China Update
HPC (CPUs, Systems, SW, Commercialization)
Quantum, AI

PUBLIC RELEASE

Dr. David Kahaner (Kahaner@atip.org)
Asian Technology Information Program (ATIP)

APRIL, 2018
http://*atip.org*

atip

On-the-ground in Asia

What's ATIP

ATIP: Asian Technology Information Program
analysis of Asian S&T (founded in 1995)
HQ in Alb NM, but almost all staff are abroad
Many government contracts: Thank You!

How:
Unclassified on-the-ground tracking of S&T

What: Reports, briefings, 'tech tours,' etc
Across the tech landscape (HPC, Bio,
nano, energy, robotics, etc.

A unique company (www.atip.org)
David Kahaner: PhD Applied Math
LANL, NIST, ONR

On-the-ground in Asia

Four Excascale Prototypes

- MOST supporting 3 prototypes to verify key Exascale technologies: NUDT, Jiangnan Institute, Sugon, each @~$5M from 2016 to 2018.
    - All must use domestic developed processors. Govt committed to domestic components
    - Local govts involved providing extra cash. Trophy sites + real applications (AI)

- Prototypes need to be >= 512 nodes.

1. Jiangnan's: two 5PF prototypes (same technical specification), SW-NG* processor (10TF/chip) upgraded from SW26010, to be installed at National SC Center in Jinan (Jinan system funded by MOST), and Qingdao Nat Lab for Marine Science and Technology (Qingdao system funded by Qingdao local government) respectively.

2. Sugon's: 5PF, Higon X86 CPU+DCU accelerator, to be installed at National SC Center in Shenzhen/Shanghai supercomputing center. Shanghai & Shenzhen govts are funding prototype. If enough funding, Sugon may build 1K nodes – half each in Shanghai and Shenzhen. Else, maybe 512 nodes divided somehow, for example, 256 in Shanghai 256 in Shenzhen.

3. NUDT's: 5PF, ARM64-based FT2000+ CPU (64-core, 16nm, 2.0-2.4GHz)+ Chinese accelerator ? to be installed at the National SC Center in Tianjin.

atip **On-the-ground in Asia**

Excascale ?

- Full Exascale system development will start in 2018

- Based on 1 (definite) or 2 (likely) selected from 3 prototypes, only two systems could be funded by MOST

- One for sci. computing: Sunway system highly likely, processor upgrade from Exascale prototype (10+TF/chip), i.e., 2 clicks beyond Taihulight's SW-26010, to be installed at Qingdao Nat Lab for Marine Science and Technology

- One for AI (likely): X86 (Sugon) more likely than ARM-based FT-NG (256-core) (NUDT), but many stakeholders, intense lobbying, opaque decision making process, to be installed in Shenzhen? depending on funding contribution from local gov.

- The 3rd Excascale (rumor): might only get a project number from MOST, but could not be funded by MOST. Developer and installation site unclear.

Quantum Technologies
in
China

Mostly due to
   Dr. Mark Foley [mfoley@atip.or.jp]
   Dr. Watson Yan [wyan@atip.org.cn]

atip

On-the-ground in Asia

China Quantum Technologies

- **Government Funding Priorities**
  - **Quantum Communications**:
    - Reached a world-class level in practical application.
    - Beginning to lead for commercialization.
    - 100s of millions of $ over past several years.
  - **Quantum Simulation & Computation**:
    - Increased focus since 2016.
    - US$20-30M per year level
    - The gap is narrowing with international advanced level

Future funding is likely to significantly increase due to the scheduled megaproject, establishment of National Laboratory for Quantum Information Science as well as more involvement of companies

- **Main Funding Sources**
  - Ministry of Science and Technology (MOST), National Natural Science Foundation of China (NSFC), and more recently from companies including Alibaba, Tencent, Baidu

- **Leading Player**
  - University of Science and Technology, China (USTC) led by Prof. Jianwei PAN

atip

On-the-ground in Asia

Important Quantum Achievements

- **Fiber-Optic Cable based Quantum Communication Network**

  ◆ 2,000-km Beijing-Shanghai quantum communications trunk line officially put into use on Sept. 29, 2017 with total investment of ~US$123M.

