Session 5: Standards Overview

High Performance Embedded Computing (HPEC) Workshop
9:05 AM on September 30, 2004 for 2 hours, 20 minutes

Session Chair: Craig Lund
CTO Mercury Computer Systems
clund@mc.com
+1 (978) 967 1264

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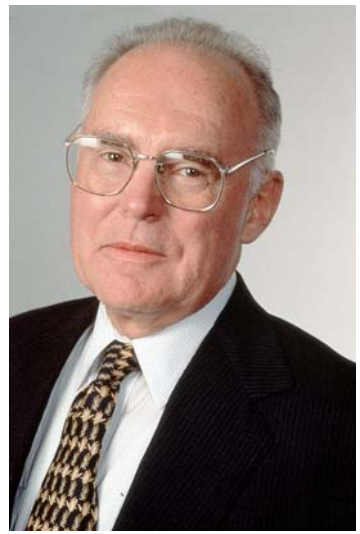
Standards Triple Witching Hour

- Hello commodity fabric
- Hello enhanced packaging
- Hello unique processor
  - FPGA, GPU, game chip, etc.

Expectations

- Computer users expect unrelenting Moore's Law improvements
  - In 1965 Moore observed that the number of transistors fabricated per square inch doubled every 12 months
  - Later revised to 18 months
- Moore said nothing about improved
  - GigaFLOPS per dollar or watt or square inch

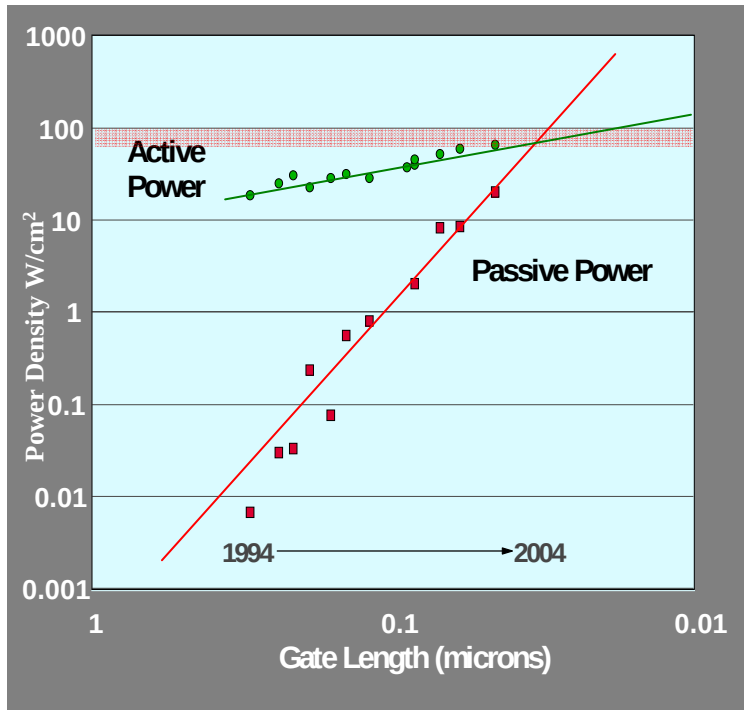
yet each is a metric that our community expects will follow Moore's Law



Gordon Moore

Public Enemy #1

- Increasing "passive power"
  - Has stalled the entire industry with respect to offering customers improved performance per watt.
- What is it?
  - Current flows across regions of semiconductor structure in which no current should be flowing.



IBM Microelectronics Graph

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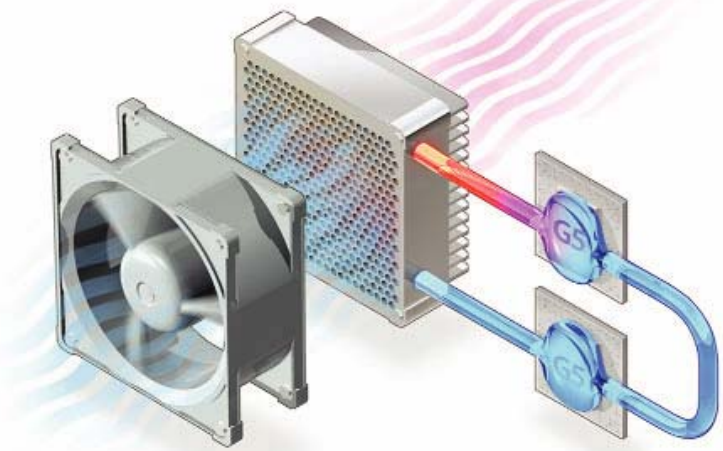
Example: Apple Liquid Cooling

- On June 9th Apple announced a 2.5 GHz IBM 970 system that uses liquid cooling. Apple uses a high capacity variation of the heat pipes found in laptops.



