

Hardware Fabric for Intelligent Machines



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Develop, demonstrate and transition the key solid state technologies that enable dominant system concepts and capabilities for the Department of Defense

-  **Pushing the limits of scaling and integration**
-  **Microsystems for spectral exploitation and sensor dominance**
-  **Systems that intelligently interact with the environment**
-  **Tools that enable scaleable and affordable access to leading edge components**

DoD Access to Winning Microsystem Technology

A New Class of Autonomous Systems

Mission Complexity

Legacy Systems

Cooperative Systems

Autonomous Systems



UCAR
(Artist's concept)



UCAV



UCAV-N



OAV
(Open Terrain)



OAV
(Artist's concept)



TMR



Global Hawk



A160



UGCV
(Artist's concept)

Remote human immersion and presence

- Human-like sensor depth
- Persistent engagement
- Effects-based tasking and performance

Environmental Complexity



Grand Challenge



**200+ miles of
some of the
toughest terrain
in the world**

**The best
autonomous
robotic vehicles
America can
build**

**\$1 million cash
prize**

13 March 2004

Winner takes all





Sunup at Barstow, CA



Approved for Public Release, Distribution Unlimited

Grand Challenge Start



Slide 6

ZJL1 Zachary Lemnios, 3/15/2004

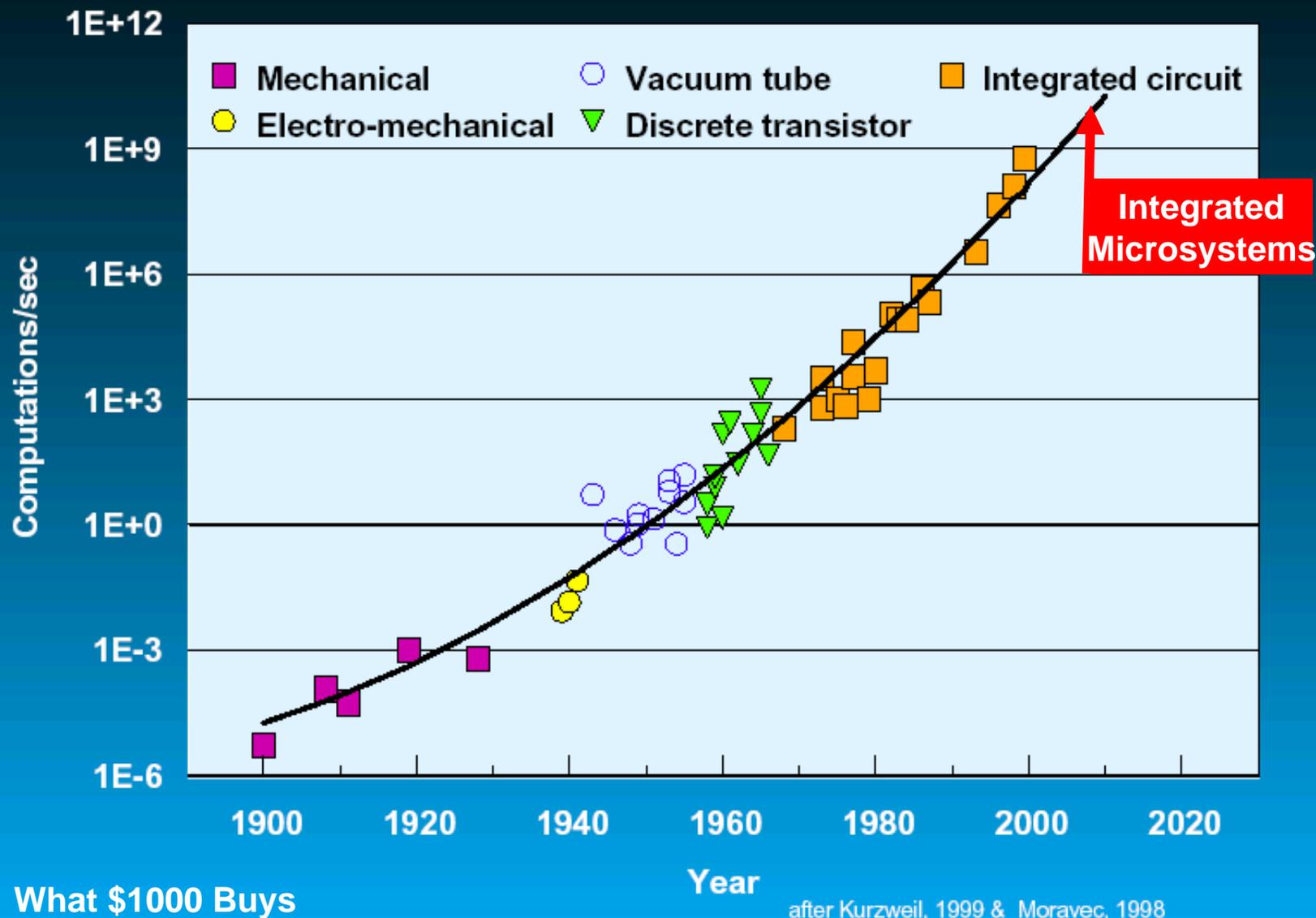
ZJL2 Zachary Lemnios, 3/15/2004

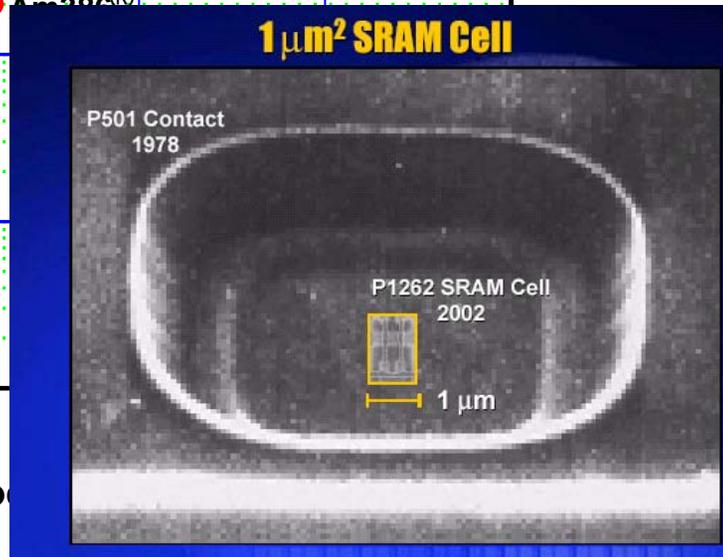
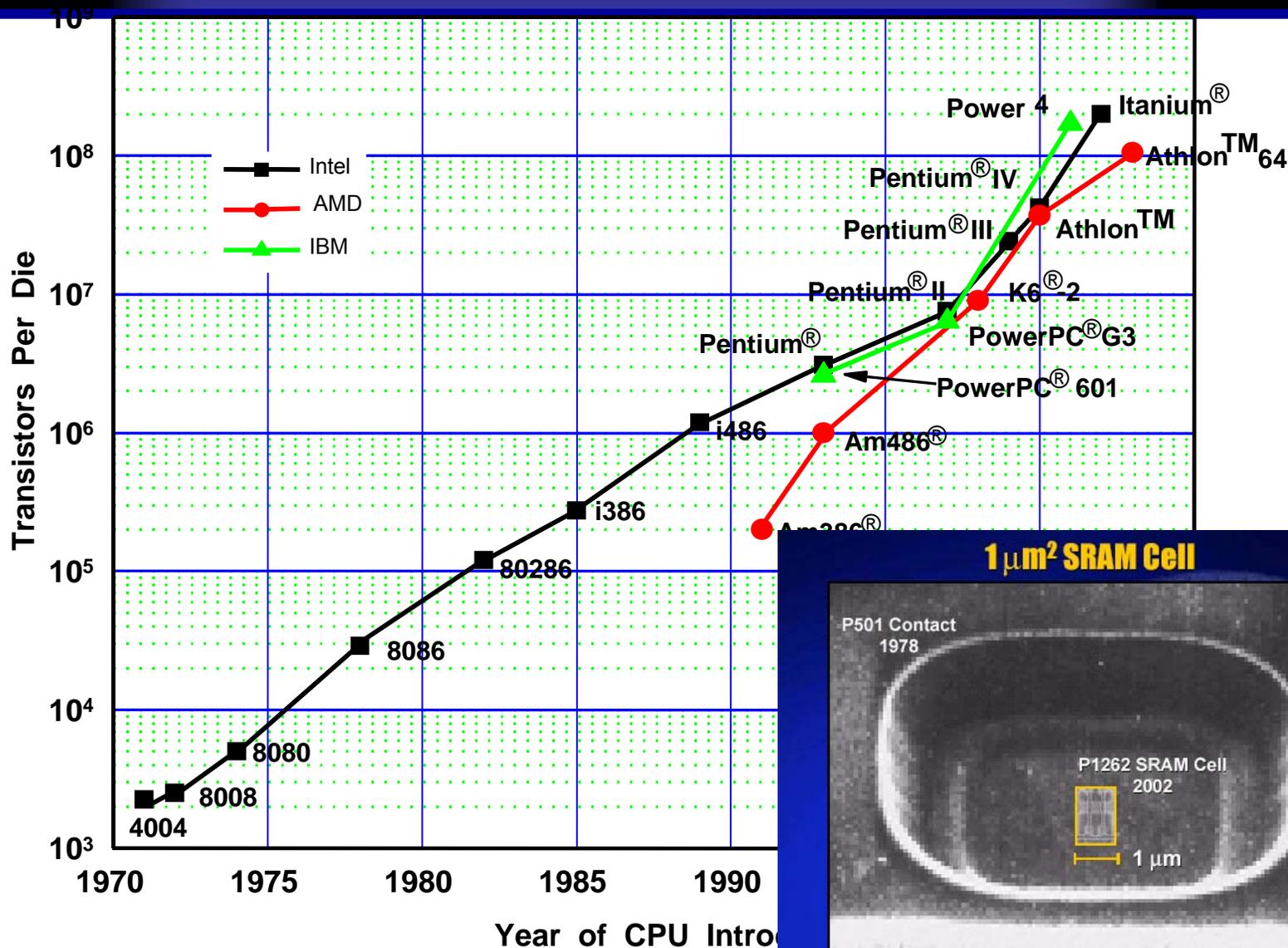
16 Ton Entry



