Parallel Processing

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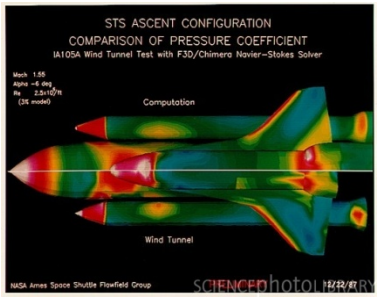
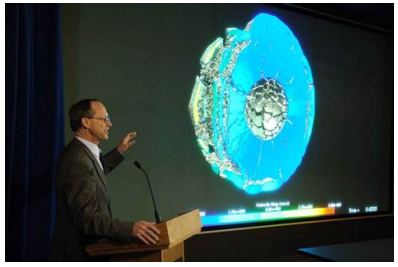
Chapter 1: Introduction

- HPC and applications
- New strends
- Introduction
  - What is parallel processing?
  - Why do we use parallel processing?
- Parallelism

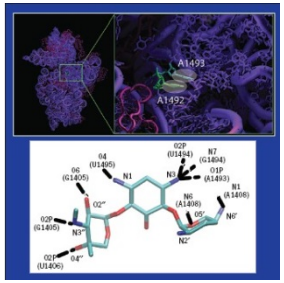
Applications (1)



Fluid dynamics

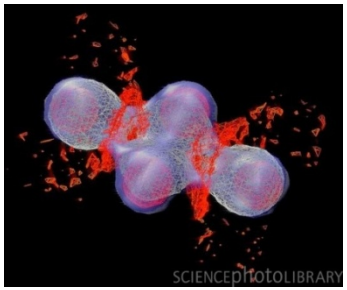


Astronomy

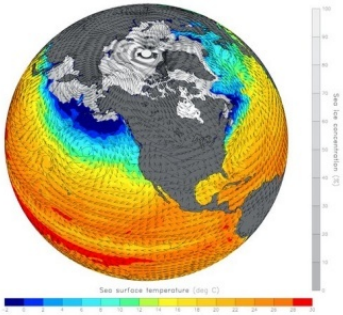


Medicine

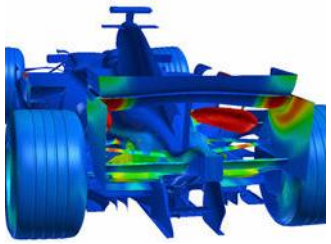
Simulation of oil spill
In in BP oil ship problem



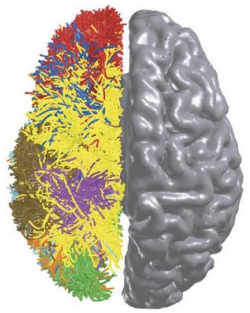
Simulation
i.e. Lithium atom



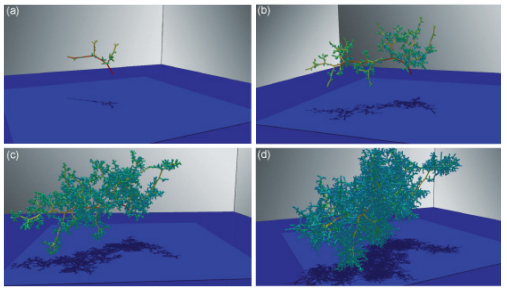
Weather forecast (PCM)



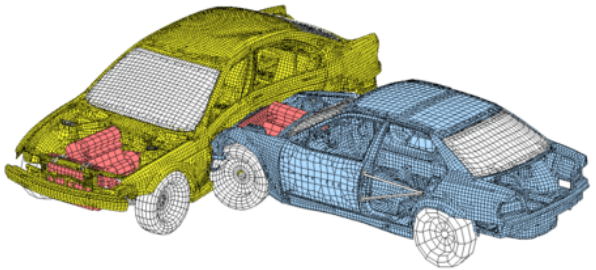
Renault F1



Brain simulation



Simulation of Uranium-235 created
from Phutonium-239 decay



Simulation of car accident

Applications (2)

- Critical HPC issues
  - Global warming
  - Alternative energy
  - Financial disaster modeling
  - Healthcare
- New trends
  - Big Data
  - Internet of Things (IoT)
  - 3D movies and large scale games are fun
  - Homeland security
  - Smart cities

30 billion RFID tags today (1.3B in 2005)

