

Past, Present, and Future of SJTU HPC

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*Center for High Performance Computing
Shanghai Jiao Tong University*

Mission

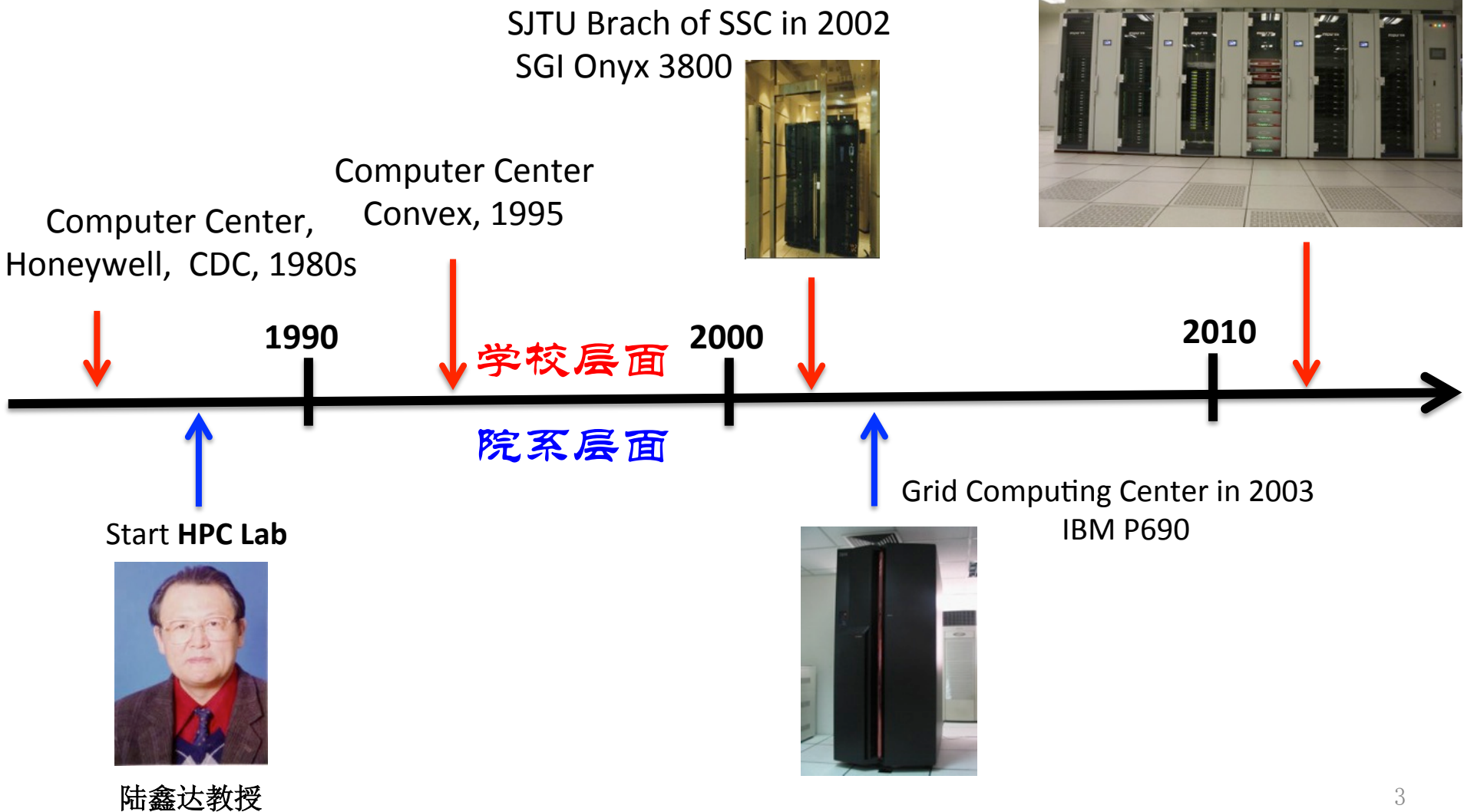


30+ Years of SJTU HPC

Center for HPC, 2012



π , 2013





Outline

- π , the NO.1 supercomputer in China University
- International Collaboration
- Education and Promotion
- GPU in SJTU



π , the **HYBRID** supercomputer of SJTU

 **No.1** Supercomputer owned by Chinese University

 **NO.1** in Shanghai and east China

 **NO.1** Kepler K20 Supercomputer in China

- NO.251 of TOP 500 in Jun 2014
- Performance: 830 **Intel SNB** E5-2670 + 100 **NVIDIA Kepler** K20m + 10 **Intel KNC** 5110P=**196.2/262.6** TFlops
- Interconnection: Mellanox IB FDR 56Gbps, 648ports
- Parallel File Storage: DDN SFA12K 720TB with Lustre
- SSD: 80 Intel SSD 400G



Inspur TS10000, Xeon E5-2670 8C 2.600GHz, Infiniband FDR, K20M/Xeon Phi 5110P

Shanghai Jiaotong University, China

Is ranked

No. 158

among the world's TOP500 Supercomputers

with 196.23 TFlop/s Linpack Performance

On the TOP500 List published at the ISC13 conference in Leipzig, June 17th, 2013

Congratulations from The TOP500 Editors

A handwritten signature in black ink, appearing to read "Hans Meuer".

Hans Meuer
University of Mannheim

A handwritten signature in black ink, appearing to read "Erich Strohmaier".

