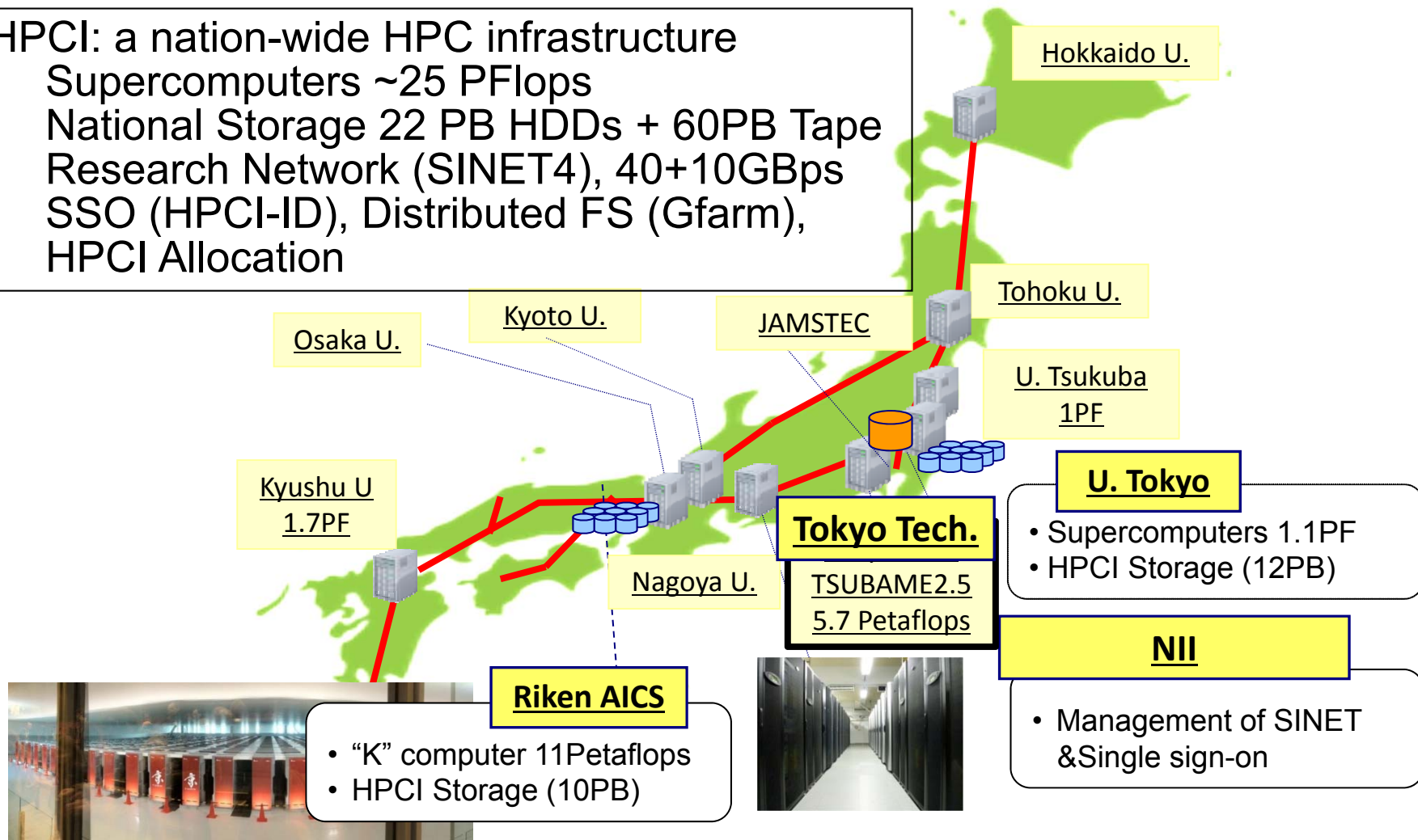


Japan's High Performance Computing Infrastructure (HPCI)