4.6 billion camera phones world wide

12+ TBs of tweet data every day

? TBs of data every day

25+ TBs of log data every day

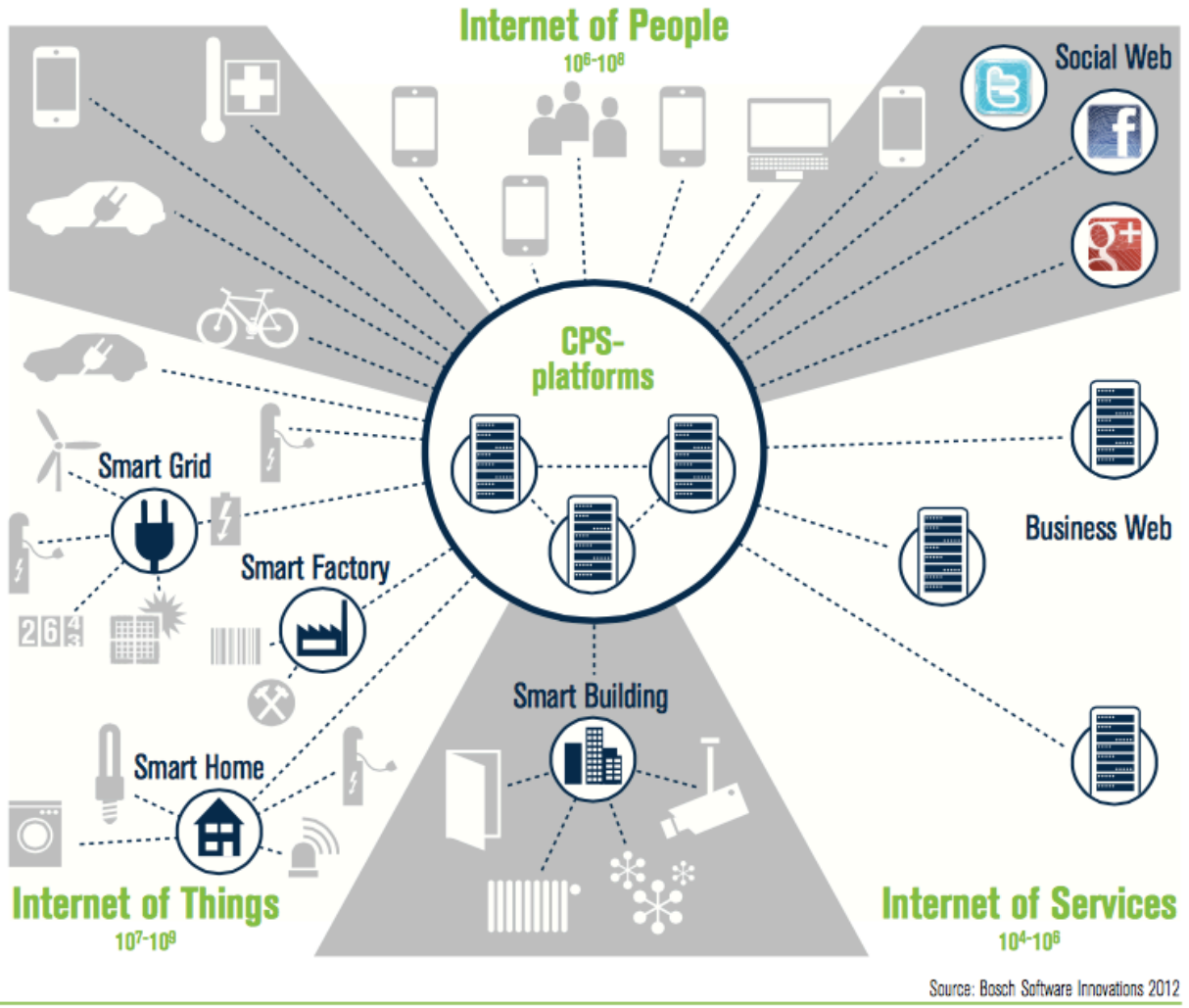
100s of millions of GPS enabled devices sold annually

76 million smart meters in 2009… 200M by 2014

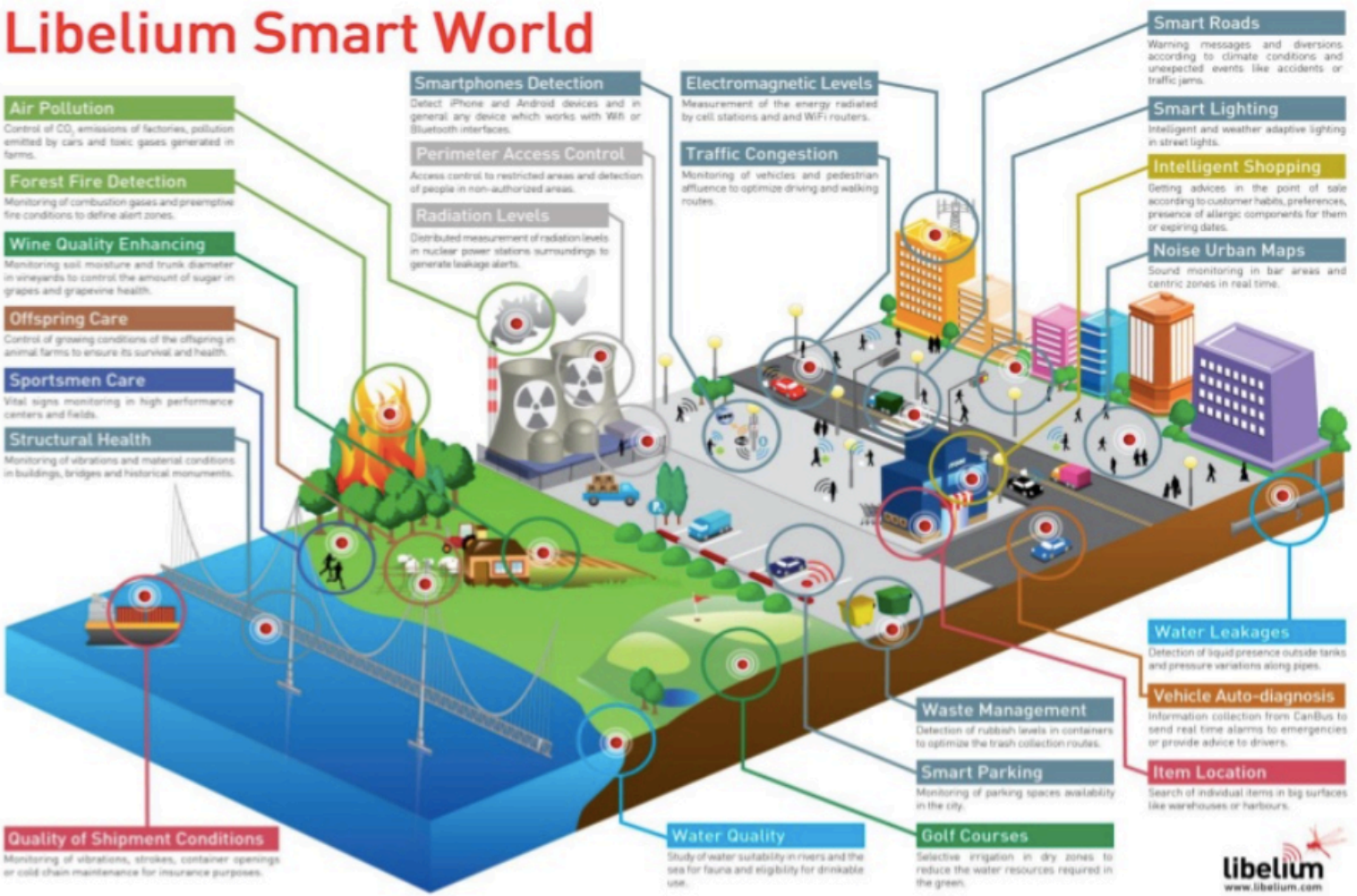
2+ billion people on the Web by end 2011

IoT and Services

Figure 4:
The Internet of Things and Services – Networking people, objects and systems