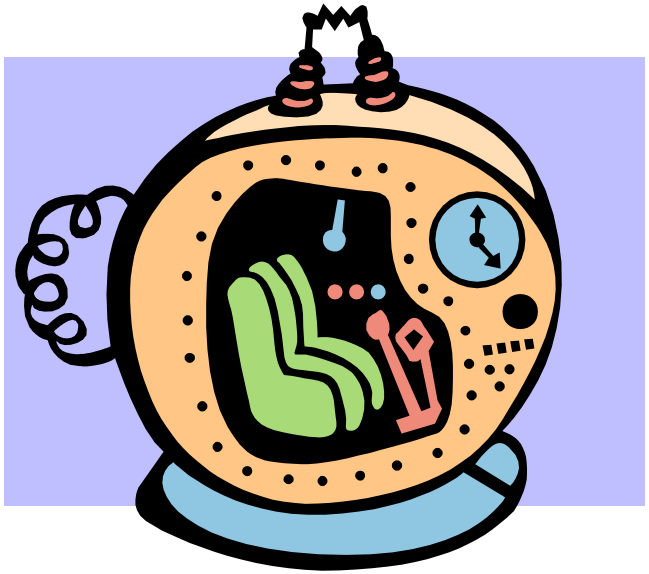
Heat Busters!

- Mercury/VME Community: VITA 48
- Intel/PICMG: AdvancedTCA® and MicroTCA
- Intel/IBM: Open BladeCenter™

Infrastructure Talks

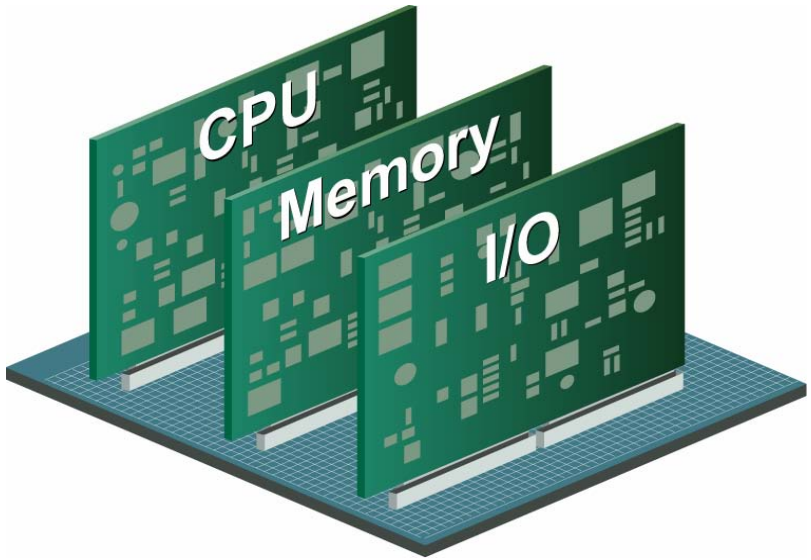
- Prior HPEC years have featured VITA 42 (VXS) and ATCA.
- After the break, Mercury's Randy Banton will quickly overview all of VITA's infrastructure activities, including VITA 48.
- Pentek's Paul Mesibov will follow Randy to give more details on VITA 49, also known as DigitalIF.

Architecture Drives Interconnect Standards



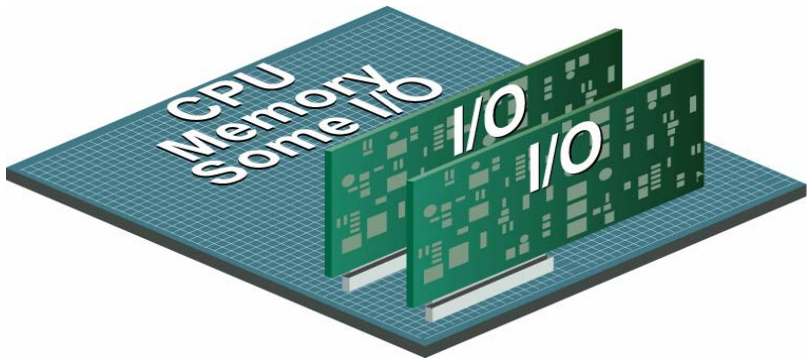
- The next three slides look backwards in time. They show that, as computer technology gets smaller, internal interconnect requirements evolve.

