SoC for HPC?—
Mindset is the biggest impediment…

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SoC Ws, Aug 26, 2014

Abstract:
An HPC is an embedded machine that should be tuned to the respective HPC workloads. In the last two decades general purpose COTS processors were employed for two reasons: (1) the cost of a custom design was prohibitive, and (2) by the time the custom design was realized it became obsolete compared to the COTS. Things are different now, frequency has flattened, energy efficiency is the king, data movement dominates, and extreme parallelism provides performance. More importantly, advances in the design tools allow custom designs (SoC) realized in a matter of months! That is why, we must rethink and consider embracing SoC design for HPC to provide customized HW/SW co-designed efficient solution.

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Retrospective & Perspective

80's	90's	00's

Custom design ----------→ COTs, Why?

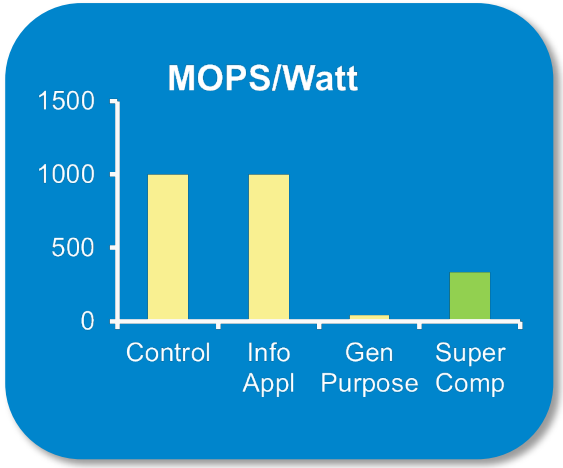
- Design cost increased every generation (2 years)
- COTs performance (freq) outpaced custom design
- Energy efficiency was secondary

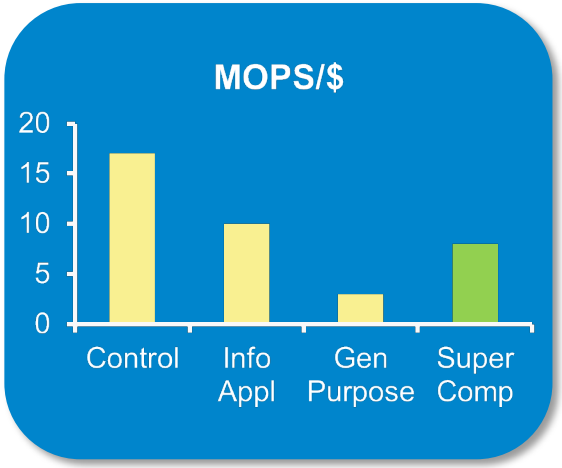
00's	10's	20's

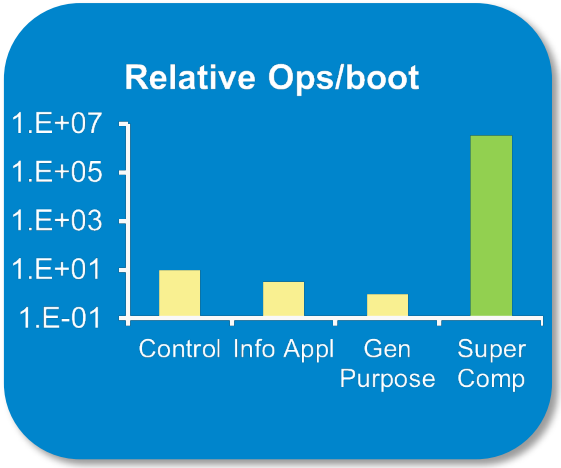
COTs ----------→ SoCs? Why?