Erich Strohmaier
NERSC/Berkeley Lab

A handwritten signature in black ink, appearing to read "Jack Dongarra".

Jack Dongarra
University of Tennessee

A handwritten signature in black ink, appearing to read "Horst Simon".

Horst Simon
NERSC/Berkeley Lab

How we build π



Assembled

Resource application



Opening Ceremony



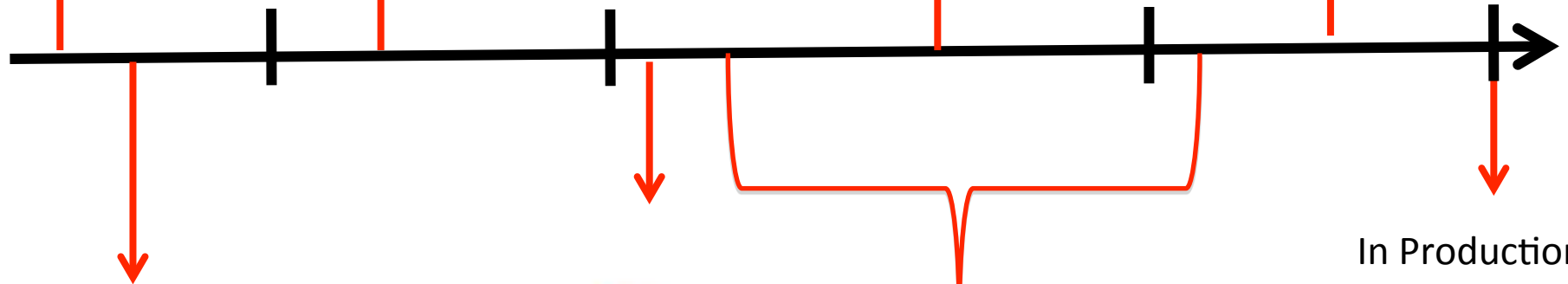
Sign Contract

Apr 2013

Jun

Oct

Jan 2014



In Production



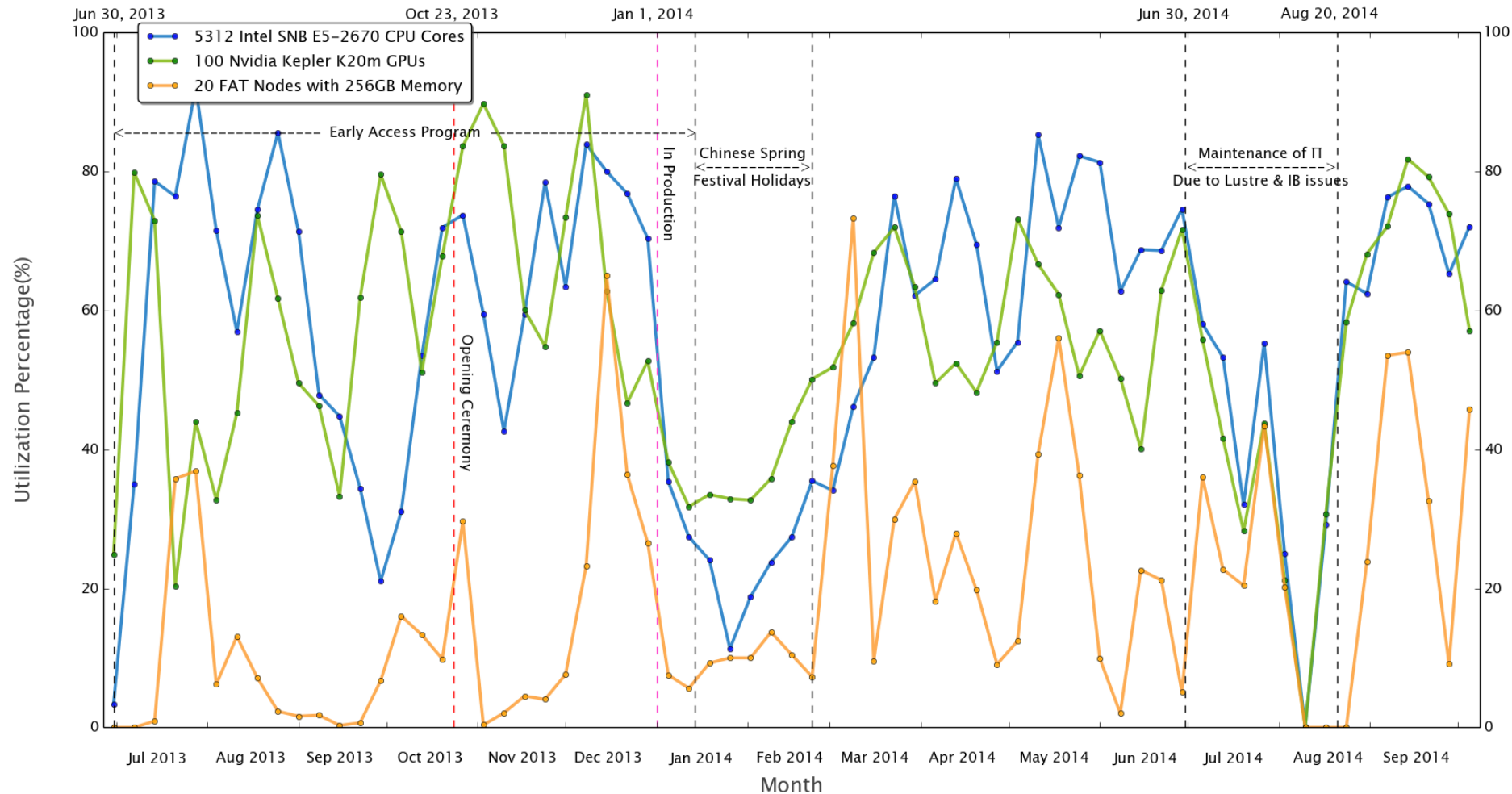
