Benchmarking Opportunities and Challenges:

The Present and Future of BenchCouncil

http://www.benchcouncil.org

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Fundamental Changes in Technology

- Technology
  - End of Dennard scaling: power becomes the key constraint
  - Ending of Moore's Law: transistors improvement slows

- Architectural
  - Limitation and inefficiencies in exploiting instruction level parallelism end the uniprocessor era in 2004
  - Amdahl's Law and its implications end "easy" multicore era

- Products
  - PC/Server $\Rightarrow$ IoT, Mobile/Cloud

A New Golden Age for Computer Architecture: Domain-Specific Hardware/Software Co-Design, Enhanced Security, Open Instruction Sets, and Agile Chip Development. John Hennessy and David Patterson, Stanford and UC Berkeley. June 4, 2018

Opportunities

- Software-centric
  - Modern scripting languages are interpreted, dynamically-typed and encourage reuse
  - Efficient for programmers but not for execution
- Hardware-centric
  - Only path left is Domain Specific Architectures
  - Just do a few tasks, but extremely well
- Combination
  - Domain Specific Languages & Architectures

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Key Problems

- Understanding workloads

- Domain-specific hardware & Software co-design

- Open-source Softwares/Hardwares

Why BenchCouncil?

- **Challenges**
  - Isolation
  - How a council work

- **Current Benchmark Organization**
  - SPEC, TPC
  - Not transparent
  - Not Open
  - Not Changing

- **Not only the playground of Academic**
  - We need Industry contributor

Challenge #1: Isolation

- HPC --- The workloads are defined clearly

- Datacenter Computing --- Isolation between industry and academia
  - Workload & dataset

- Collaborate

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Challenge #2: How Council Works

- We don't know how it works ?
  - ➤ Not open and not transparent
    - ▪ SPEC organization
    - ▪ TPC organization
  - ➤ Not Changing

- Hard to join a new member

We need a new benchmark organization for the changing world

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What is a Benchmark?

" The process of running a **specific** program or workload on a **specific** machine or system and measuring the resulting performance ."

- Saavedra, R. H., Smith, A. J.: Analysis of benchmark characteristics and benchmark performance prediction, ACM Transactions on Computer System, vol. 14, no. 4, (1996) 344-384

What is a Benchmark Suite?

- A popular measure of performance with a variety of applications
  - To overcome the danger of placing too many eggs in one basket
  - the weakness of any one benchmark is lessened by the presence of the other benchmarks
  - characterize the relative performance

- e.g. EEMBC, SPEC

-- Computer architecture: a quantitative approach

BenchCouncil

- International Open Benchmarking Council
  - A Non-profit Organization, which aims to promote multi-disciplinary benchmarking research and practice and foster collaboration and interaction between industry and academia.

- www.benchcouncil.org
- www.benchcouncil.com
- Mission
- Philosophy
- Procedure

BenchCouncil Mission

- Establish and maintain a repository of benchmark specifications

- Review, shepherd, and release open-source benchmark implementations.

- Publish newsletters and research articles

- Organize conferences, workshops, and teleconferences fostering the transfer of knowledge between industry and academia

- Organize challenges and competition using released benchmarks

BenchCouncil's Philosophy

- **Open, Transparent, and Balanced**

- **Open**: anyone can submit a benchmark proposal. Anyone can contribute to benchmark specification and implementations.

- **Transparent**: any outcome will be published by **TBench**. Each one's contribution will be recorded and publicly available.

- **Balanced**: each working group has to consist of half industry researchers and half academia researchers.

BenchCouncil's Procedure

■ Each benchmarking pipeline consists of the following six steps:

- benchmark proposal
- formation of working group
- publish benchmark specifications
- open-source implementations of benchmark specifications
- challenges and competitions
- archive performance numbers.

Benchmark Proposal → Working Group → Specification → Journal Publish → Implementation

Balance the industry and academia. Open and Transparent !

Benchmarking Proposals

- Big Data Benchmarking: Applications and Systems
  - *Prof. Geoffrey Fox, Indiana University*
- MLPerf: The Vision Behind an ML Benchmark Suite for Measuring the Performance of ML Software Frameworks, ML Hardware Accelerators, and ML Cloud and Edge Platforms
  - *Prof. Vijay Janapa Reddi, Harvard University*
- DataMotif: A Benchmark Proposal for Big Data and AI
  - *Dr. Wanling Gao, ICT, CAS*
- A Benchmark proposal for Deep Learning Benchmarks
  - *Prof. Xiaoyi Lu, The Ohio State University*
- A Benchmark proposal for Datacenter Computing
  - *Dr. Chen Zheng, ICT, CAS*
- PeakBench: A Benchmark Proposal for Scalable Transaction Processing
  - *Prof. Weining Qian, East China Normal University*
- TS-benchmark: a benchmark proposal for time series databases
  - *Prof. Yueguo Chen, Renmin University of China*
- A Benchmark proposal for large-scale and high-speed spatiotemporal data processing and analytic
  - *Prof. Zhiyuan Chen, Prof. Jianwu Wang, Univiersity of Maryland, Baltimore County*

BenchCouncil Open Meeting

- Morning of Day2 (Dec 11th)

- Discuss the Benchmark Proposals

- Formation of Working groups

- Made the groups' Specifications

BenchCouncil Activities

- Conference & Workshops
  - Lead the benchmarking research area
  - Big Data, AI, Datacenter computing, AI for super computing, IoT, Scalable Transaction processing

- Competition

- Archive performance numbers

Bench Council Conferences

- International Symposium on Benchmarking, Measuring and Optimizing
  - **Bench 18**
  - **Dec 10-11, 2018 @ Seattle, WA, USA**
  - **Bench 19**
  - **Nov 14-16, 2019 @ Denver, Colorado, USA**

- BenchCouncil Annual System Technical Conference (BenchCouncil ATC)
  - **BenchCouncil ATC 19**
  - **June 2019 @ China**

Benchmark Competition

- Promote the benchmarks and ads the community

- Optimize the Given benchmark workloads:

- Scores:
  - Practical /research Value (20%)
  - Algorithm Innovation (30%)
  - Parallel implementation (30%)
  - Method Value (20%)

BenchCouncil Awards

- BenchCouncil Achievement Award
  - This award recognizes a senior member who has made long-term contributions to benchmarking, measuring, and optimizing.

- BenchCouncil Contribution Award
  - This award recognizes influential sponsors/donors who made significant contribution to benchmarking, measuring, and optimizing researches and practices.

- BenchCouncil Rising Star Award
  - This award recognizes a junior member who demonstrates outstanding potential for research and practice in benchmarking, measuring, and optimizing.

CFPS

- Call for papers
  - BenchCouncil ATC 19.
    - June 2019, @ China
  - Bench 19
    - Nov 14-16, 2019 @ Denver, Colorado, USA

- Call for Benchmark Proposals
  - TBench

Welcome!

Please Join the BenchCouncil
http://www.benchcouncil.com/html/join.html