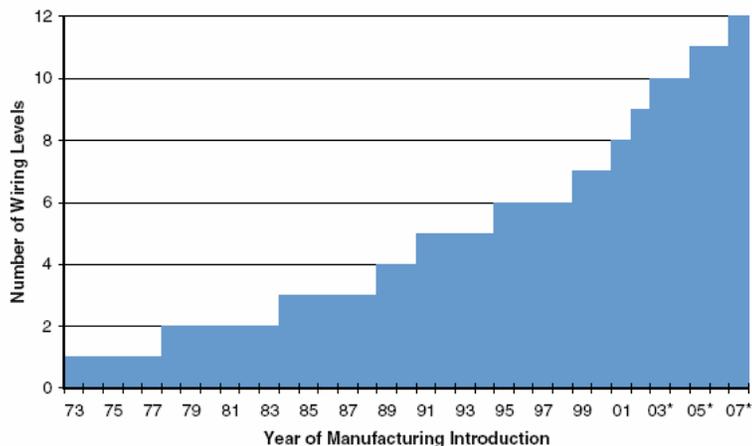


Technology Transition in the Last Century



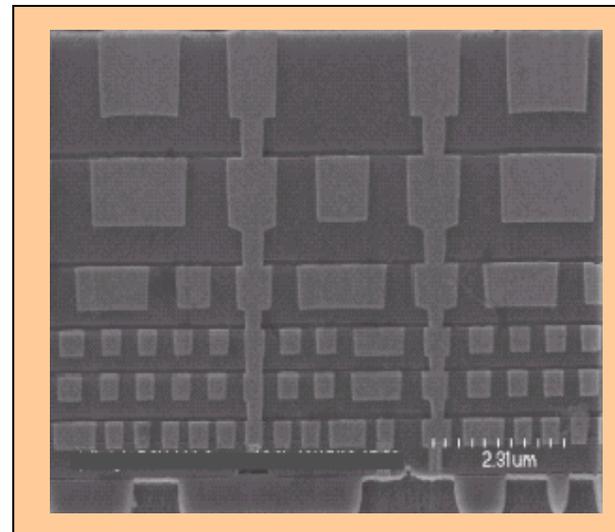


The Layers Keep Building Up
Wiring Levels of Advanced ASICs

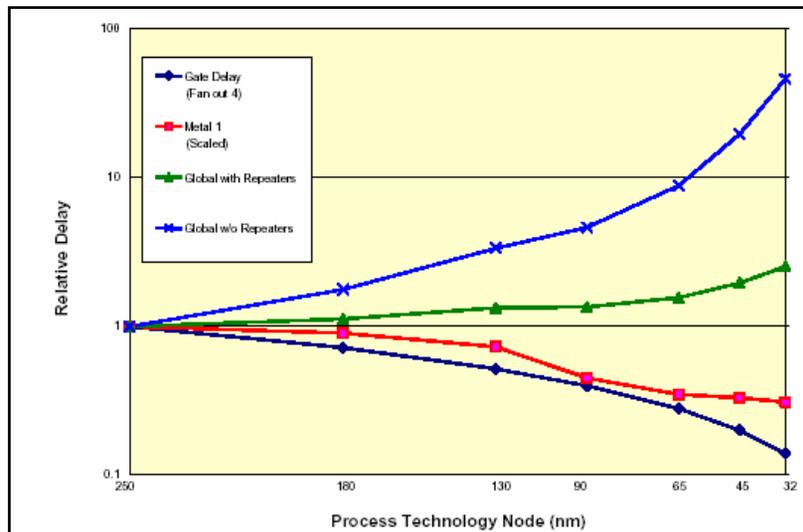