Smart cities

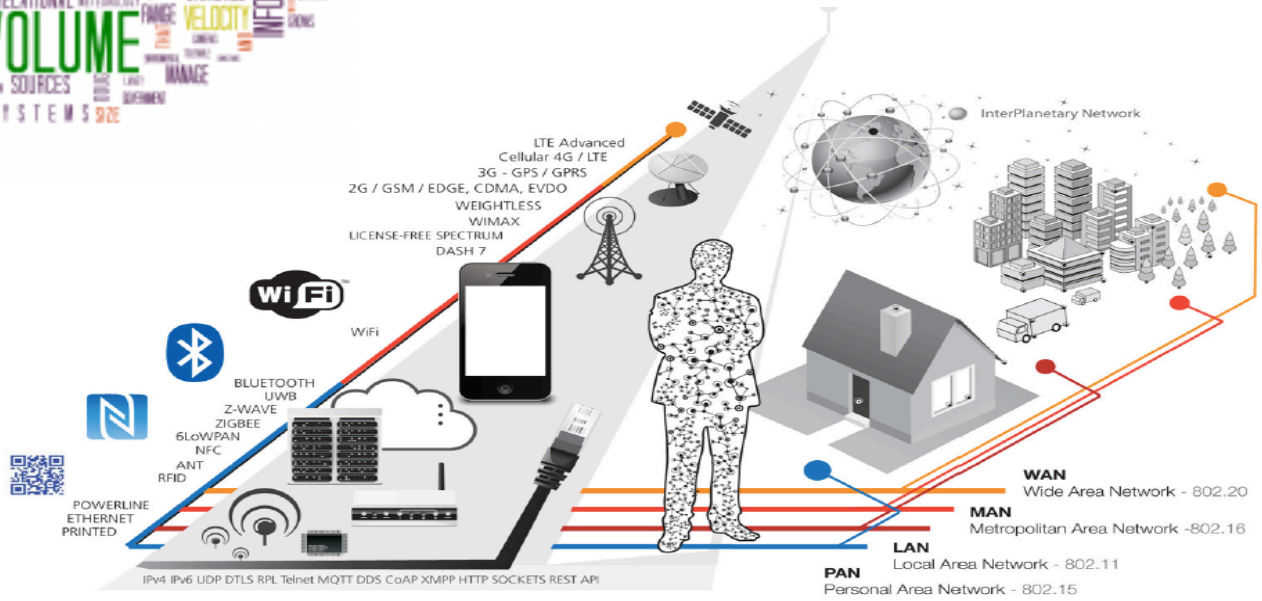


http://www.libelium.com/libelium-smart-world-infographic-smart-cities-internet-of-things/

Different thinking

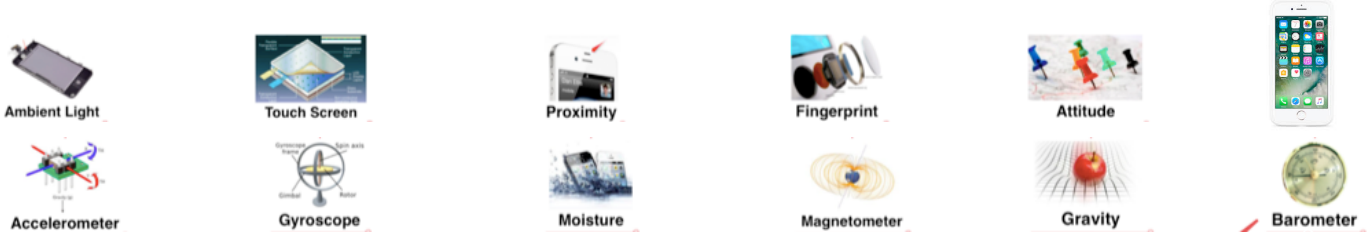
- Smart cities: 2008 <> 2018
- Industry: 4.0 <> 3.0

Data collection



Connect

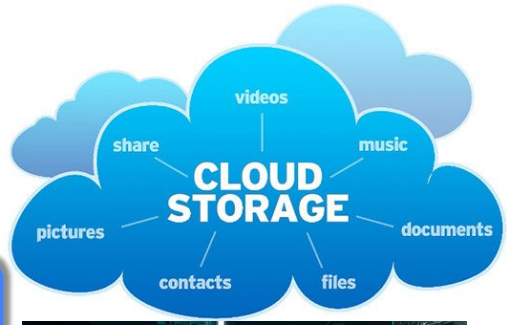
Things



Data analytics

Learn

Collect



High Performance Computing - HPC

HPC wire

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July 30, 2015

White House Launches National HPC Strategy

John Russell and Tiffany Trader

Yesterday's executive order by President Barack Obama creating a National Strategic Computing Initiative (NSCI) is not only powerful acknowledgment of the vital role HPC plays in modern society but is also indicative of government's mounting worry that failure to coordinate and nourish HPC development on a broader scale would put the nation at risk. Not surprisingly, early reaction from the HPC community has been largely positive.

The European HPC Strategy

The Commission recognised the need for an EU-level policy in HPC to optimise national and European investments, addressing the entire HPC ecosystem. The Commission adopted its HPC Strategy on 15 February 2012 in the Communication "High Performance Computing (HPC): Europe's place in a global race" to ensure European leadership in the supply and use of HPC systems and services by 2020. The Competitiveness Council on 29/30 May 2013 adopted conclusions on this Communication, highlighting the role of HPC in the EU's innovation capacity and stressing its strategic importance to the EU's industrial and scientific capabilities as well as to its citizens.

High-Performance Computing (HPC) is a strategic resource for Europe's future. Mastering advanced computing technologies from hardware to software has become essential for innovation, growth and jobs.