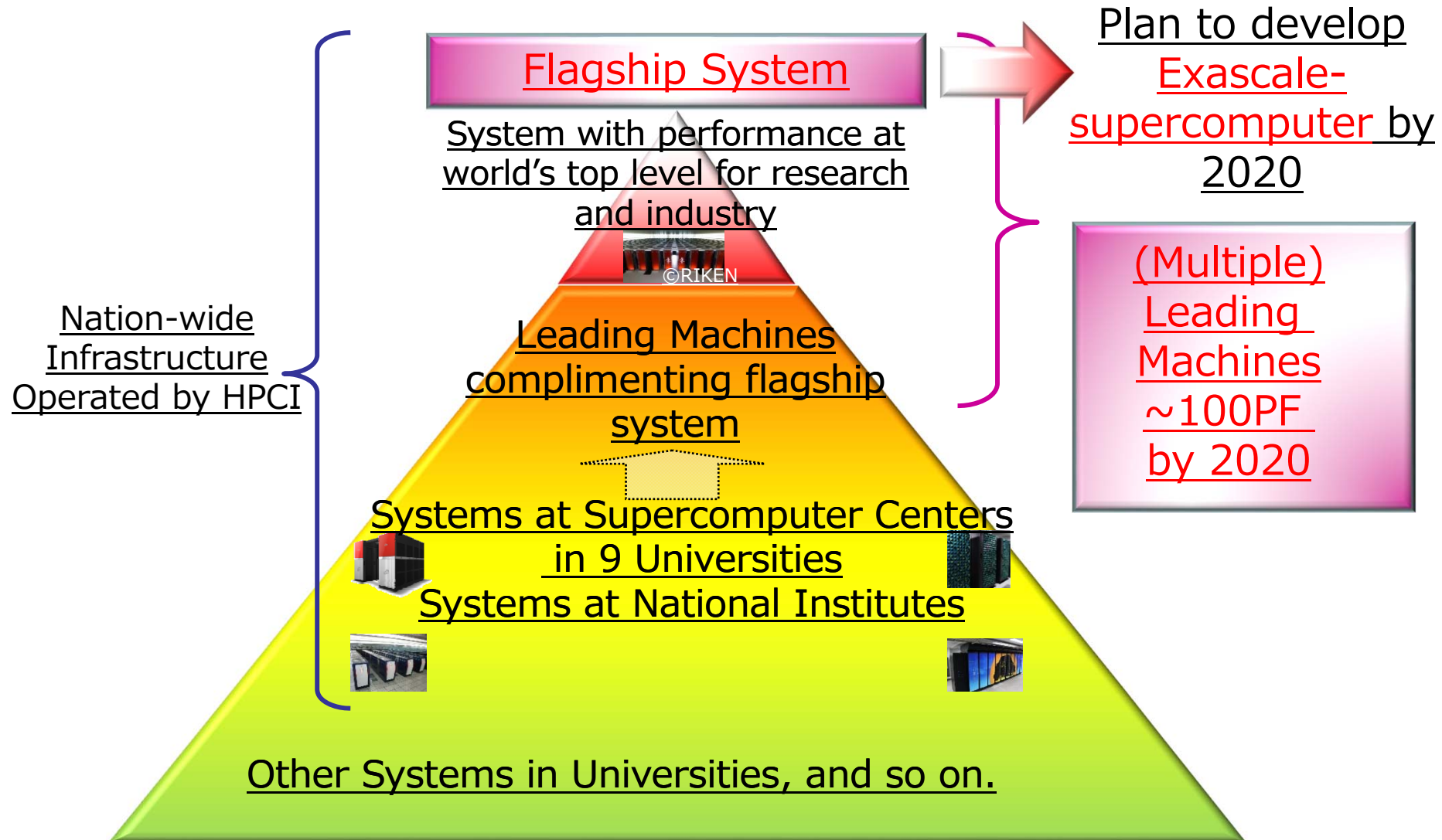
HPCI: a nation-wide HPC infrastructure

- Supercomputers ~25 PFlops
- National Storage 22 PB HDDs + 60PB Tape
- Research Network (SINET4), 40+10GBps
- SSO (HPCI-ID), Distributed FS (Gfarm), HPCI Allocation