Early Access Program

NO.158 in the world



How we use π

Weekly Utilization of π , the Supercomputer of SJTU

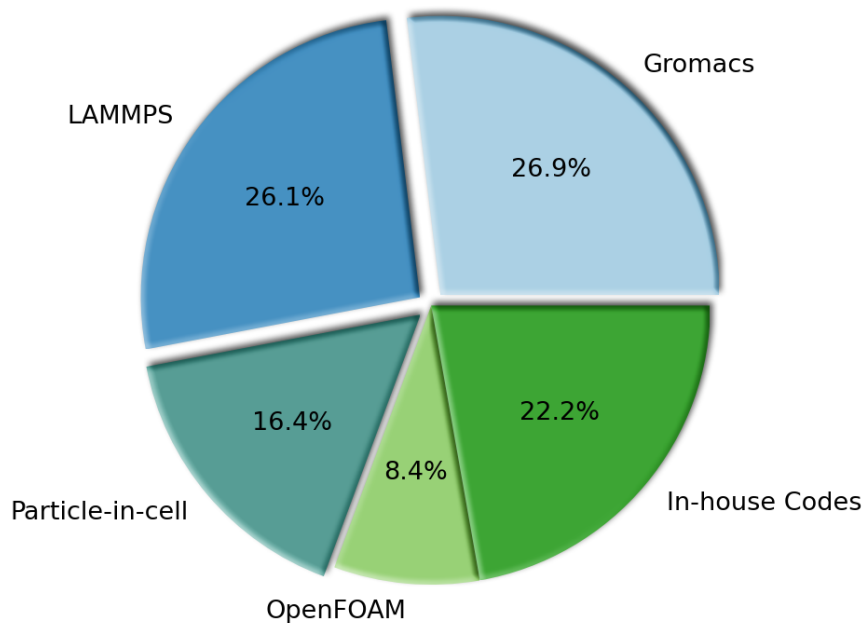




Top Applications on π -----> Potential for Accelerator-centric Supercomputer

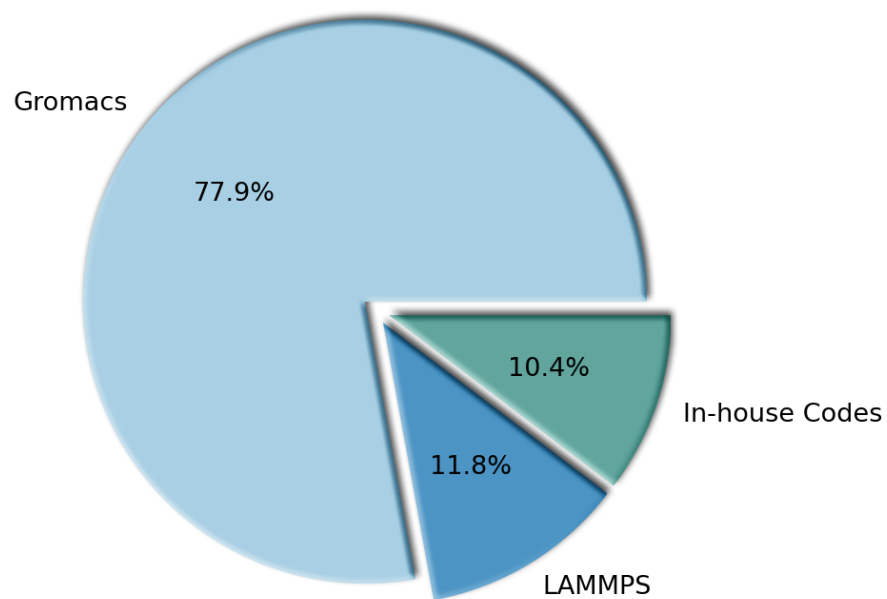
Top Applications on CPU Nodes of π

(2013.06 ~ 2014.10)



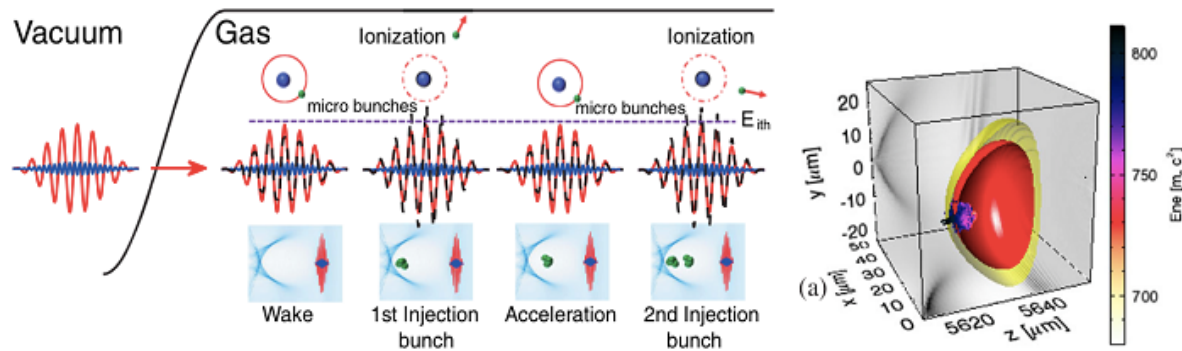
Top Applications on GPU Nodes of π

(2013.06 ~ 2014.10)



