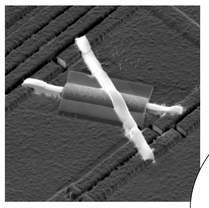
Microelectronics designs are advancing faster than our capacity to analyze them

- When chips fail, whether due to a logic, timing or reliability issue, failure analysis determines the exact cause.
- Imaging and analysis tools isolate and identify the problem.
- Ideally the fix is proven by editing circuits on the prototype chip before any new attempts at fabrication.

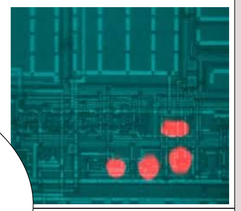


CAT targets each of the five major areas of failure analysis

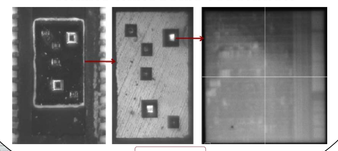
Thrust 1: Circuit Edit: Cut or create new connections

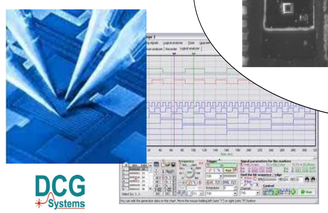


Thrust 2: Fault Isolation: Identify and localize defects

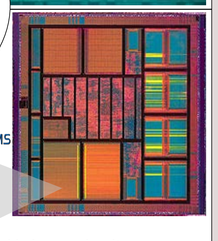


Sample Preparation: enable nanoscale resolution



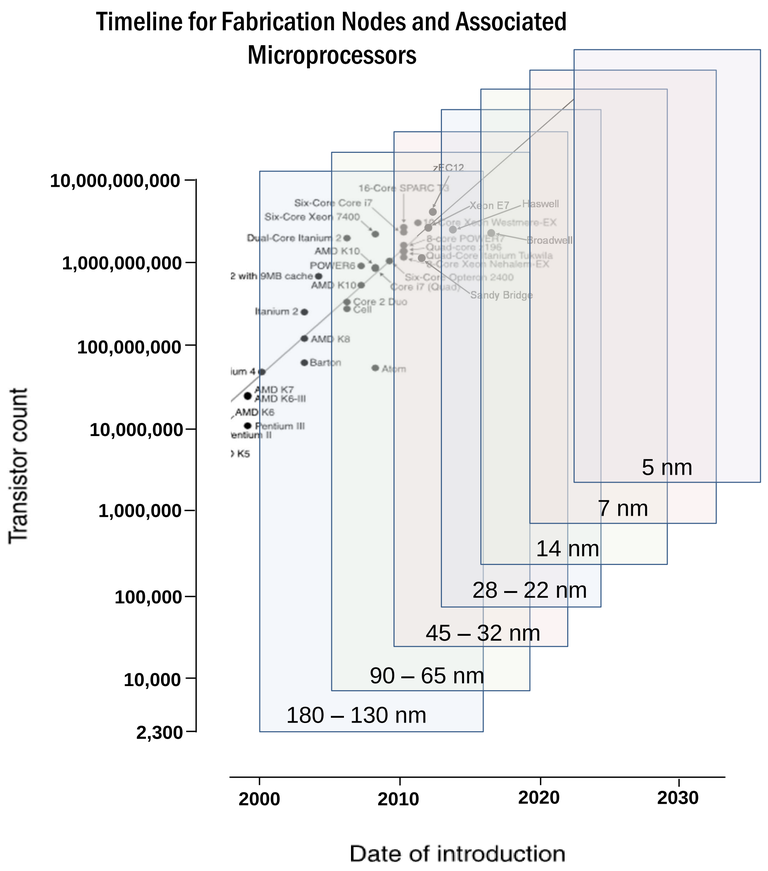


Thrust 3: Logic Analysis: test logic states and timing

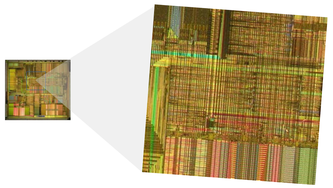


Thrust 4: Fast Imaging: quickly image circuits

Before CAT, the best commercial tools could only image, probe, and edit chips at the 22nm node or higher



The circuits we care about are very small…



Next generation circuits are 10000x smaller than a human hair

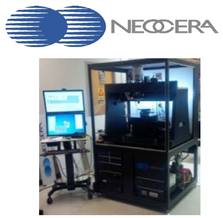
CAT leveraged the fundamental physics and chemistry of semiconductor devices to drive new tools and techniques

- First Time Resolved Emission (TRE) image at less than 0.5V.
- First two-photon Laser Assisted Device Alteration (LADA) with 100 nm resolution (vs. 300 nm in 2010).
- First demonstrated deposited metal at a linewidth of less than 10nm and a pitch of 15nm – 100 nm linewidth and 200nm pitch was state-of-the-art in 2010.

Logic Analysis Tool

Circuit Edit Tool

Sample Preparation Tool



Magnetic Field Imaging Tool

- First demonstration of a magnetic imaging system isolating failures in a complex 3-D interconnected package with sixteen die.
- One of the world's first optical images of a 14 nm circuit.
- One of the first instances of reproducible, computer-controlled wafer thinning to less than 5 µm while maintaining uniform thickness.