Oakforest-PACS
13.55 Petaflops
556,104 cores

Summit 122.3 Petaflops
2,282,544 cores

Sunway TaihuLight
93.0 Petaflops
10,649,600 cores

Piz Daint
19.59 Petaflops
361,760 cores

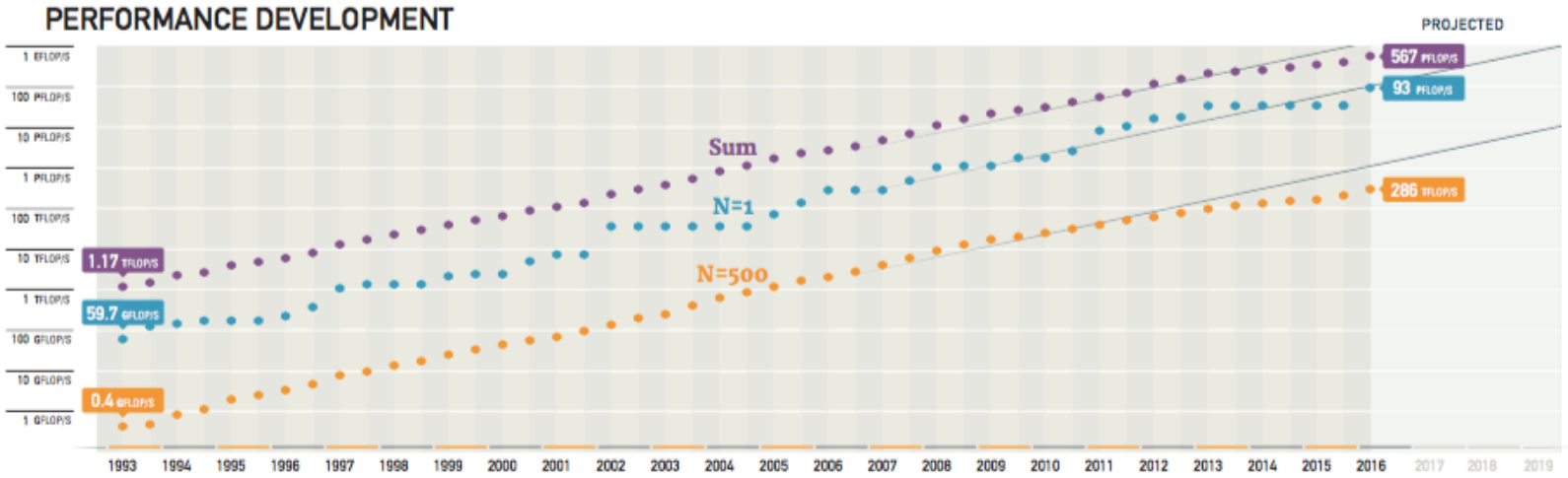
http://www.TOP500.org/

TOP 500 The List.

PRESENTED BY ICL INNOVATIVE COMPUTING LABORATORY · BERKELEY LAB Lawrence Berkeley National Laboratory · ISC GROUP Moving Forward.