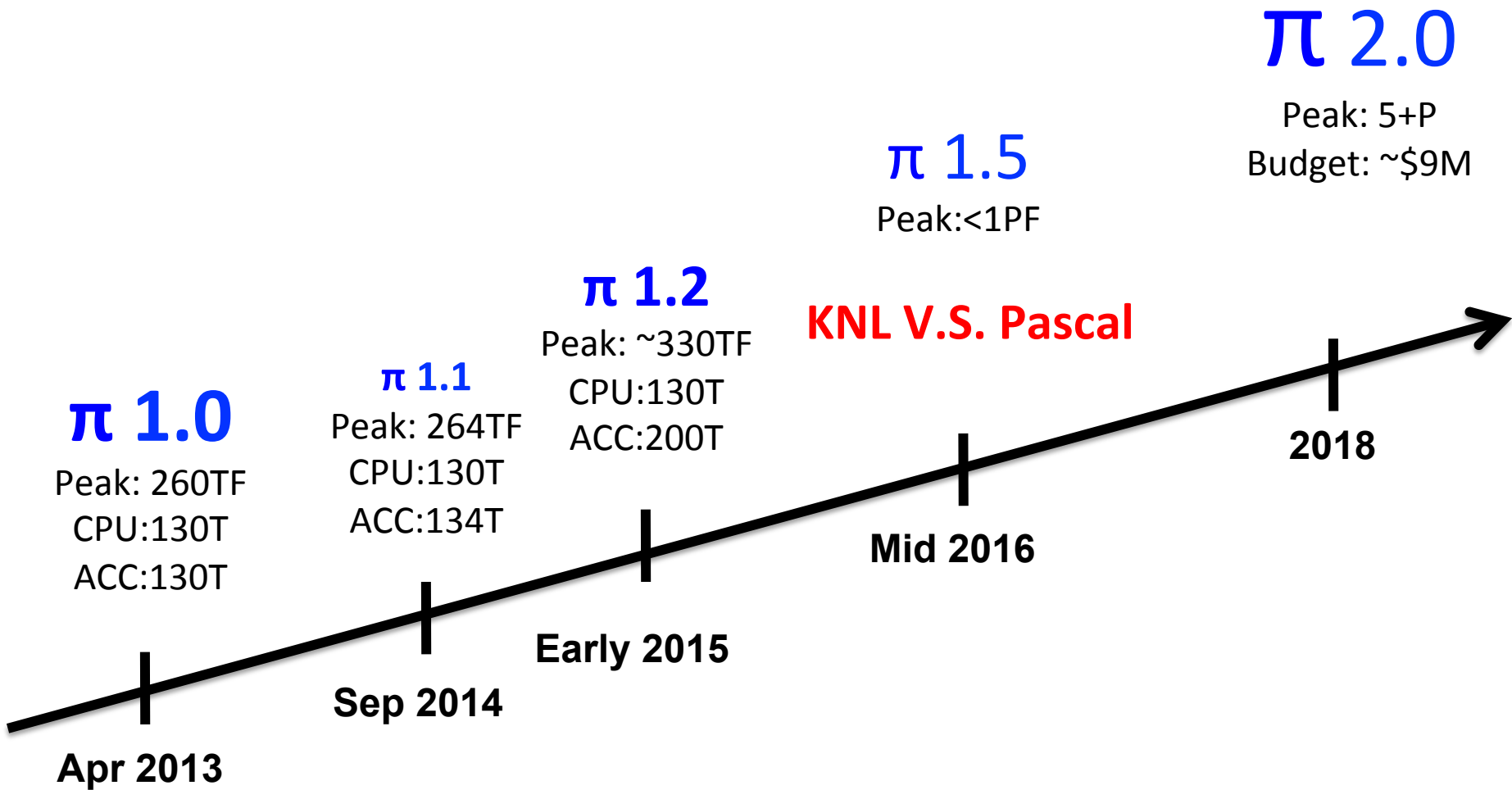
How we support π users

- High end research & Large amount of engineering projects





Roadmap of π





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ICSC2014

HPC World Leaders' Summit in SJTU

Keynote Speaker



Jack Dongarra
Director
Innovative Computing
Laboratory

Panel Discussion Moderator



William Harrod
Division Director
U.S. Department of Energy

Invited Speakers



Jacqueline H. Chen
(SNL)



Shiyi Chen
(PKU)



Omar Ghattas
(UT-Austin)



Kirk Jordan
(CSC)



Petros Koumoutsakos
(ETH)



Yutong Lu
(NUDT)



Satoshi Matsuoka
(Tokyo Tech)



Zeyao Mo
(IAPCM)



Depei Qian
(BHU)



Thomas Schulthess
(ETH)



Rick Stevens
(ANL)



William M. Tang
(Princeton)



Jinchao Xu
(PSU)



Linbo Zhang
(CAS)

HPC Leaders from:

