NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY POLICY

From K to FUGAKU

September 2021
Shig Okaya,
Deputy Director General,
NISTEP,MEXT

Who I am…

- Served 5 years in RIKEN in charge of post K computer development and AI center management. (2015-2020)
- Participated in management of research institutes in Japan and abroad, including ITER in France, top national research institutions such as AIST, and RIKEN in Japan.
- Assumed many positions in ministries of the Japanese government (MEXT, METI and Ministry of the Environment) and Science/Nuclear Attaché at the Japanese Embassy in the USA.
- MS Nuclear Engineering from Kyoto University and MBA from Stanford University.

K Computer

- Politically controversial
  ("Why can't it be No.2?" open screening process under Democratic Party's regime 2009)
- Became No.1 in Top 500 (June 2011)
- Used SPARC architecture (not globally popular)

Post K

2013
December (CSTP prior evaluation)

- HPC identified as the key technology tool for nation's competitiveness
- Codesign
- Maximum 100 times more than K in application speed.
- 2.36-3.15 times more thank K in energy consumption

Accelerator vendor dropped out. Change needed for design.

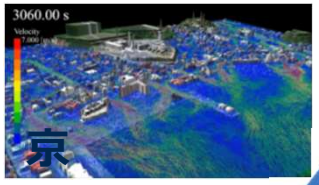
Codesign concept of post K

Science of Computation

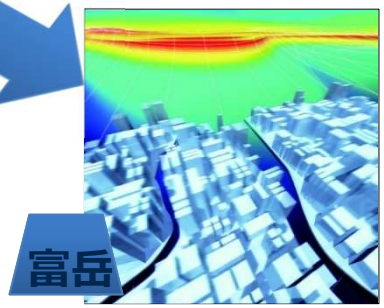
Science by Computation

Expected results

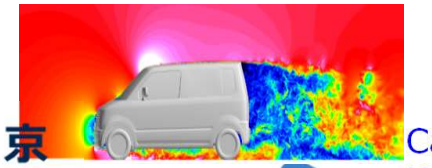
10km city Tsunami disaster simulation



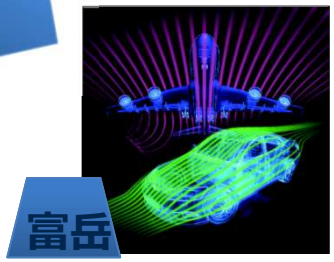
Total city Tsunami and earth quake compounded disaster simulation