Note: Includes local interconnects
Source: IBM, IC Insights

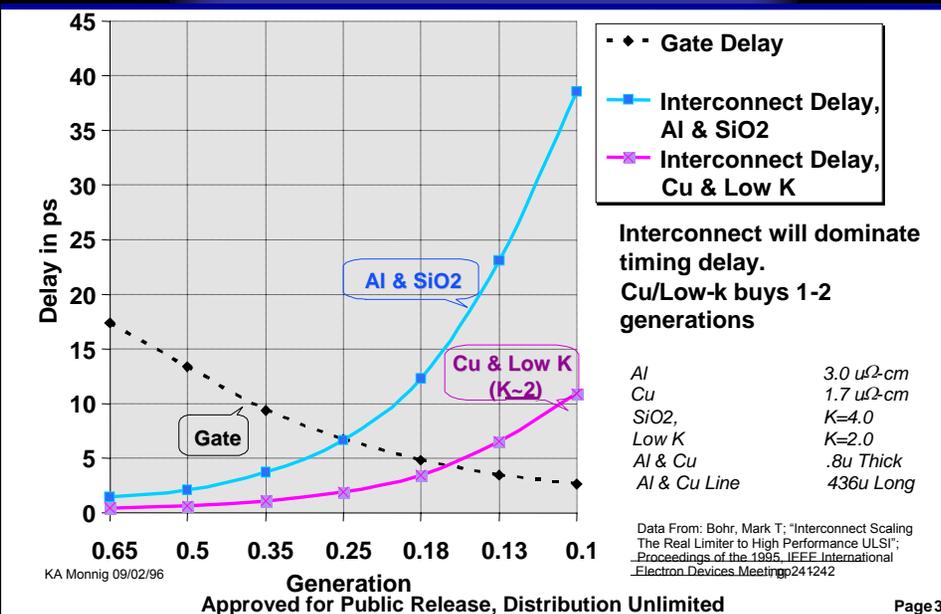
*Forecast



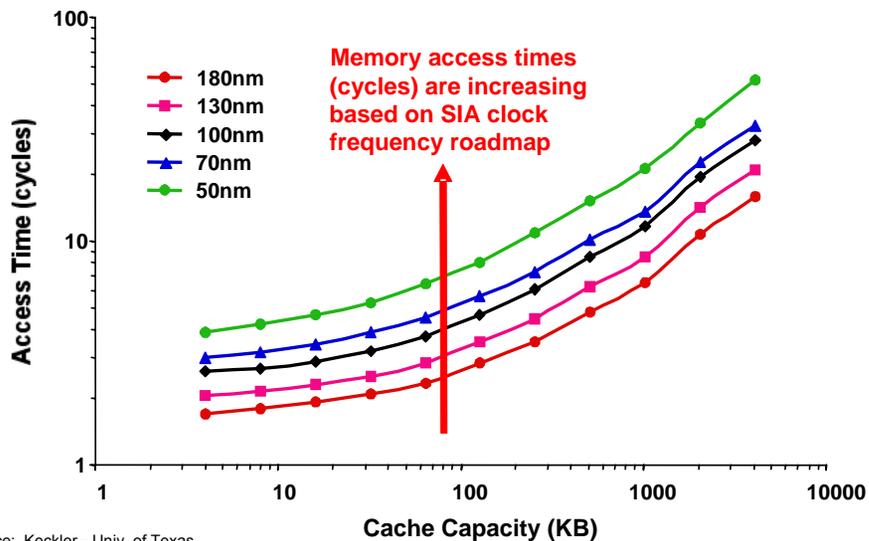
**Chip Wiring Paradigm:
More levels of copper,
but global interconnect
performance does not
scale.**