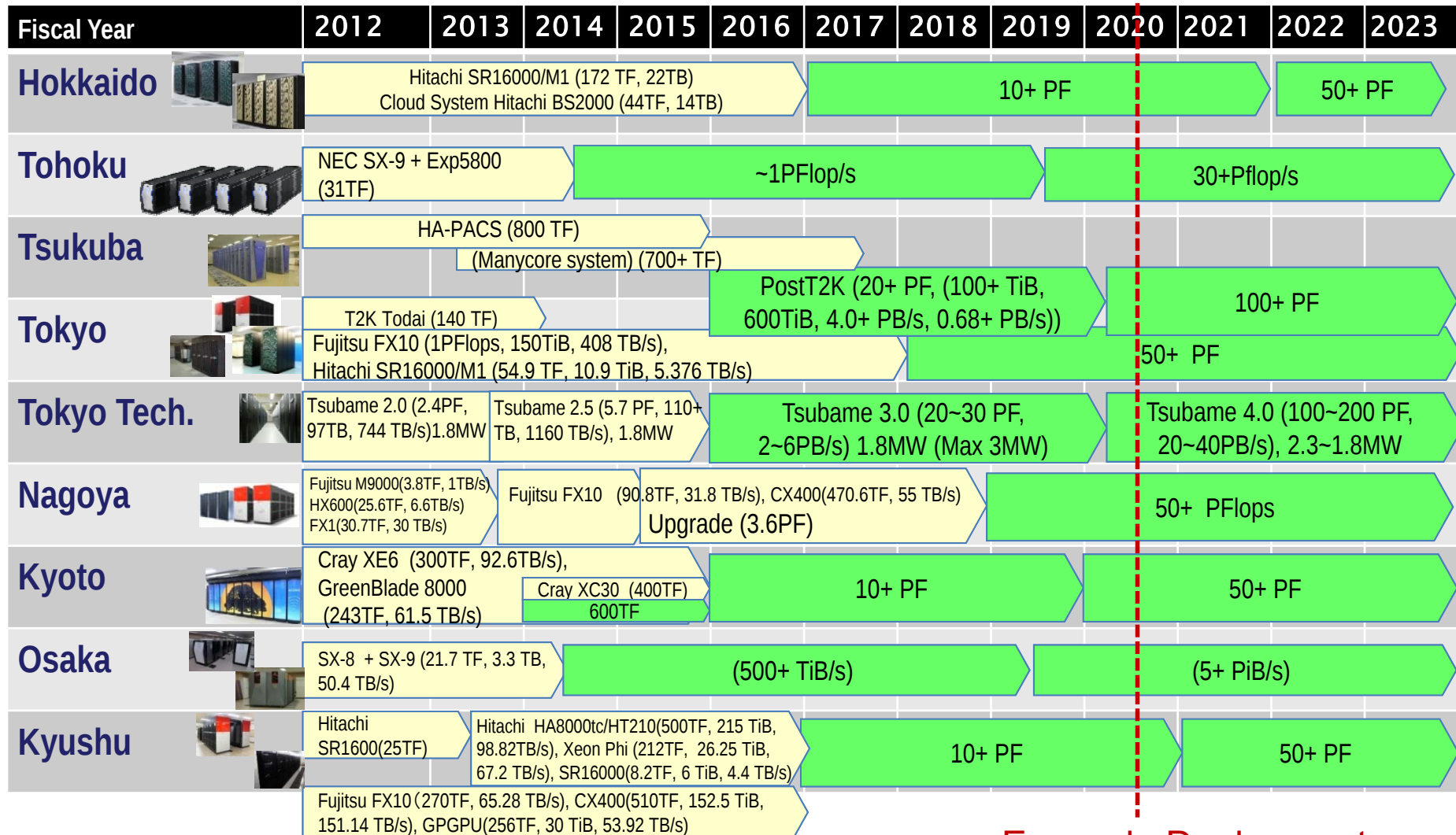
Direction for Development of Next Gen. Supercomputers towards EXASCALE