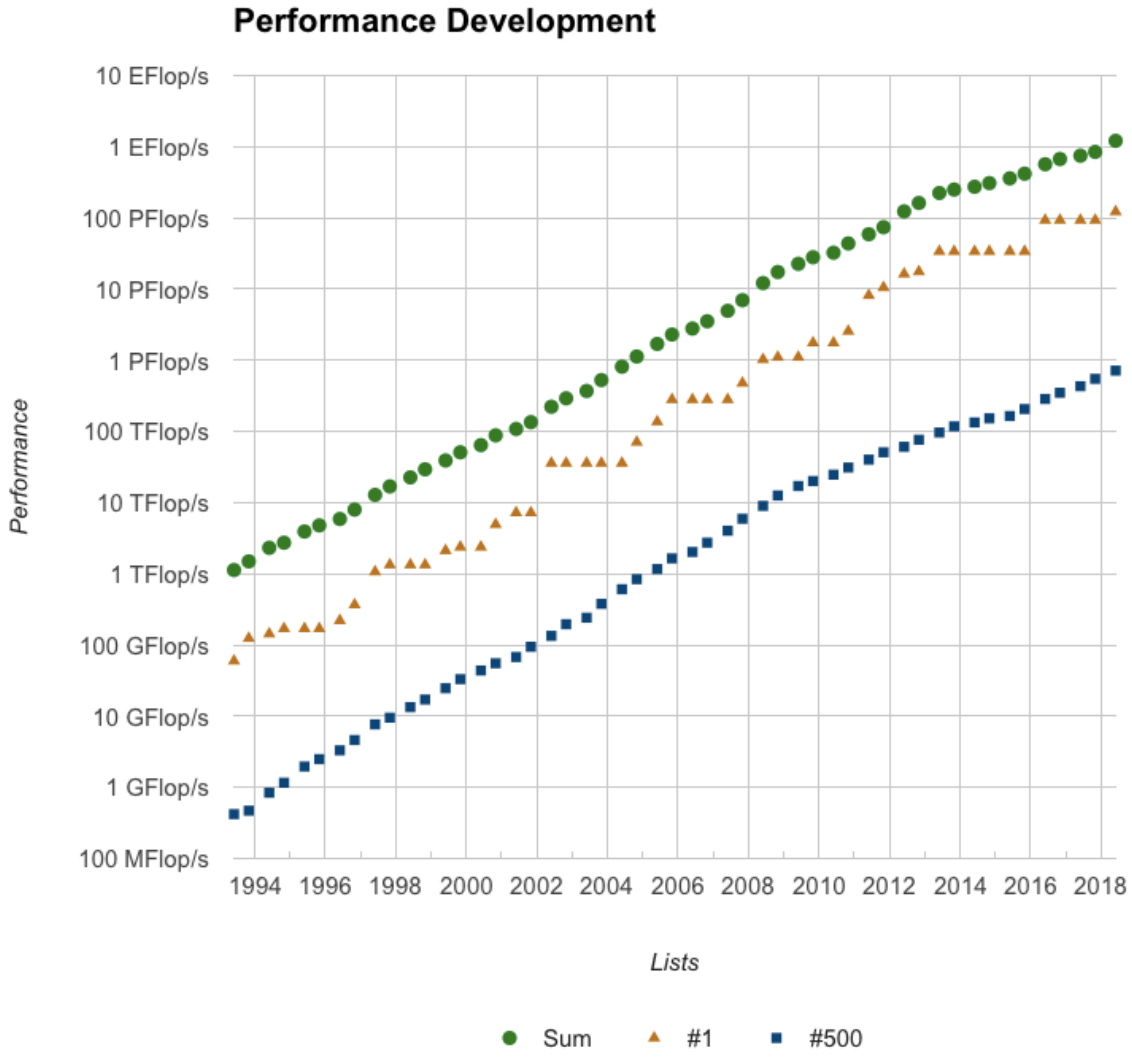
FIND OUT MORE AT top500.org

	NAME	SPECS	SITE	COUNTRY	CORES	RMAX PFLOP/S	POWER MW
1	Sunway TaihuLight	Shenwei SW26010 (260C 1.45 GHz) Custom interconnect	NSCC in Wuxi	China	10,649,600	93.0	15.4
2	Tianhe-2 (Milkyway-2)	Intel Ivy Bridge (12C 2.2 GHz) & Xeon Phi (57C 1.1 GHz), Custom interconnect	NSCC in Guangzhou	China	3,120,000	33.9	17.8
3	Titan	Cray XK7, Opteron 6274 (16C 2.2 GHz) + Nvidia Kepler GPU, Custom interconnect	DOE/SC/ORNL	USA	560,640	17.6	8.2
4	Sequoia	IBM BlueGene/Q, Power BQC (16C 1.60 GHz), Custom interconnect	DOE/NNSA/LLNL	USA	1,572,864	17.2	7.9
5	K computer	Fujitsu SPARC64 VIIIfx (8C 2.0 GHz), Custom interconnect	RIKEN AICS	Japan	705,024	10.5	12.7



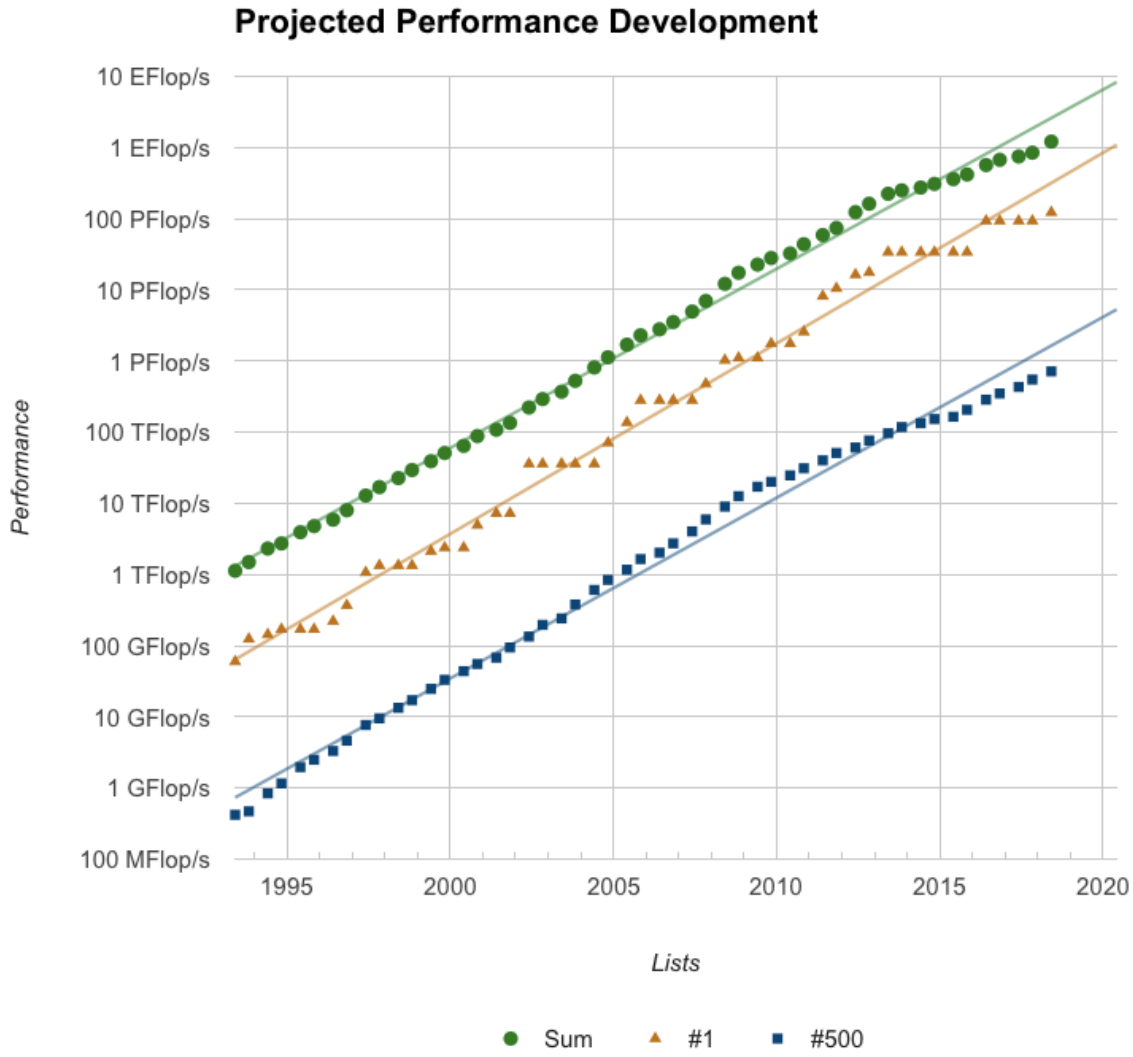
Performance development (1)