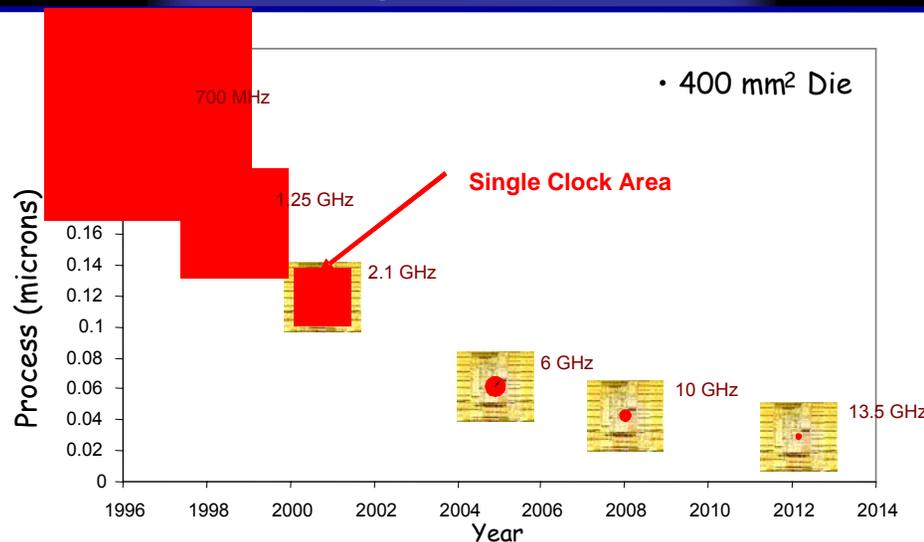
Sources: Int'l Technology Roadmap on Semiconductors, McLean Report



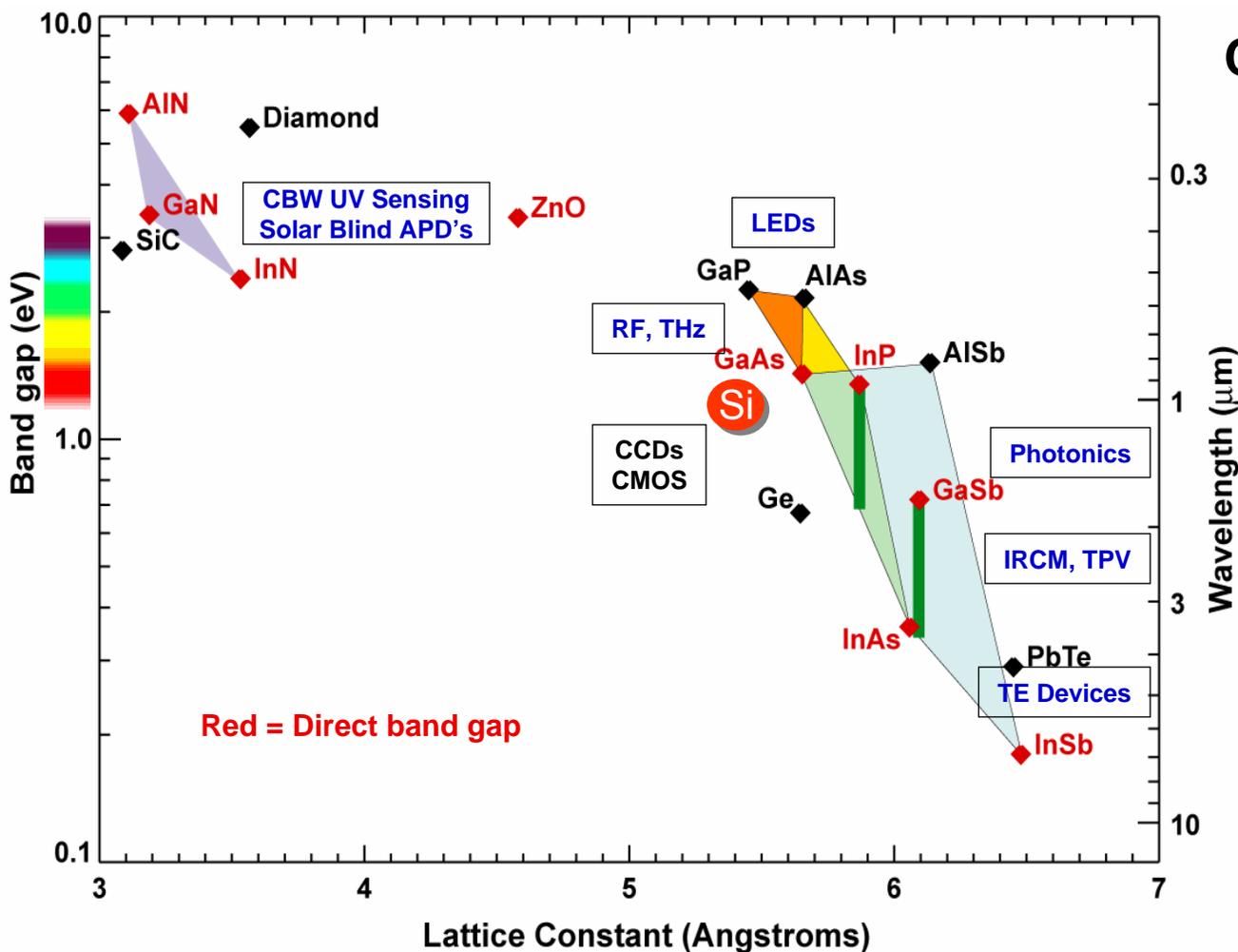
Novel Architectures are Needed to Overcome Memory Wall



