

# Challenges in Nanocomputing for Dependability and Security

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# Sources of threats

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- Smaller feature size
- Weaker signal strength
- Increased transistor counts

## Q1: Which are the most important dependability and security threats imposed by nanocomputing?

### Giga-scale computing with nano-scale technology

- Silicon complexity
  - ♦ Variability (device parameter, threshold voltage)
  - ♦ Reliability (migration, aging, breakdown, soft error)
  - ♦ Current leakage
- System complexity:
  - ♦ Transistor counts
  - ♦ Interconnect (delay, synchronization)
  - ♦ Reuse (interaction with black box)

## Q2: How would you rank the severity of these threats in terms of the research and engineering effort

- Severe threats come from silicon complexity
  - ◆ larger defect rate in production,
  - ◆ higher level of transients in operation
  - ◆ shorter life of workable components in systems' life cycle
- But, more severe is system complexity
  - ◆ broader spectrum of abstraction levels from nano-scale transistors to globally networked systems

### Q3: Will the abundance of components allow us to deal with these threats using pure hardware solutions?

- Simply introducing hardware redundancy is not sufficient.
  - ♦ Power and area need to be taken into consideration as a major issue
  - ♦ “Abundance of components” can be another source of threats, i.e. complexity and uncontrollability

## Q4: How will nanocomputing affect the way we build dependable and secure software?

- VLSI design itself has long been software engineering
- System-level architectures have already been brought into on-chip
- Dependability and security design at a higher level should be consistent with lower levels
- Performance/power variability will give good chances for dynamic power optimization

# What concern

- Huge gap between the intended dependability and security for VLSI components and the perceived dependability and security for services information systems deliver
- Customers don't care about how dependable and secure the VLSI components are
- But, they care about how dependable and secure the services delivered are

# Challenges

--- difficult, but important ---

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- Define **metrics** of dependability and security at service level from **user's (stakeholder's) point of view** in such a way that the metrics can be decomposed and reduced consistently into **design goals and specifications of VLSIs** at system development levels