June 2018

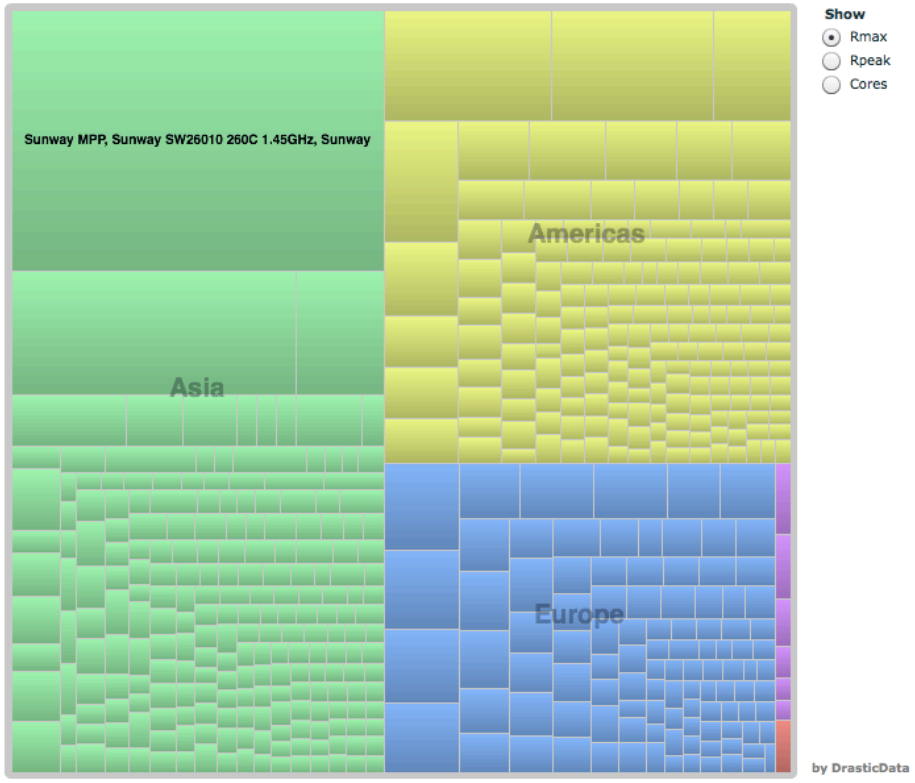


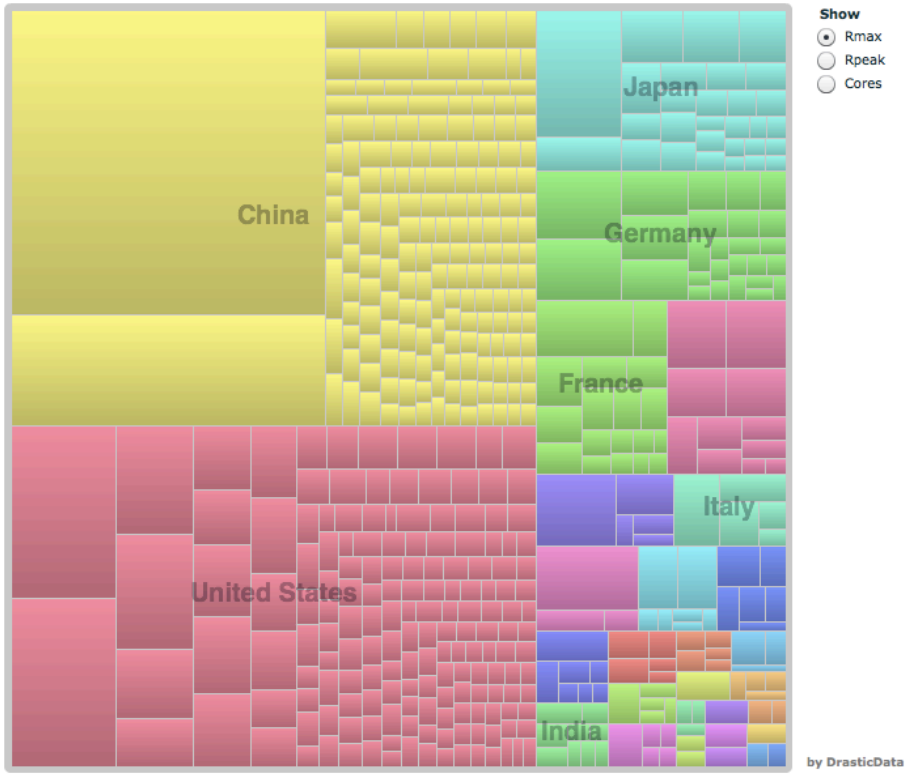
Performance development (2)

June 2018



HPC distribution in TOP500 (Jun 2016)