<Picture of Infrastructure for Computational Science and Technology in Japan>



Japanese “Leading Machine” Candidates

Roadmap of the 9 Centers



Exascale Deployment
vs. ~500PF aggregate

Future Big Data Application

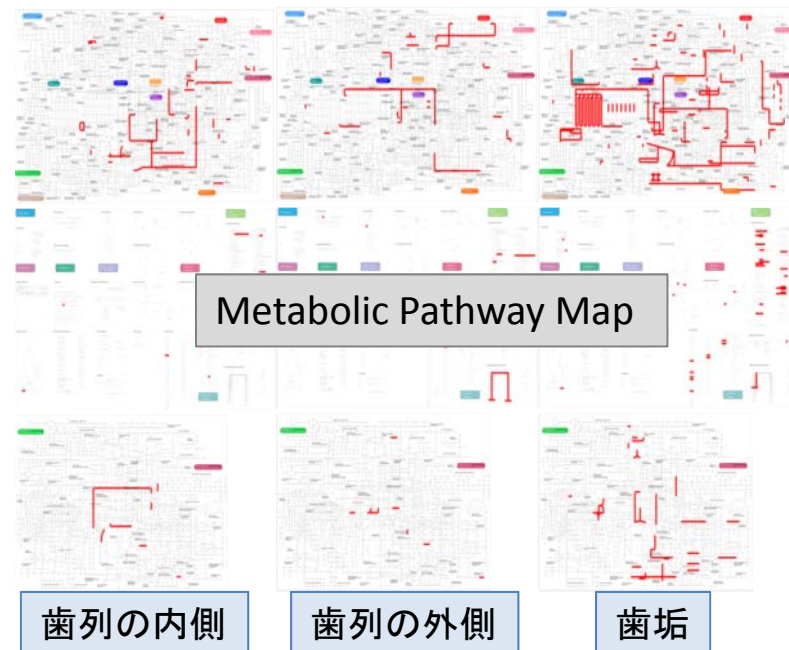
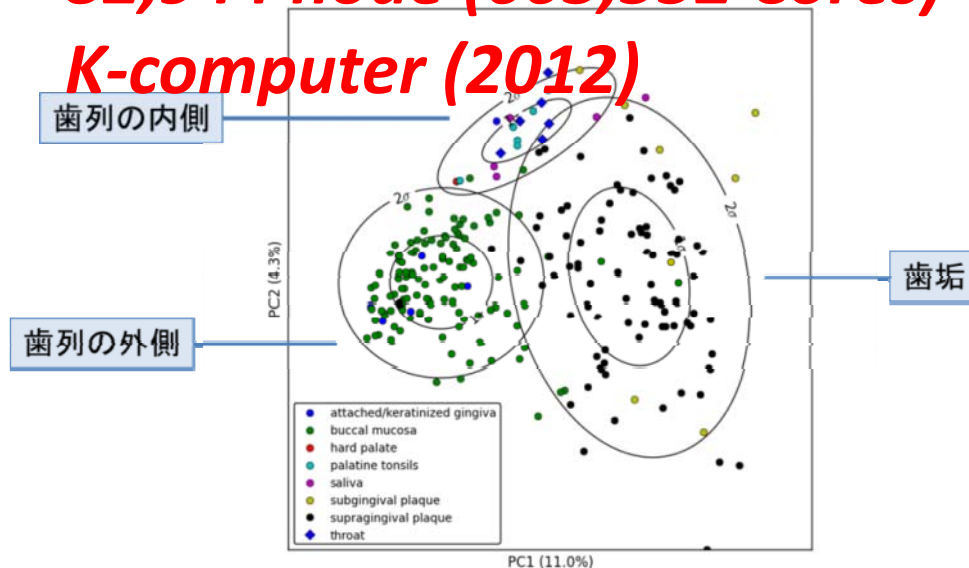
Akiyama group@Tokyo Tech