- Design productivity→ SoC design cost is affordable
- Frequency levelled off, parallelism → Performance
- Energy efficiency is paramount

HPC—Embedded Class Machines



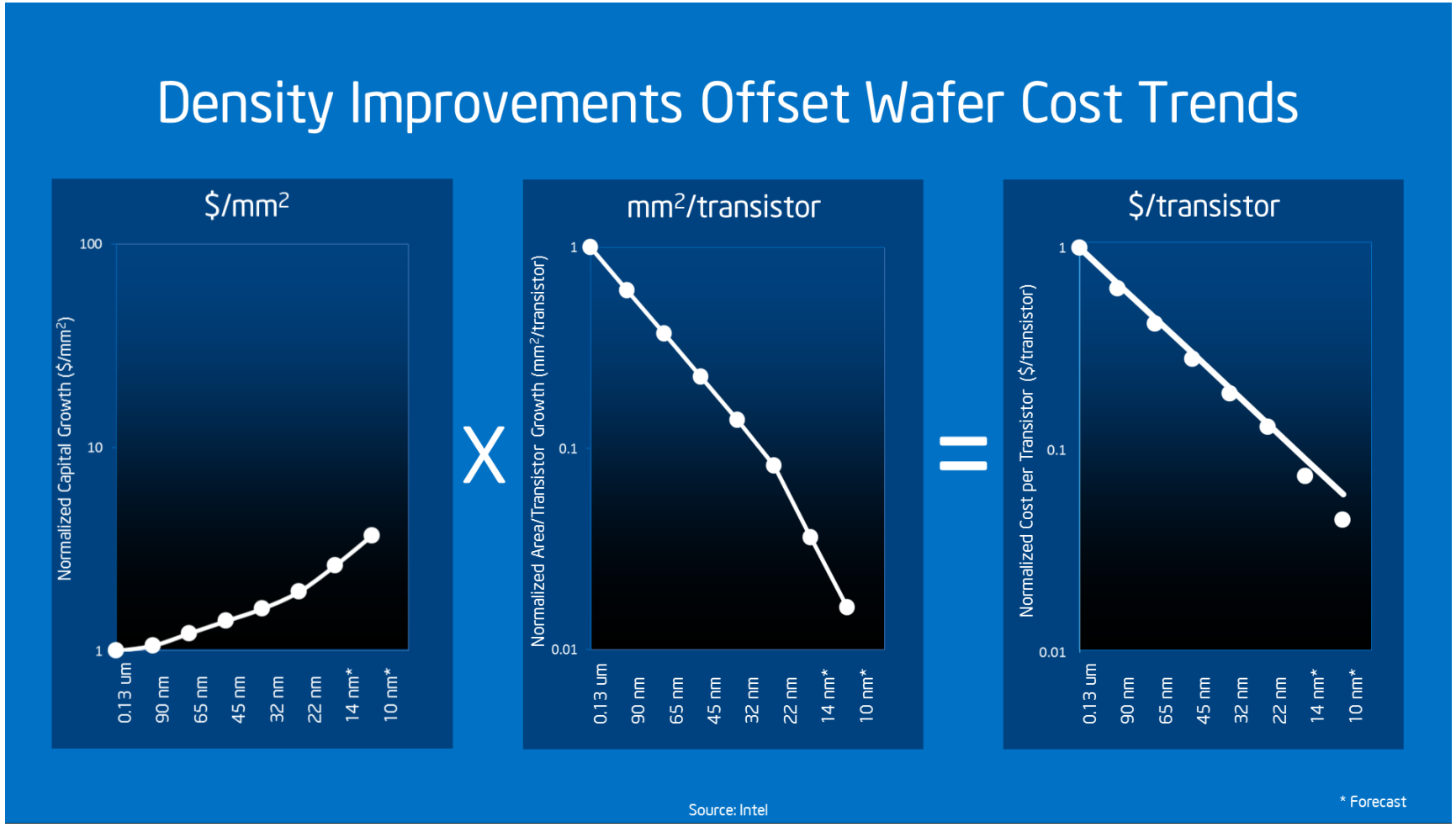




1. High energy efficiency
2. Low $ cost per operation
3. Not general purpose—targeted applications (no-shrink wrapped SW)
4. Highest system dependability