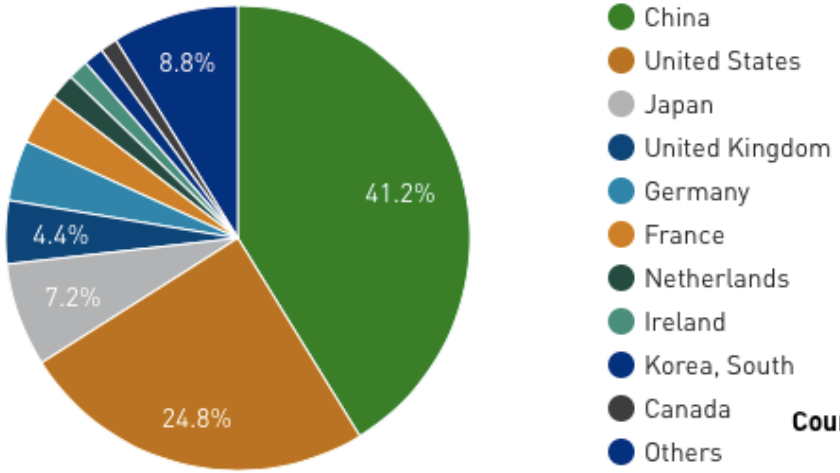




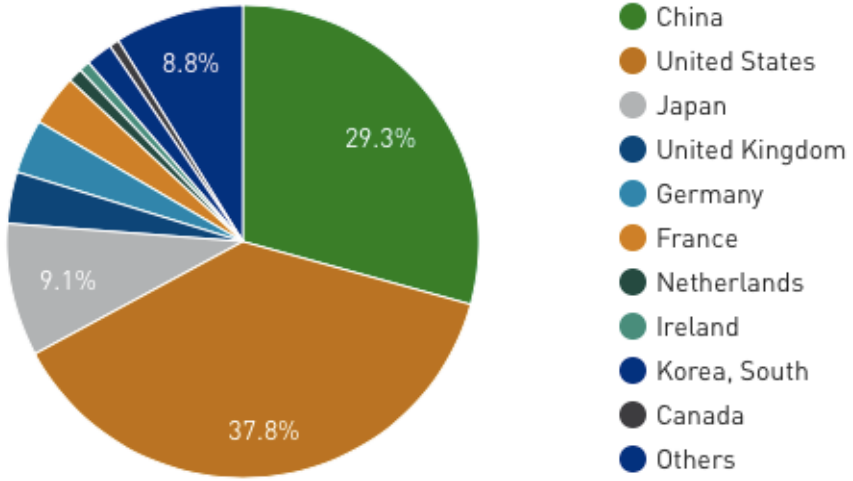
HPC distribution in TOP500

June 2018

Countries System Share



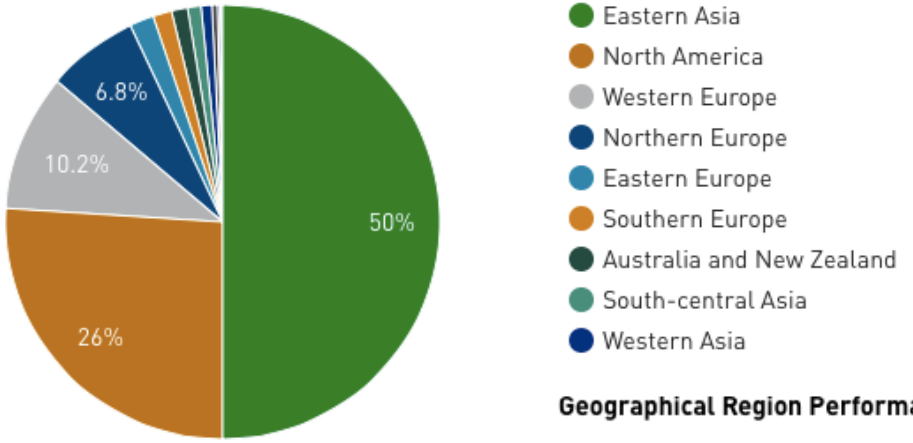
Countries Performance Share



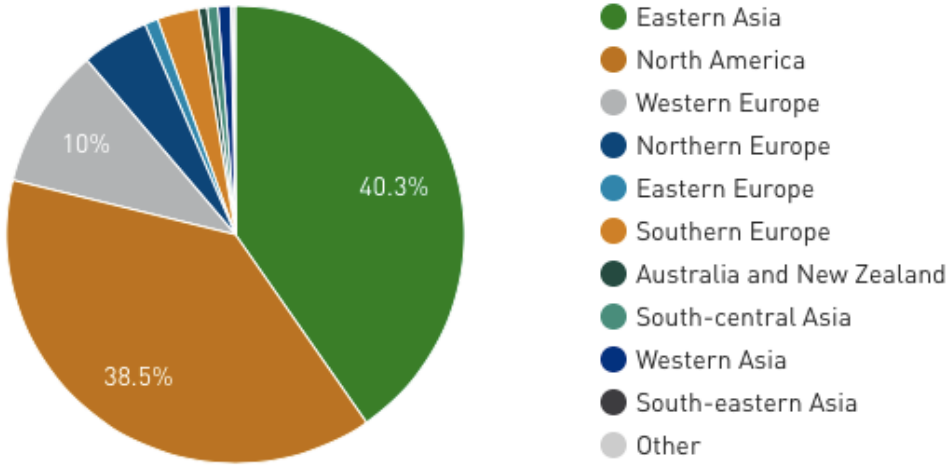
HPC distribution in TOP500

June 2018

Geographical Region System Share



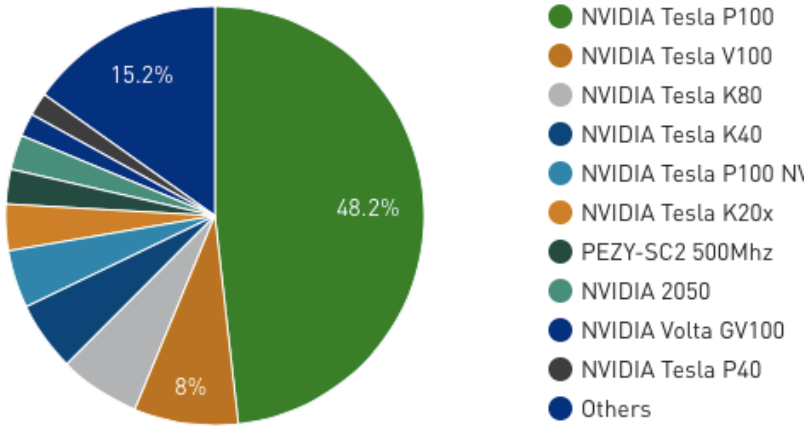
Geographical Region Performance Share



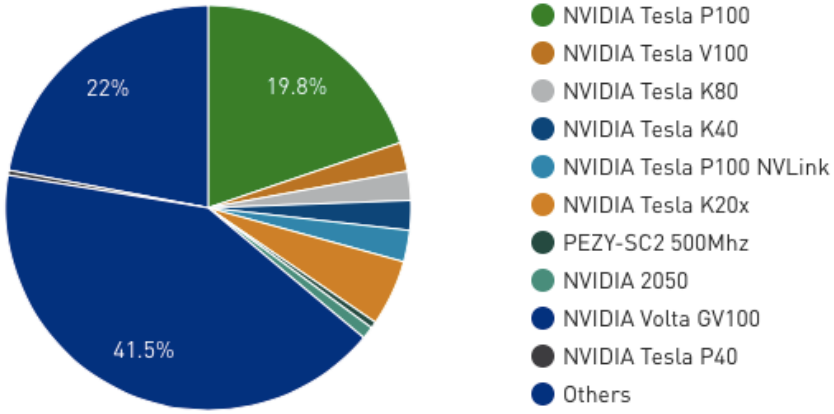
HPC distribution in TOP500

June 2018

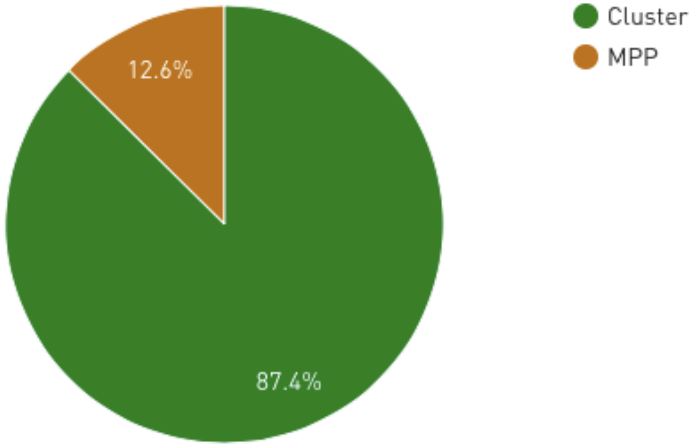
Accelerator/Co-Processor System Share



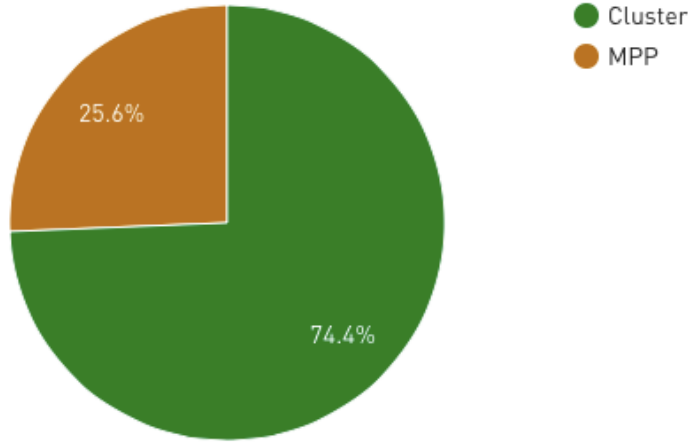
Accelerator/Co-Processor Performance Share