Architecture Circa 1980



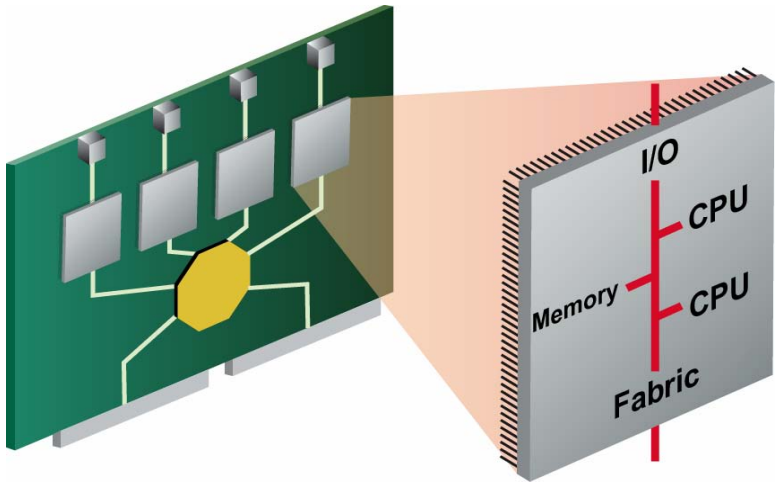
- Computers contained multiple circuit boards connected by a shared bus.

Architecture Circa 1990



- When CPU and memory could fit onto a single card, the bus connection off the board became I/O oriented.
- PCI bus was first deployed around 1994 and quietly found its way into embedded devices

Architecture Today



- System-on-a-chip (SOC) technology has evolved the basic architecture of an embedded system from master/slave toward peer-to-peer.
- Mercury pioneered this basic architecture within the embedded domain with ANSI/VITA RACEway in 1993. We joined with Motorola to develop what became RapidIO® in 2000.

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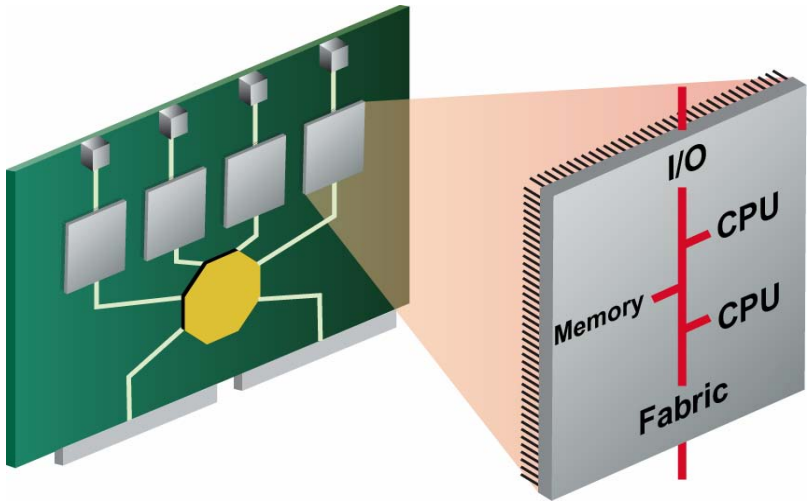
No Fabric Talks

- We have covered fabrics extensively in past HPEC workshops. HPEC-oriented products are now shipping.
- I put the architecture slides into this summary for another reason …

Software Standards Delayed



- Today's SOC architecture impacts the software model. Everything becomes a little multicomputer.
- Commercial OS and middleware vendors are responding with proprietary solutions that enable DMA transfers among the sea of peer SOC processors.
- So far users appear content to accept proprietary APIs provided the enabling software runs on hardware from multiple vendors.

Changing Focus

- Past HPEC solutions targeted stand-off applications.
- Looking forward, HPEC solutions will move in-theater.
- The impact on software is to raise the importance of the in-theater network. Think grid computing.

Today's Software Advances in Adjacent Domains

- Thus today's software talks:
  - RTI will discuss their publish/subscribe technology, standardized by OMG and recommended in the Navy Open Architecture.
  - Verari (RackSaver plus MPI SoftTech) will discuss multiple vendor interoperability of MPI implementations.

Session Agenda

9:05	15 min	**Standards Overview** Craig Lund
9:20	25 min	**GPUs: Engines for Future HPC** (invited) Dr. John Owens of UC Davis
9:45	25 min	**OMG Data Distribution Service (DDS)** Mr. Gerardo Pardo-Castellote of RTI
10:10	25 min	**High Productivity MPI** Dr. Tony Skjellum of Verari Systems Software
Break (view next session's posters)		
10:55	15 min	**HPEC Related VITA Standards: An Update** Mr. Randy Banton of Mercury
11:10	15 min	**DigitalIF Interface Standardization** Mr. Paul Mesibov of Pentek

Invited GPU Talk

- Some people are using GPUs today for computation. Few standards exist at this point. Nevertheless …
- The HPEC Program Committee decided to invite an expert to give us a broad introduction to this new application of a technology that all of us already have.
- I yield the podium to Dr. John Owens, an assistant professor at UC Davis.