Design cars with Less nose



Calculate half a day of what K would take tens of days

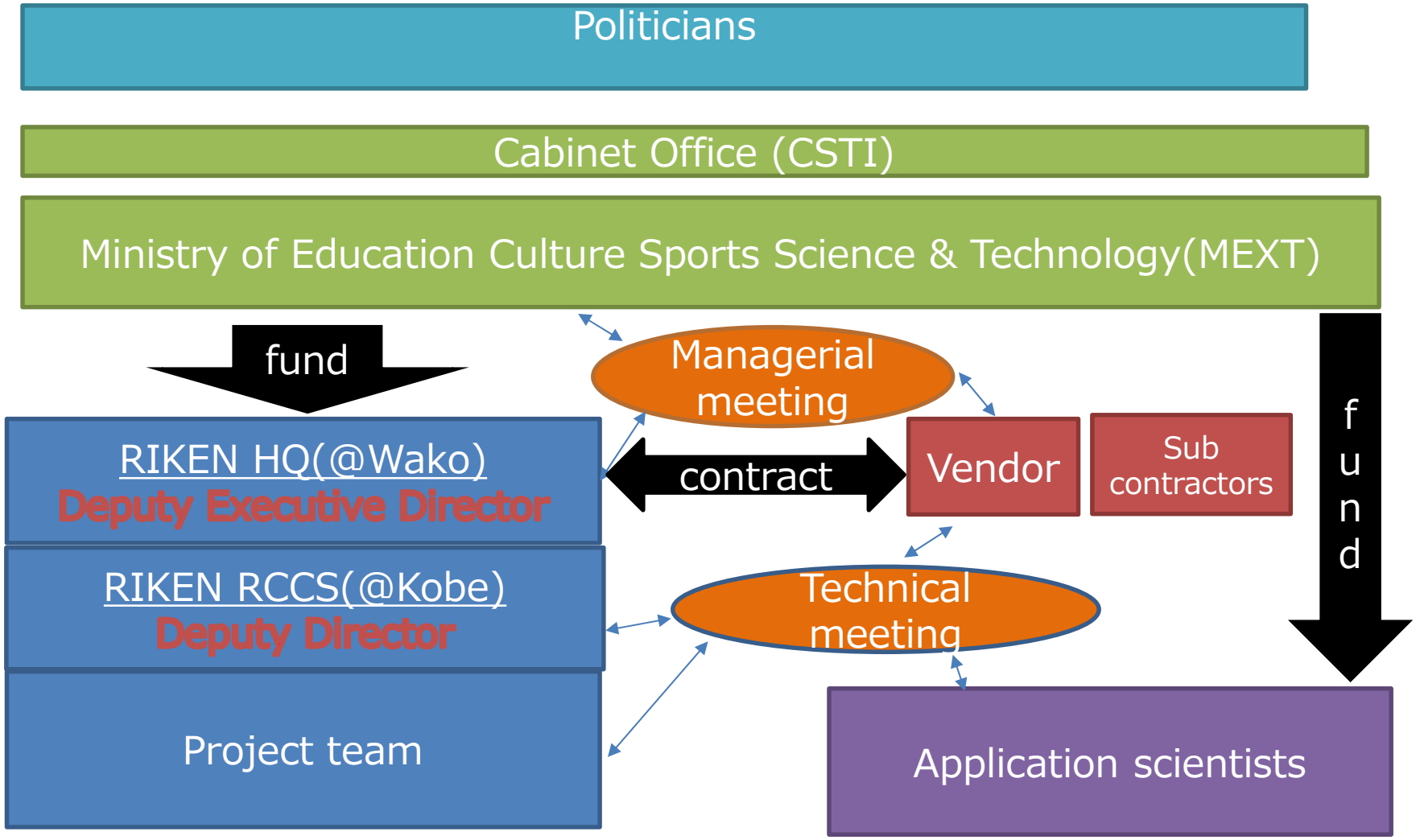


⇒2020 Nov. almost all 9 target applications have attained their multiplication goals

January (CSTI reevaluation)

- Flagship Project 2020 named.
- 9 target applications identified.
  Maximum 100times more than K in one of the target applications
- Total government spending (including application development)110BY
- Accelerator dropped
- Risk management necessary as CPU will be sourced outside of Japan
- To gain understanding from the public, clear articulation of the outcome necessary

stakeholders and management system



Administrative Review

November

Administrative review, open public hearing under current LDP regime

Issues raised in the Administrative review, public hearing

(chaired by Minister of administrative reform Mr. Kono, and external experts from various fields including now president of Keio Univ professor Itoh)

1. About 110 BY tax payer's investment expected but the expected return both in terms of science and in terms of economy/society need to be well explained to the public.
2. Because limited company will be undertaking the project, cost reduction and project management should be double checked by external experts and with global comparison in mind.

(comments from the experts)

- Unlike case of K computer, Japan cannot fabricate chips by itself. How do you frame our national merit?
- It is good that you have target application and its goals. But you need to dig deeper what that means scientifically. One might easily assume that only limited scientists enjoy the luxury of the machine. The real scientific benefit should be shown as an outcome of the output.
- The amount of investment and target of the outcome are all considered "in Japan". We do not know whether they are appropriate internationally. More deeper analysis and comparison should be done "internationally"

January (MEXT)

- Basic design approved
- 4 Characteristics of the machine specified

Speed, energy efficiency, ease of use, impact of outcome

Riken Fujitsu signing detailed design contract

March (CSTI)

- Basic design and its evaluation confirmed

June

Use of ARM architecture announced

August (MEXT)

- Schedule delay (12-24months)
- CPU 10nm ->7nm, memory change
- Upgrade modification requested to enhance usability

December

IDC report of ripple effect to MEXT subcommittee

IDC presentation at MEXT subcommittee

IDC
Analyze the Future

A Study of the Ripple Effects From The K Computer And The Potential Impacts Of The Post K Computer

Earl Joseph, ejoseph@idc.com
Steve Conway, sconway@idc.com
Robert Sorensen, bsorensen@idc.com
Kevin Monroe, kmonroe@idc.com
Nishi Katsuya, nishi@hpcwire.jp

December 5, 2016

January
RIKEN-CEA/FRANCE
collaboration agreement
Collaboration on ARM based software stack etc.

October (Cost and performance evaluation, MEXT)

- FP16 and memory change
- International third party consultant; comparison of performance of HPCs at the time of post K delivery, and evaluation of post K usability
- Adopt Linux distribution, collaborate on open source community, establish ARM ecosystem

Green light to FUGAKU

2018

<u>September (Mid tern evaluation MEXT)</u>

- The first chip's sound evaluation reported by RIKEN, confirming steady progress to the target.
- FP16 deployed to meet wider user demand on deep learning.
- High end Arm-CPU expected to be utilized worldwide.

<u>November (Mid term evaluation, CSTI)</u>

- Final green light for fabrication

2019

<u>March</u>

Fabrication starts (agreement between Riken and Fujitsu)

<u>May</u>

Post K is named "FUGAKU"

FUGAKU is another name for Mt. Fuji. The name implies of its high performance and wide usage

NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY POLICY

FUGAKU

2020
May
FUGAKU installed in Kobe
June, November
FUGAKU winning 4 top awards in Top500

2021
March
FUGAKU started service to the public use

What was effective in convincing Japan?

1. Change from “Speed paramount” to “4 characteristics”
2. Introduced non-Japanese expert consultant to give non-Japanese perspective
3. Expanded potential user community
4. International coordination with global market horizon in scope
5. Contingency management
6. Real output

What I foresee…

1. Simulation needs to provide outcome to the society
2. Technology to enhance energy efficiency needed
3. Chip fabrication demand increase more to edge computing (may affect HPC chip fabrication resources?)
4. Industry will have more international alliance (grouping?)