Ready, Fire, Aim –
20 years of hits and misses at Hot Chips

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(but tonight's positions are purely my own)

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Hot Chips 1 - 1989

Hot Chips was founded with a mission to bring timely technical information on new processor related chips in a forum easily accessible to students and engineers.

In 1989 it seemed like everyone had a processor. Hot Chips 1 included:
1. SPARC(8) (Cypress/Ross, Sun/BIT, Fujitsu, LSI, Prisma, Solbourne,TI, Witek)
2. MIPS(2) R3000 CPU and R3010 FPU
3. Motorola 88000
4. Motorola 68040
5. Intel 486
6. Intel 960
7. Intel i860
8. Intergraph Clipper
9. NexGen x86
10. National 32GX32
11. AMD 29000

Longevity Award

Criteria: ISA appeared in 1st (1989) and 20th (2008) Hot Chips

Three winners

- SPARC
  - 1980: Cypress, Sun/BIT(ECL), Prisma(GaAs), Fujitsu, LSI
  - 2008: Sun Rock, Fujitsu SPARC64VII

- MIPS
  - 1980 MIPS R3000
  - 2008: China GodSun-3 using ~MIPS ISA

- x86
  - 1980: Intel 486, NexGen
  - 2008: Intel Larrabee, Intel Nehalem

Design by Committee Award

Question: What's a camel?
Answer: A horse designed by a committee.

Winners:

1. IBM and Motorola
   - For PowerPC - Every year 1992-1999

2. Intel and Hewlett Packard for Itanium
   - Appearances in 2000, 2001, 2002, 2003, 2004 and 2008

3. SONY, Toshiba and IBM for Cell and derivatives
   - 2005: Cell – Heterogeneous multicore with 2 different instruction sets
   - 2008: Toshiba SPURS and IBM PowerXCell 8i

Most Religious Conversions Award

To the architect who has changed architecture families the most over the range of Hot Chips.

Winner: Dan Dobberpuhl and teams
- Alpha at DEC
- StrongARM at DEC
- MIPS at SiByte
- PowerPC at PA Semi
- now with Apple Computer

Longest Continual Derivatives Award

For the longest life of an initial design continuously evolved
to the present day.

Winners:

1. Intel for their 1995 presentation on Pentium Pro (P6)
whose out-of-order engine has supplied the basic pipeline for
derivatives that survive through 2008's Nehalem implementation.

2. Fujitsu for their SPARC64VII which appears to have derived from
HaL's 1995 SPARC64 presentation.

Best re-animation Award

For reviving an implementation long thought dead.

Winner: Intel's Larrabee

For utilizing a CPU derived from the Pentium processor, presented by Don Alpert at Hot Chips in 1992.

Processor Darwinism Award

For simultaneously getting the largest number of implementers
of an architecture, while at the same time applying a market Darwinism
making it difficult for them to succeed. License for $1 and IEEE standard.

Winner: Sun Microsystems for SPARC Proliferation and Competition

Hot Chips SPARC presenters included:
- Sun Microsystems
- Texas Instruments
- Fujitsu
- LSI Logic
- Cypress Semiconductor / Ross Technologies
- HaL
- Bipolar Integrated Technology
- Metaflow
- Solbourne
- Prisma
- Witek

HITS

Superscalar

Binary Compatibility

Low Power x86

VLIW/SIMD/Vector for most FLOPS with low power

Return of In-order pipelines for lower power

MISSES

Use of any technology except standard bulk CMOS, including:
- Gallium Arsenide e.g. Prisma SPARC (89)
- Bipolar SPARC and MIPS (Sun 89, MIPS 90, both fabbed at BIT)
- BiCMOS (Sun/TI SuperSPARC 1991)

Most multiprocessor proposals

JAVA processors

New architectures trying replace the x86

HITS and MISSES

Some Chips were misses from a market success or too early, but HITS from being in the right technical direction

VLIW for media processing
- e.g. Philips LIFE(1991), TriMedia

Vector and wide SIMD Floating Point

RISC Processors
- Many x86 translate to internal RISC (UOP/ROP)
- Are modern x86 OOO chips really RISCs?
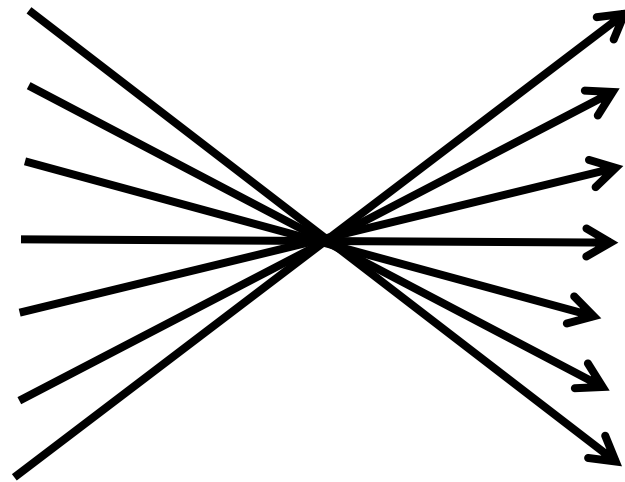
Low Power x86
- Transmeta Crusoe (2000)
- Pentium(1992) now low power in 2008 for Larrabee

Rank order –

My ISA admiration list

1. DEC Alpha
2. MIPS
3. HP-PA
4. Itanium
5. SPARC
6. IBM Power
7. x86

Rank order –

Recent Market Success

1. x86
2. IBM Power
3. SPARC
4. Itanium
5. HP-PA
6. MIPS
7. DEC Alpha

Summary: Lessons from 20 years Hot Chips

Minor evolution ruled over revolution

x86 binary compatibility overcame advantages of non-x86 hardware

Hot Chips papers are often on the "bleeding edge"
- Chips available before market developed to support them

General purpose and graphics processing appear to be merging.

Merging hits and trends predicts the future "Hot Chip" will be:
- x86 compatible
- Low Power
- Multicore
- with Graphics
- on a single chip