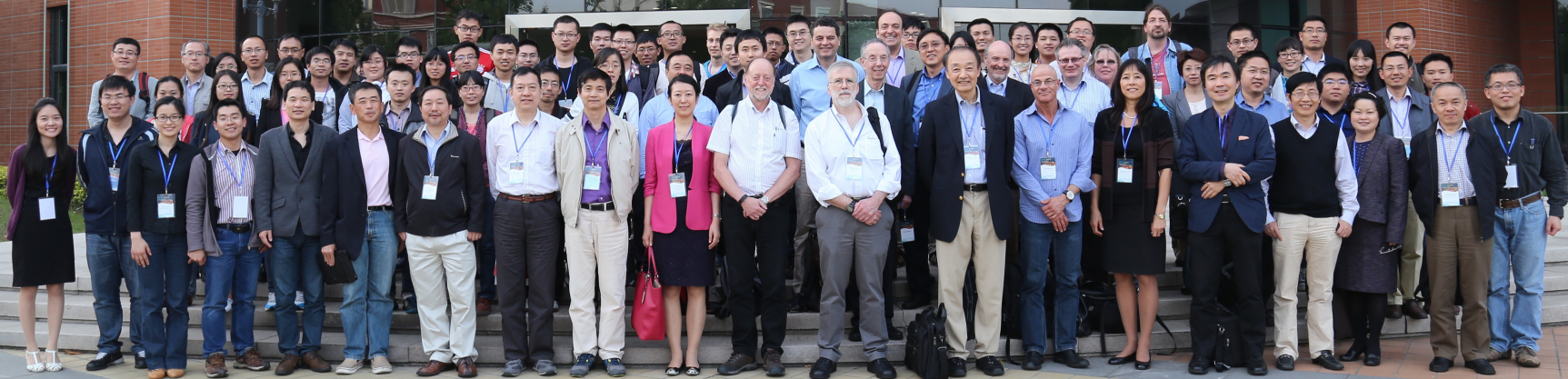
- US, DOE labs
- China
- EU
- Japan

Sponsors



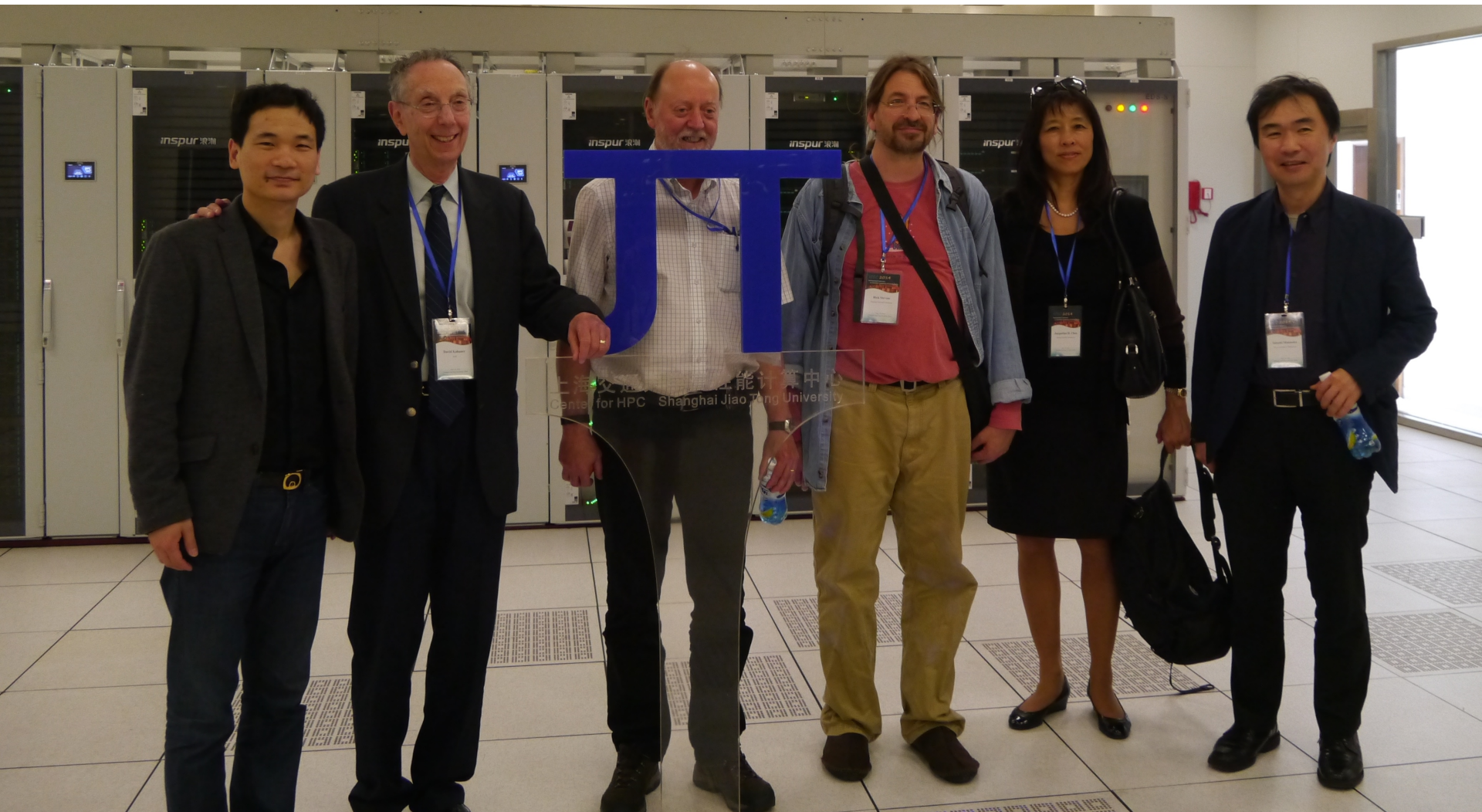


*International Conference on Scientific Computing at Extreme Scales
ICSC 2014*



May 7-9, 2014, Shanghai, China
at Shanghai Jiao Tong University

US Big names@SJTU



James@Cambridge



HPC Connections in APAC





We are 16th CCOE in the world!