Extreme embedded computers

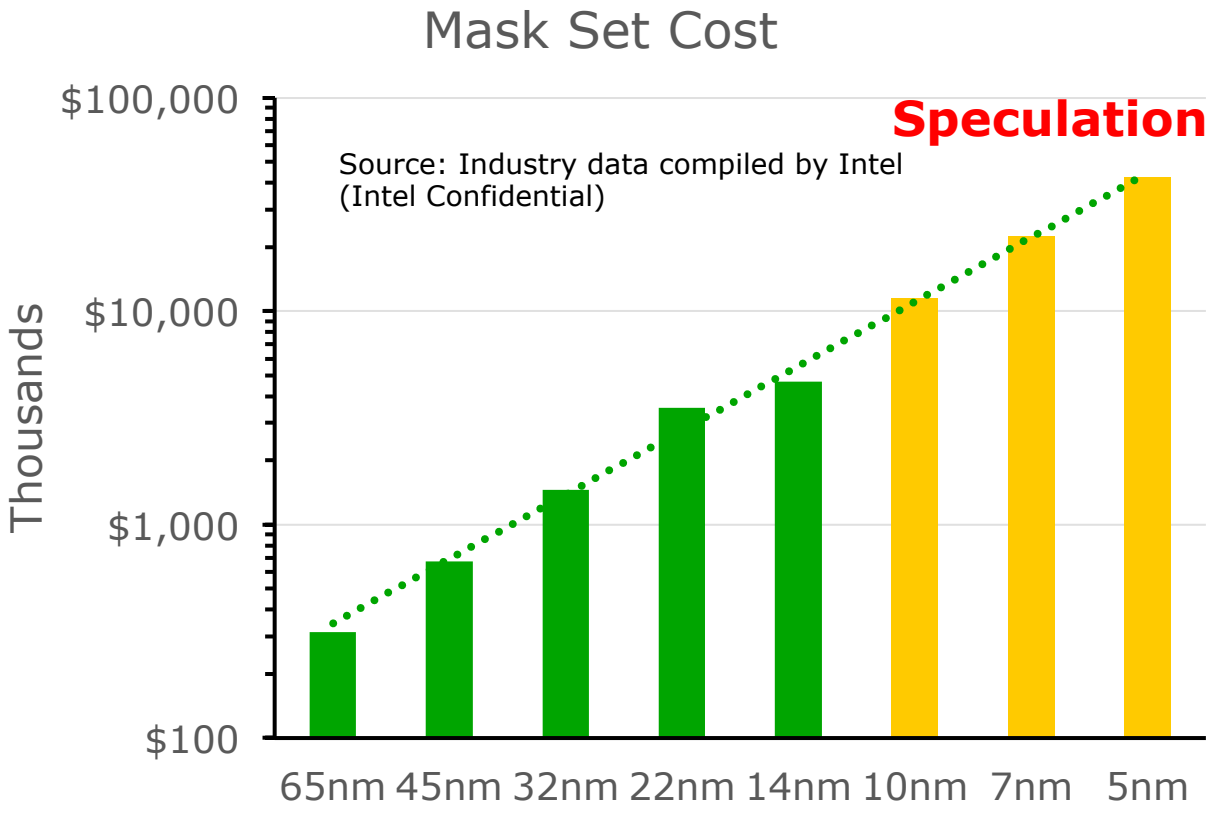
Moore's Law (Economics) continues…

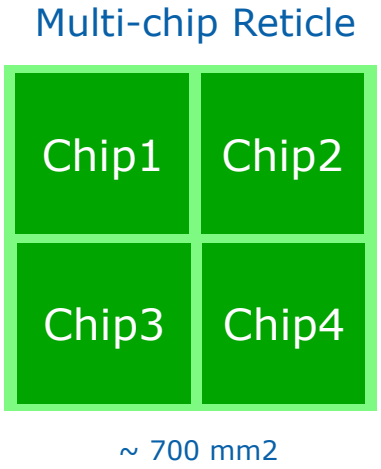


Bill Holt, Intel, Investor meeting, Nov 21, 2013.

…But

Design Cost?





It's not the chip design cost, but the mask cost that will dominate

SoC's amortize the cost by sharing a reticle

Benefits

- **Application specific solution with SoC**
  - Accelerators, HPC specific custom features
  - Higher performance, and higher efficiency
- **Allows system tuning with learning's**
- **HW/SW co-design**
- **Enables a truly embedded solution for HPC**