SIA Roadmap Impact on Computer Architectures

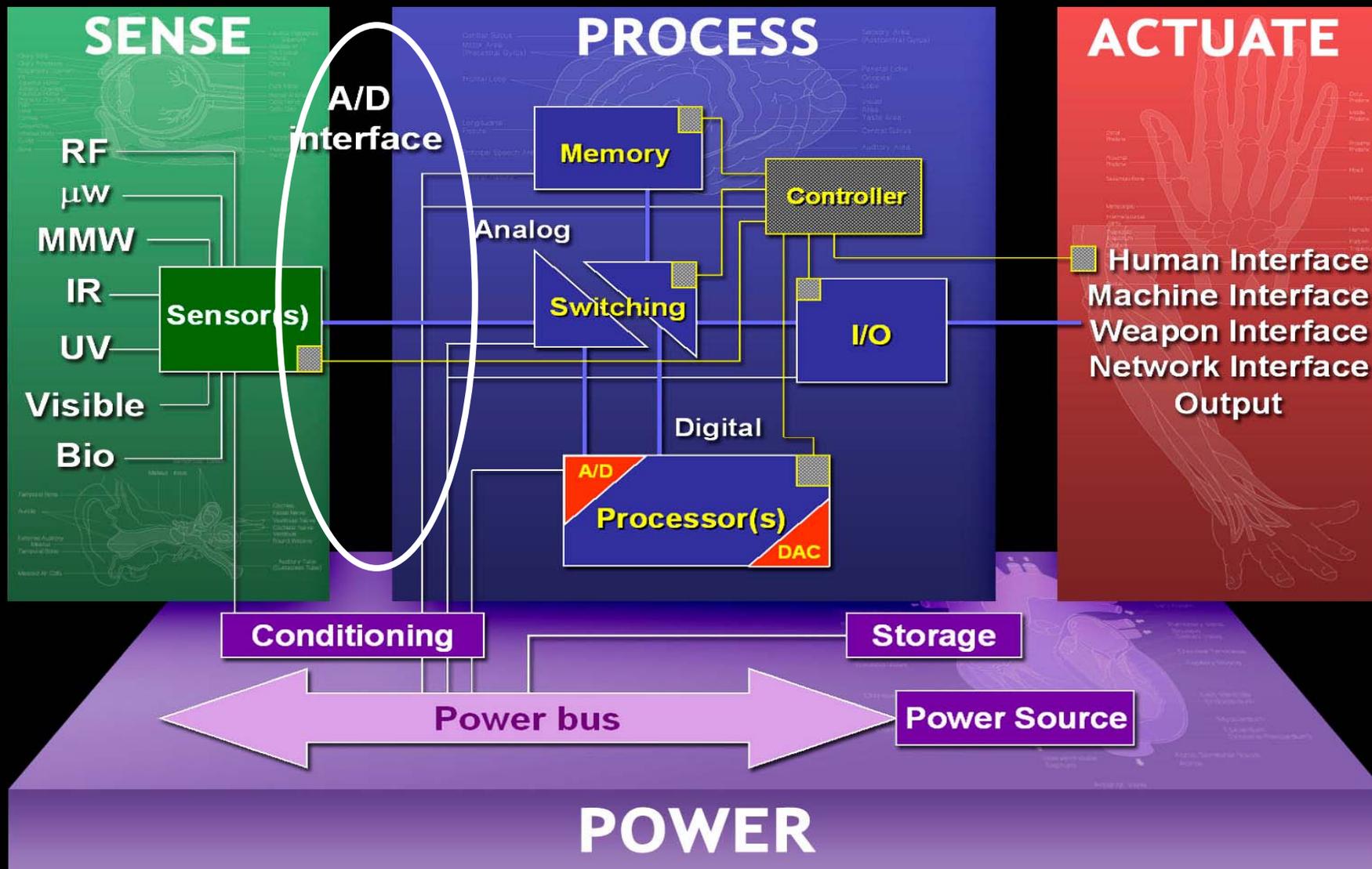


New architectures are required to accommodate smaller clock regions

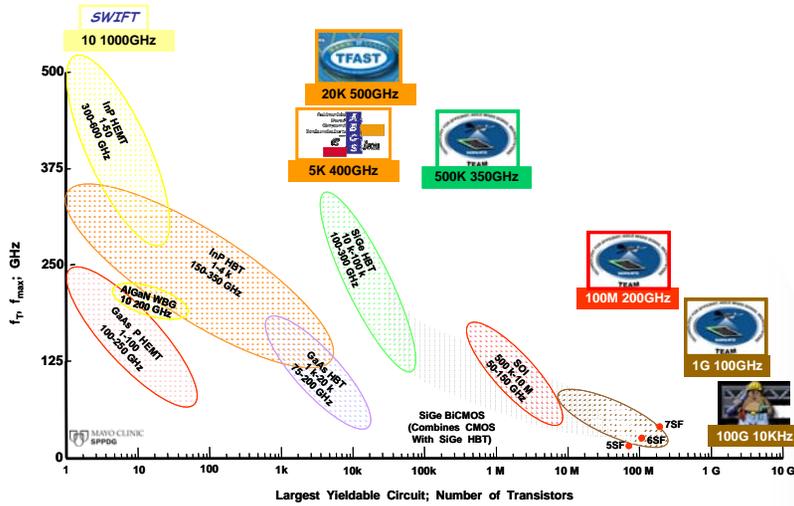


Critical Applications