Carnegie Mellon University

Carnegie Mellon University
Silicon Valley



STANFORD
ENGINEERING



CUDA Achievements Finals @GTC14



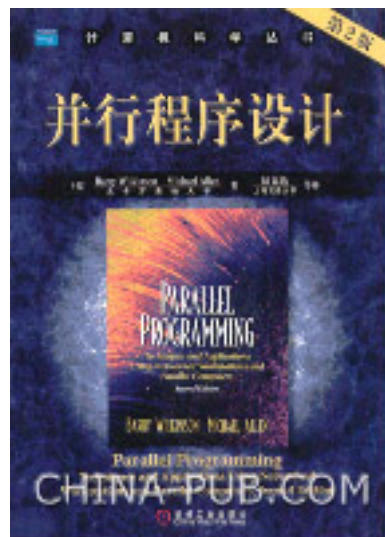
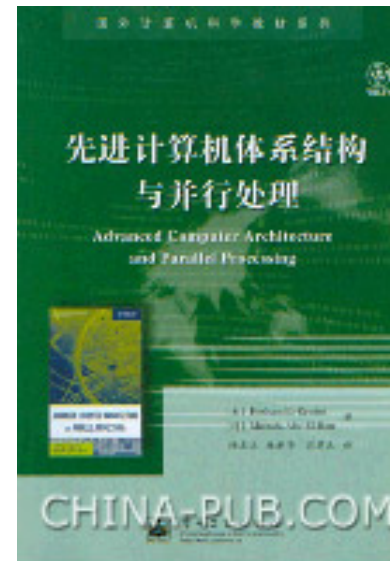


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HPC Text Books by us





GPU on π Seminars

- Every 2-month
- Make them be interested in HPC



We hosted ASC13 the 1st Student Cluster Contest in Asia



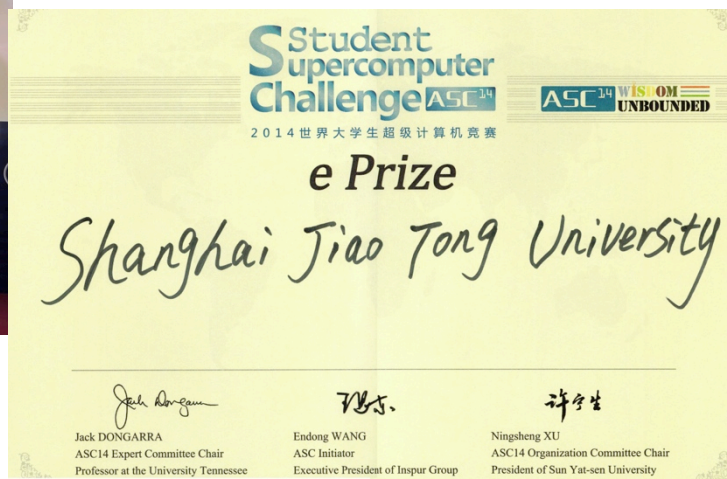
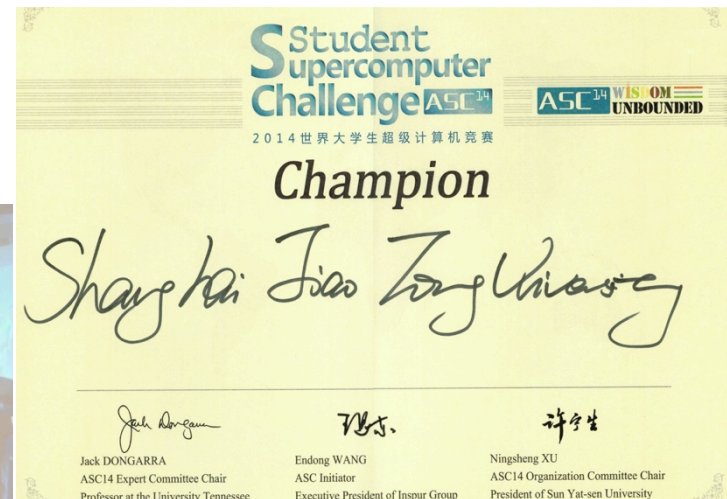


The Champion and e-Prize of ASC14

The world biggest student challenge ever!