Ultra high-sensitive “big data” metagenome
sequence analysis of human oral microbiome

- Required > **1 million node*hour product** on K-computer
- World's most sensitive sequence analysis (based on amino acid similarity)
- Discovered at least three microbiome clusters with functional differences.
(Integrated 422 experiment samples taken from 9 different oral parts)



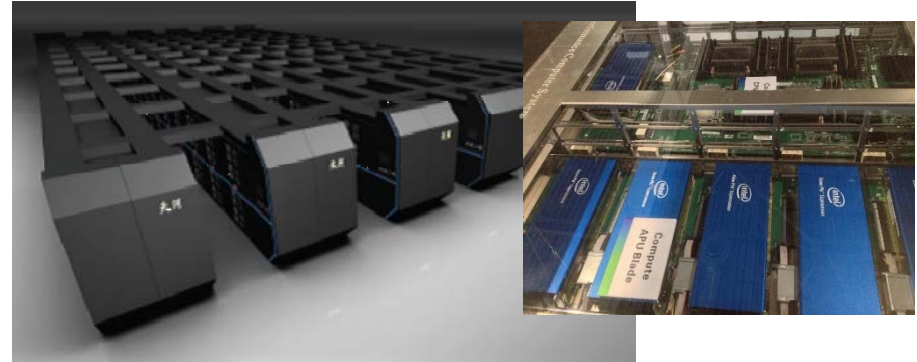
572.8 M Reads / hour
82,944 node (663,552 Cores)
K-computer (2012)



Top Supercomputers vs. Cloud IDC



K Computer (#1 2011-12) Riken-AICS
Fujitsu Sparc VIII-fx Venus CPU
88,000 nodes, 800,000 CPU cores
~11 Petaflops (10^{16})
1.4 Petabyte memory, 13 MW Power
864 racks, 3000m²



Tianhe2 (#1 2013) China Gwanjou
48,000 KNC Xeon Phi + 36,000 Ivy
Bridge Xeon
18,000 nodes, >3 Million CPU cores
54 Petaflops (10^{16})
0.8 Petabyte memory, 20 MW Power
??? racks, ???m²

C.f. Amazon ~= 450,000 Nodes, ~3 million Cores

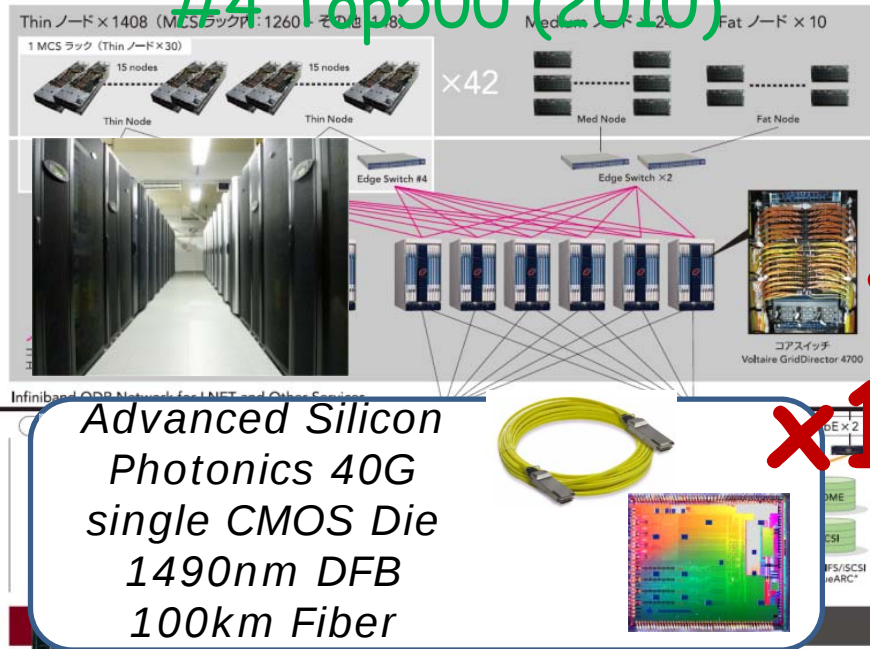


#1 2012 IBM BlueGene/Q "Sequoia"
Lawrence Livermore National Lab
IBM PowerPC System-On-Chip
98,000 nodes, 1.57million Cores
~20 Petaflops
1.6 Petabytes, 8MW, 96 racks