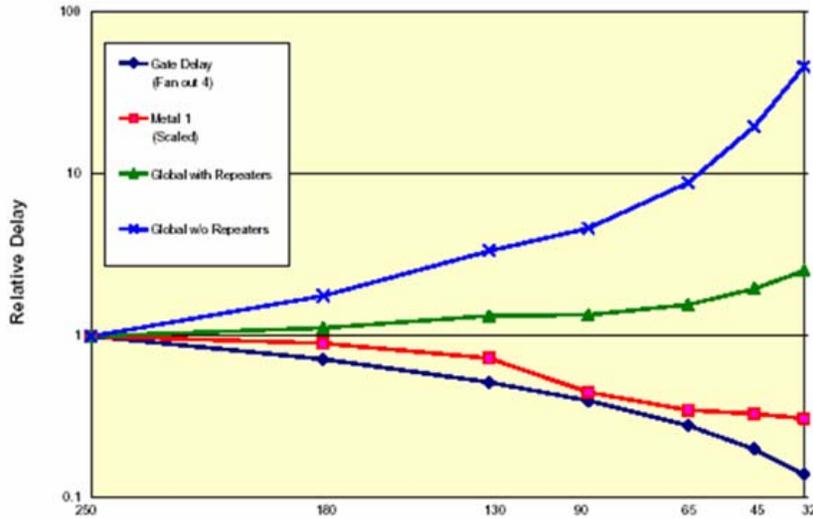
- IR detectors
- Thermophotovoltaic devices
- Solar blind UV detectors
- Lasers / LEDs
- Thermoelectric devices
- Optical waveguides and photonics
- THz Sources