Preliminary round teams: 82

Final round teams: 16



e-Prize: the best performance on 1024 nodes of Tianhe-2



ISC14 in Leipzig of Germany





Outline

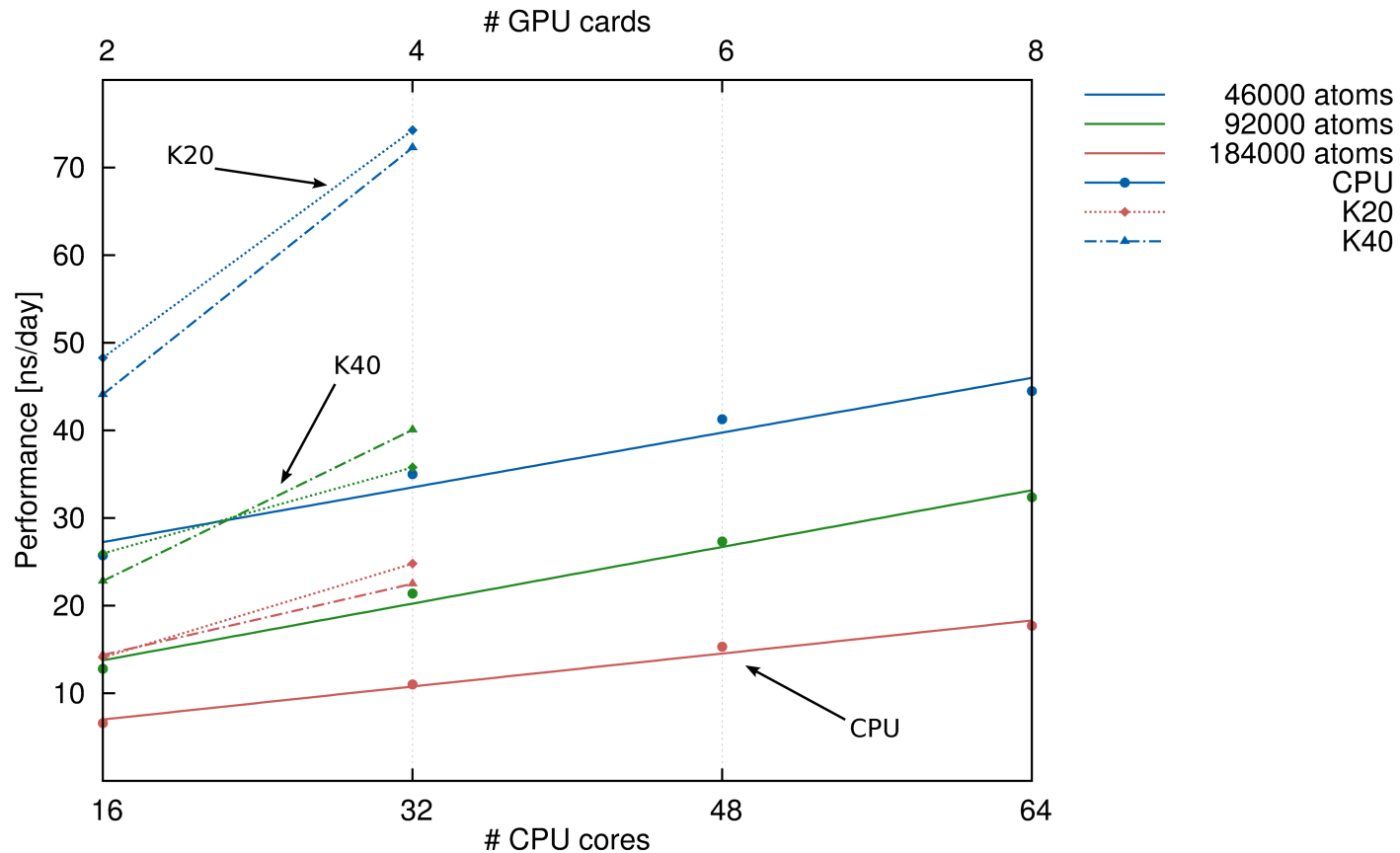
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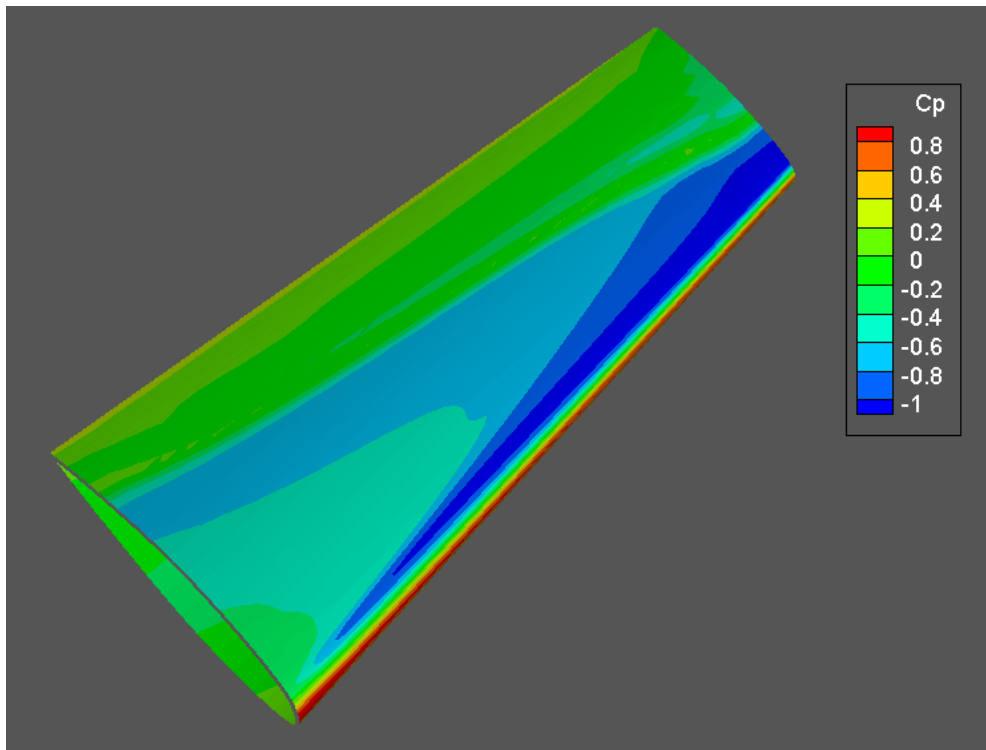
MD on π