  ◆ Metropolitan quantum networks within Beijing, Shanghai, Hefei, Jinan and Wuhan, etc. have or will come into commercial use.
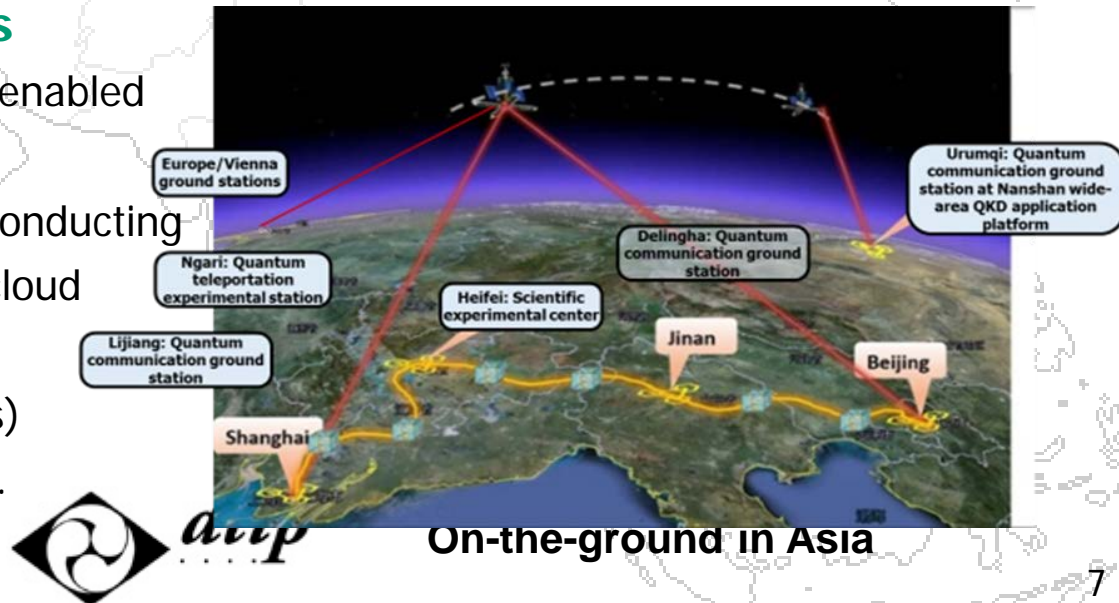
- **Free-Space Quantum Communications**

  ◆ Launched world's first quantum experiment satellite (Micius) in 2016.

  ◆ Finished the first space-earth quantum experiments (over 1200km) in 2017.

  ◆ Conducted the world's first cross-continental video call between Beijing and Vienna in 2017.

- **Quantum Computing Systems**

  ◆ Developed a 10 single photon qubits enabled quantum simulator in 2017.

  ◆ Developed a 11-qubit enabled superconducting quantum chip and started providing cloud computing service in 2018.

  ◆ Developed a 3-qubit (6 quantum dots) semiconductor quantum chip in 2018.

Beijing
Jinan
Hefei
Shanghai

Europe/Vienna ground stations
Ngari: Quantum teleportation experimental station
Lijiang: Quantum communication ground station
Shanghai
Heifei: Scientific experimental center
Delingha: Quantum communication ground station
Jinan
Beijing
Urumqi: Quantum communication ground station at Nanshan wide-area QKD application platform

On-the-ground in Asia

AI in China

AI Policy & Research

● **National strategy** announced in July 2017: to become world leader in AI -- by policy and investments
✓ End of phase 1 (2020), China's AI core industry worth 150B RMB (~US$23.5B).
✓ End of phase 2 (2025), AI revenue to reach 400 billion RMB (~US$63B)
plus 5 trillion RMB (~US$783B) in related industries.
✓ End of phase 3 (2030), goal to establish China as the world leader in AI.
    AI core market projected to reach over 1T RMB (~US$157B) With total value of 10T RMB (~US$1.57T) in related industries.
✓ Will this succeed? Maybe. But government will direct support, both funding and appropriate arm twisting, to push in this direction.

● **Research**
✓ Focus: big data driven human-like intelligent technology, intelligent interaction and intelligent robots from 2016 to 2020
✓ Strong areas: computer vision, speech recognition, machine translation, natural language perception, machine learning

● **Most companies focus on application development:** top 3 areas
✓ Computer vision and image
✓ Natural language processing
✓ Autonomous driving

atip

On-the-ground in Asia

China's Strength & Challenge

- **Essential factors for AI development:** computing, algorithm and data
  - ✓ Data: current competition front
  - ✓ AI chip: future competition front
  - ✓ Algorithm: low access barrier, most are open-sourced
- **Strength**
  - ✓ Gov elevates AI as a national strategy
  - ✓ Computing: rapid progress in HPC system development, nationwide supercomputing centers and cloud computing centers, more computing platforms will be built
  - ✓ Enormous data & easy to access to: large population, diverse applications, weak privacy protection
- **Challenge**
  - ✓ Talent shortage: small talent pool; domestic AI education not able to meet the industry demand in terms of both quality and quantity
  - ✓ Original AI research is still lacking
  - ✓ Domestic companies tend to pursue rapid/near-term gains, lag behind international companies in terms of forward-thinking about AI

atip   **On-the-ground in Asia**

SINCERE THANKS FOR YOUR INTEREST AND SUPPORT !

Questions/Comments - Contact Anytime: **Kahaner@atip.or.jp**

On-the-ground in Asia