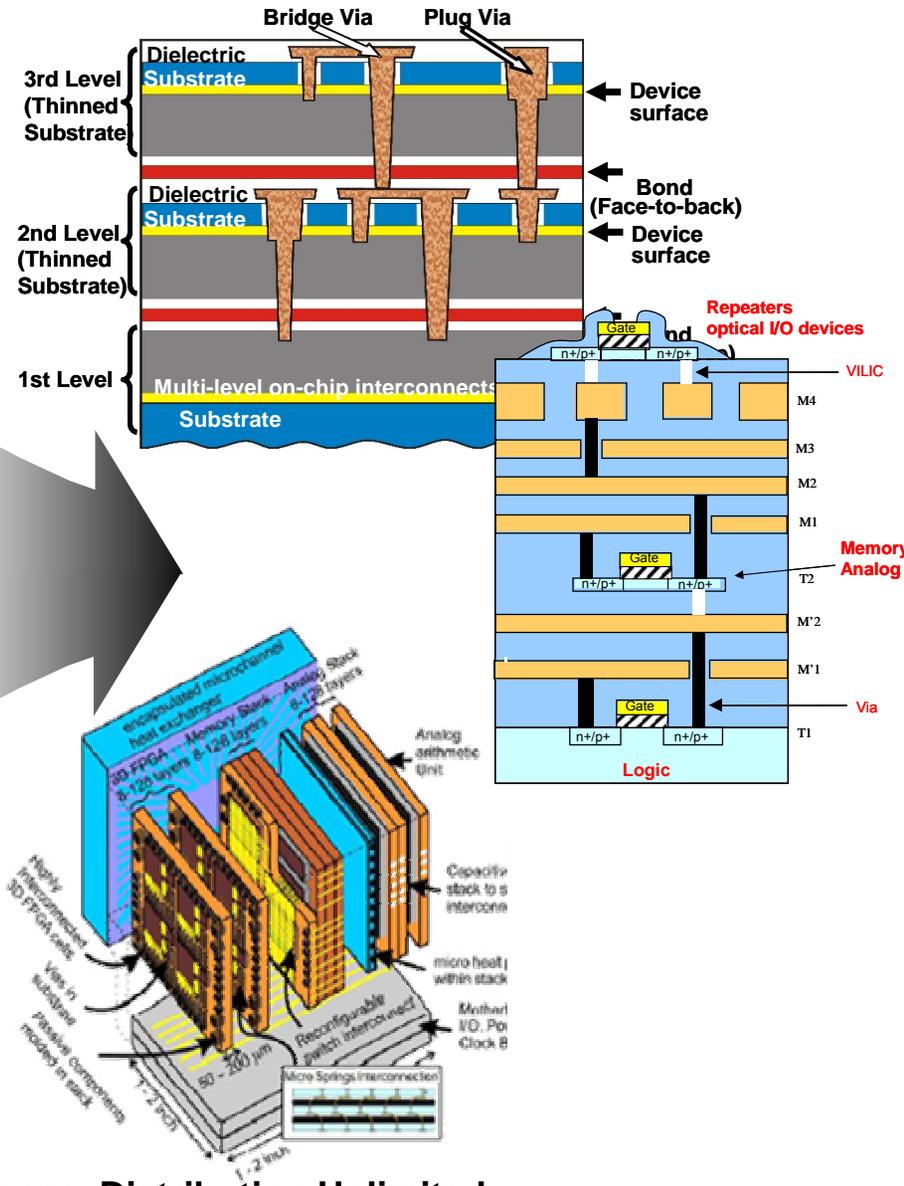
The Next Revolution 3-D Integrated Microsystems



Device Scaling



Interconnect Limits

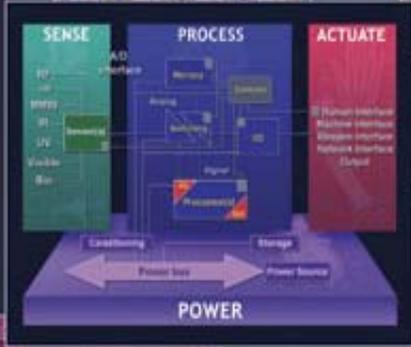


- How do we fundamentally represent information?
- The engineering of Terrascale Systems
- Sub KT/q signal pathways
- System level episodic memory
- Engineered purposeful perception
- Dynamic planning
- Hardware fabric for intelligent microsystems
- From data to information to knowledge

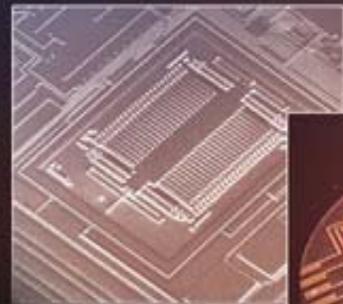
- Integrated Microsystems will be the next revolution in microelectronics
 - Apply integration and scaling to interact with the environment
 - Systems that adapt to changing environments
 - Systems that learn from their experiences
- Integrated Microsystems will push the limits of conventional scaling, integration, linearity, power dissipation

Scalable and affordable access to leading edge components

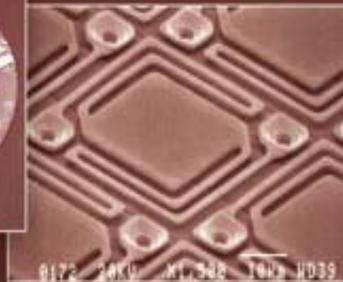
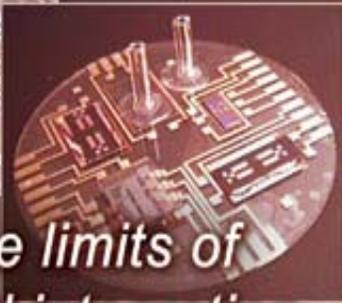
Microsystems for spectral exploitation and sensor dominance



DoD Access to Winning Microsystem Technology



Pushing the limits of scaling and integration



Systems that interact with the environment

