Sunrise or Sunset: Exploring the Design Space of Big Data Software Stack

HPBDC 2017 panel

Panel moderator: Dr. Jianfeng Zhan

Professor, ICT, Chinese Academy of Sciences and University of Chinese Academy of Sciences

May 29. 2017
Orlando, USA
The past panel (2015)

- Wide Adoption of HPC Techniques in Big Data: Hype or Reality?
- Panel Moderator: Jianfeng Zhan
- Panellists:
  - D. K. Panda, The Ohio State University
  - Dan Stanzione, Texas Advanced Computing Center
  - Zhiwei Xu, Institute of Computing Technology, Chinese Academy of Sciences, China
  - Xiaodong Zhang, The Ohio State University
The past panel (2016)

- **Merge or Split: Mutual Influence between Big Data and HPC Techniques**

- **Panel Moderator:** Jianfeng Zhan

- **Panellists:**
  - Chaitanya Baru, San Diego Supercomputer Center  [Slides](#)
  - Pete Beckman, Argonne National Laboratory, The University of Chicago
  - Andrew A. Chien, The University of Chicago, Argonne National Laboratory  [Slides](#)
  - Geoffrey C. Fox, Indiana University Bloomington  [Slides](#)
  - D. K. Panda, The Ohio State University  [Slides](#)
This year’s panel

- Sunrise or Sunset: Exploring the Design Space of Big Data Software Stack
- Panel Moderator: Jianfeng Zhan
- Panellists:
  - Prof. Geoffrey C. Fox, Indiana University Bloomington
  - Prof. Satoshi Matsuoka, Tokyo Institute of Technology
  - Dr. Ren Wu, NovuMind
  - Prof. D. K. Panda, The Ohio State University
Topics

- Are big data software stacks mature or not?
  - If yes, what are the new technology challenge?
  - If not, what are the main driving forces for new-generation big data software stacks?

- What chances are provided for the academia communities in exploring the design spaces of big data software stacks?
Two driving forces

- Application-driven
  - One-size-fits-a-bunch
    - SQL, NoSQL, DW
  - Need Benchmarks

- Technology-driven
  - Super computers and Big Data enable deep learning.
BigDataBench summary

- An open-source Big Data Benchmark suite
  - [http://prof.ict.ac.cn/BigDataBench](http://prof.ict.ac.cn/BigDataBench)


BigDataBench 3.2

BDGS (Big Data Generator Suite) for scalable data

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15 个真实数据集

37 个负载

Search Engine | Social Network | E-commerce |
Multimedia | Bioinformatics | |

Impala | Flink | Alibaba |
NoSql |
Shark | GraphX | GraphLab |
Hadoop RDMA | MVAPICH |
Oracles | My SQL |
Hive | MPI |
DataMPI | |
The BigData 100 project

- [http://www.bafst.com/items/top100/index.html](http://www.bafst.com/items/top100/index.html)
- Using BigDataBench data sets and workloads
Requirement-Driven

- Human activities in terms of hundreds milliseconds
  - Nature of our nervous and motor systems
- Computers or smart devices consistently provide information and knowledge to human being in the order of a few tens milliseconds.
  - We coin a new term **10-ms computing** to call attention to this class of workloads
Millissecond-scale computing

- Grand Challenges to both big data software stack and hardware stack

- Go game is only one of benchmarks

- Energy efficiency of human brain!
Cost of deep learning

- [Link](https://www.reddit.com/r/MachineLearning/comments/6b64u4/d_nvidia_k80_training_time_performance/)
- Imagenet 120 epochs 256 batch size (~4k batches per epoch) ~ 3 or 4 gpus for a Resnet 50 (batchsize 64 per gpu).
  - With mxnet this setting it takes around 1.1 sec per batch
  - 4.4K sec per epoch (say 1.2 hours) x120 epoch --->
  - 144hours *4 *1$ ~ 570$$ of training time !!!
- Human being is still much more expensive!
Workload driven

- Internet services have much simple workloads
  - Select, aggregation and etc.

- Hive, SparkSQL and etc

- We need consider more broader workloads
Big data dwarfs in BigDataBench

- Linear Algebra
- Sampling
- Transform operation
- Graph operation
- Logic operation
- Set operation
- Statistic operation
- Sort
Paradigm change

- SMB just rent infrastructure

- Big data in cloud

- Alibaba
  - Can not tolerate 100 ms service interruption
Schedules

- Positions from the panelists (each one has 10 minutes)
- First round of rebuttals (each one has 4 minutes)
- Second round of rebuttals (each one has 4 minutes)
- Questions from the audience