- Gromacs, one of top applications in SJTU

Gromacs 5.0.4

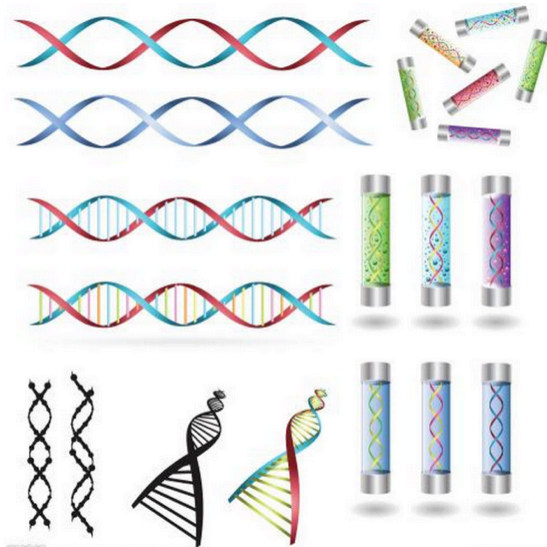


RANS Solver in SJTU

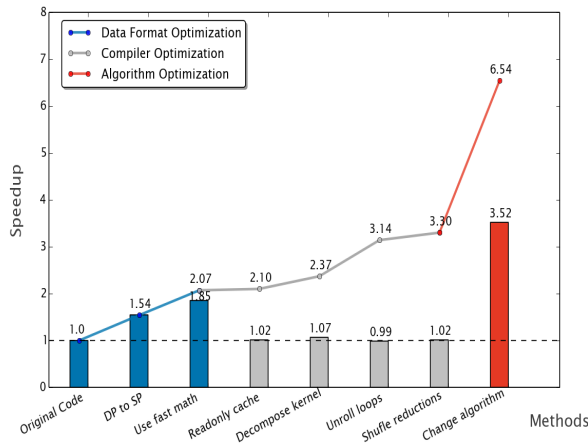


- CFD code by SJTU
- Used in COMAC
- Simu. For Wing design
- Based on RANS Equ.
- FVM on Struc. Grid
- 20~30x speedup

Optimization on Gene Analysis



- Gene analysis program of BGI
- Used for microbe identification
- Based on Hierarchical clustering & GMM
- Optimized in Data format, compiler & algorithm
- Achieved 6.5+ speedup

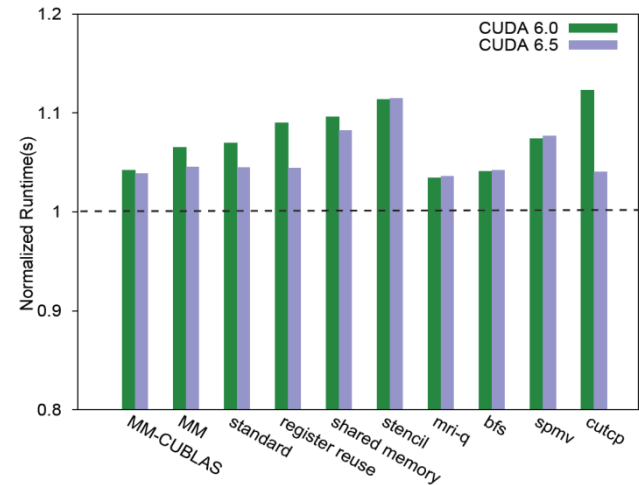




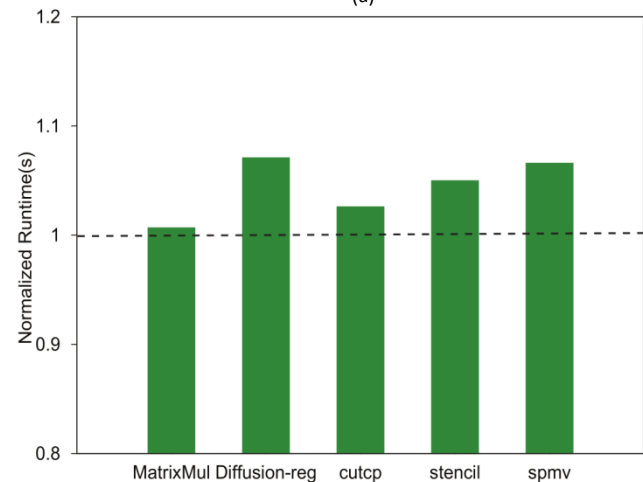
Evaluation of Unified Memory Technology on NVIDIA GPUs

- Introduce an evaluation methodology of the Unified Memory technology.
- Measure the performance loss of different applications when using Unified Memory on K40 and TK1.
- We also validated that the performance loss is caused by redundant memory transfers and page faults when adopting the Unified Memory programming model.
- We developed five microbenchmarks to summarize when redundant memory transfers will happen.
- Study the memory behavior on TK1. There still exists memory transfers between CPU and GPU in Unified Memory programming model.

Performance of different Benchmark Suites on K40. (a). Part of the experiment results based on TK1 are presented in subfigure (b). Green and purple histograms correspond to Unified Memory version with CUDA 6.0 and CUDA 6.5



(a)



(b)



The team





Thank you!