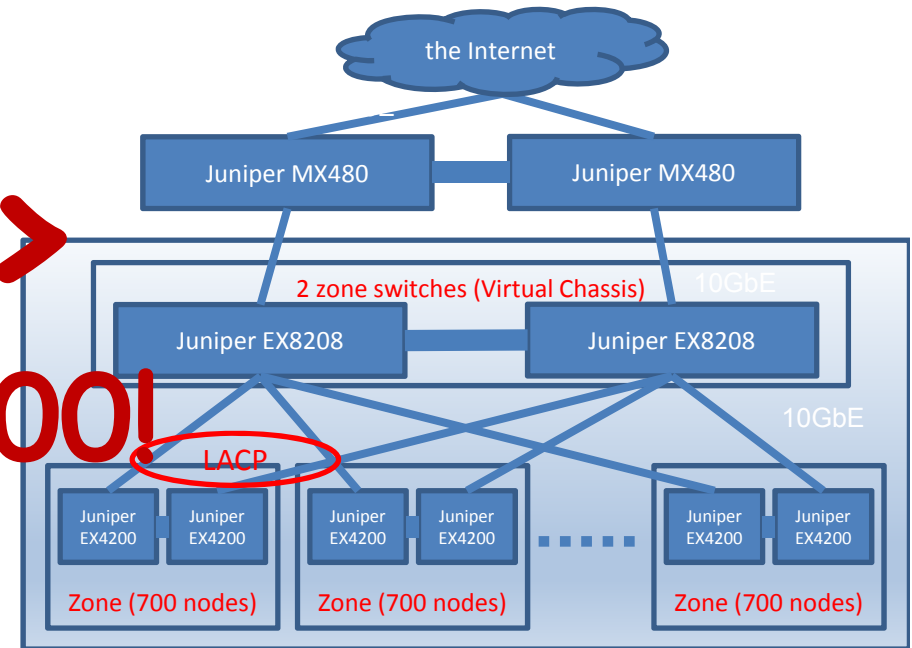
DARPA study
2020 Exaflop (10^{18})
100 million~
1 Billion Cores

Supercomputer Tokyo Tech. Tsubame 2.0 #4 Top500 (2010)



~1500 nodes compute & storage
Full Bisection Multi-Rail
Optical Network
Injection 80GBps/Node
Bisection 220Terabps

A Major Northern Japanese Cloud Datacenter (2013)

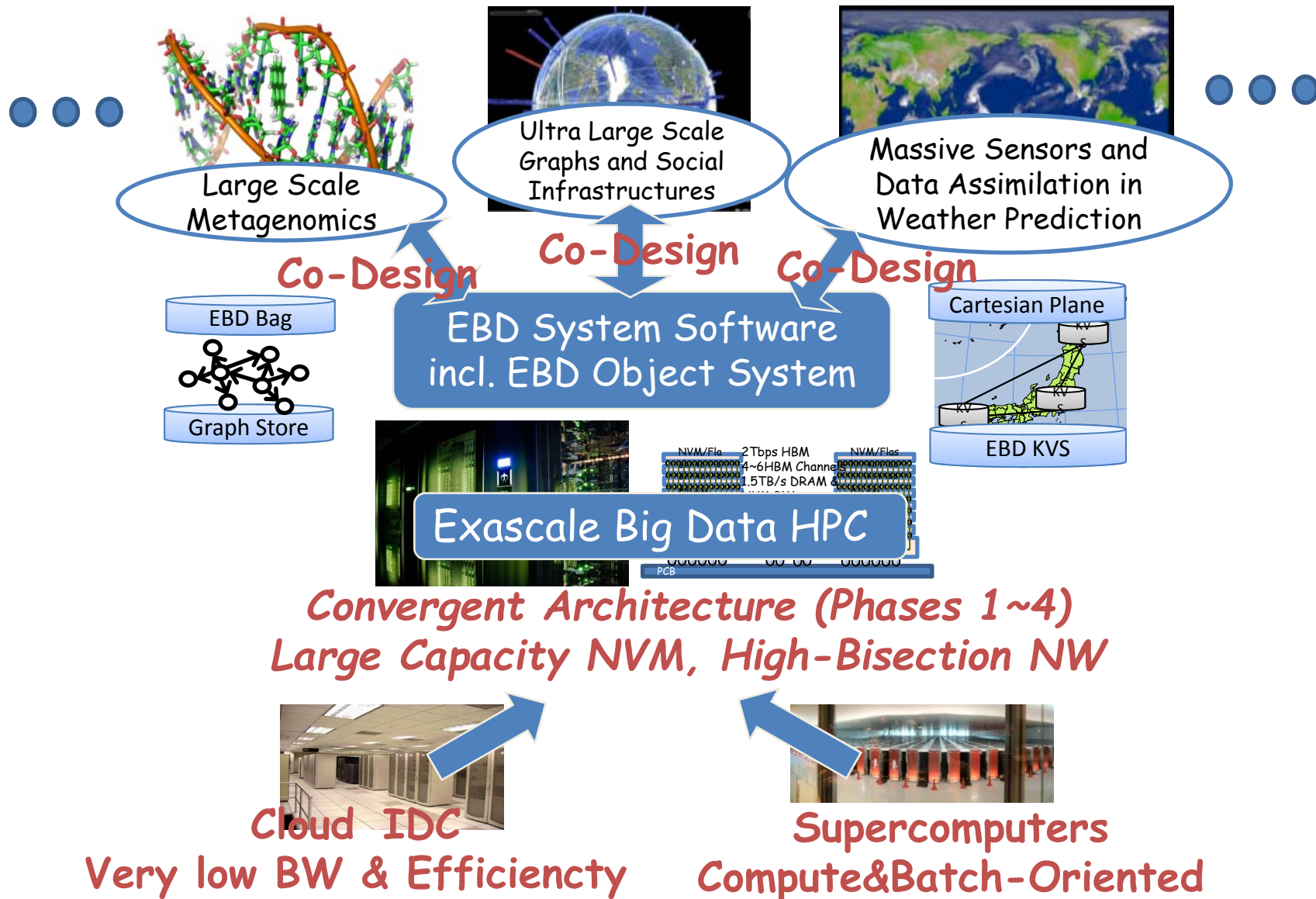


8 zones, Total 5600 nodes,
Injection 1GBps/Node
Bisection 160Gigabps

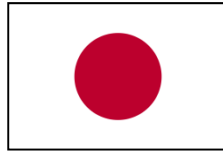
C.f. Entire Global Internet BW average:
213 Tbps (source: CISCO)

Extreme Big Data:

Convergence of Big Data and HPC



Project Arrangement between US and Japan on R&D Collaboration for HPC System Software Development



Agreement between US and Japan on Cooperation in R&D in Sci. and Tech. (1988)



The Implementing Arrangement Concerning Cooperation in R&D in Energy and Related Fields
MEXT, Japan ⇔ DOE, US
<April 30, 2013>

※Cooperative area described in this arrangement:
(Nuclear Fusion Science, High Energy Physics, Nuclear Physics, **Computer Science**, etc)



※At Joint High Level Committee Meeting on Science and Technology cooperation
(April 30, 2013)

TBC

(As One of cooperative area)

Project Arrangement to the Implementing Arrangement between US and Japan Concerning Computer Science and Software Related to HPC for Open Scientific Research

- Participating Organizations:
National Lab. (DOE, US), RIKEN (Japan), other centers and companies
- Cooperative Area:
System Software
- Major Contents
Description for Forms of Cooperation and Management of Project etc