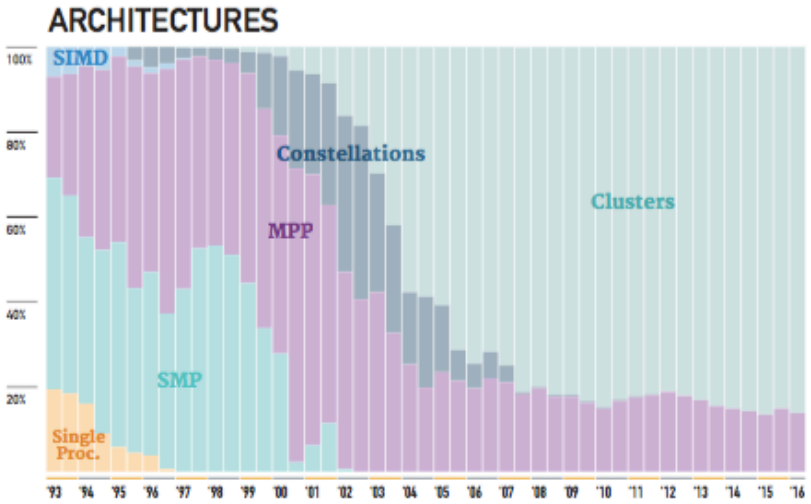
Architecture System Share

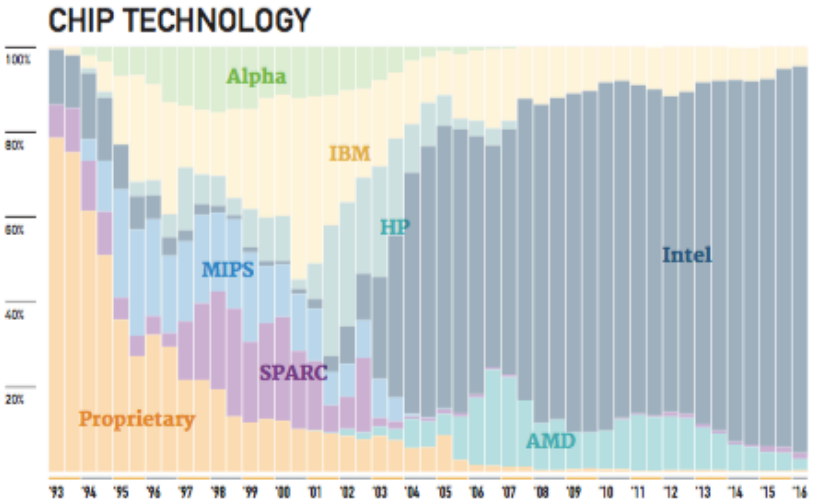


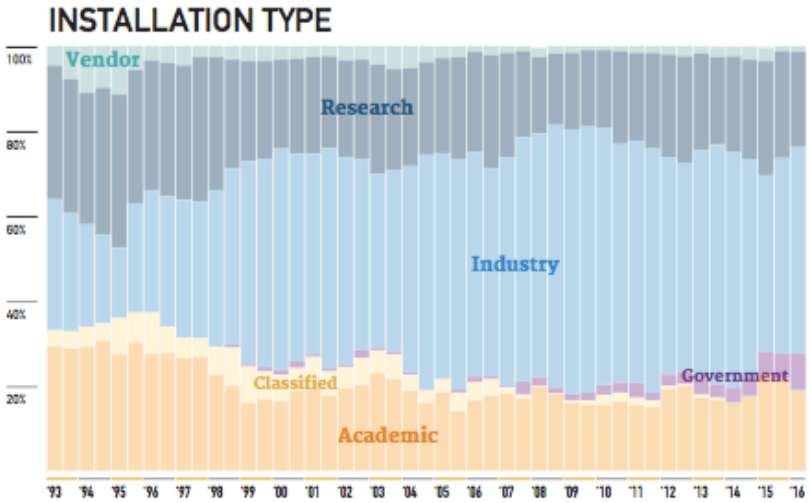
Architecture Performance Share

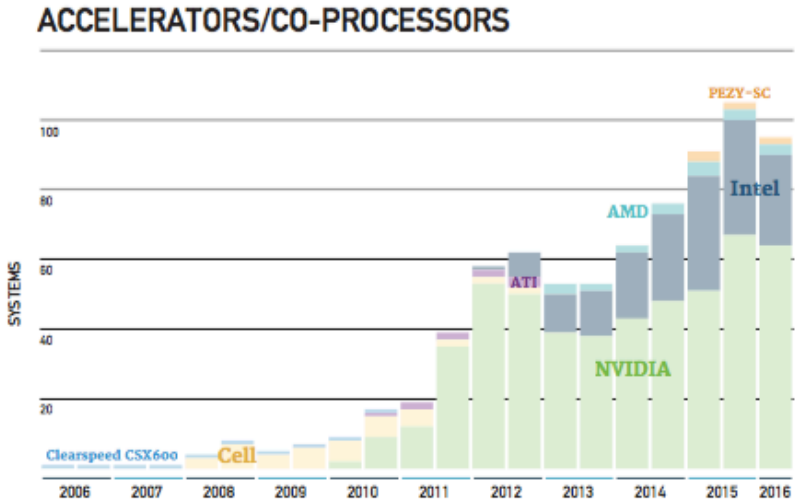


TOP500 (Jun 2016)









IDC-Projected Exascale Dates and Suppliers

U.S.

- Sustained ES: 2023
- Peak ES: 2021
- Vendors: U.S.
- Processors: U.S.
- Initiatives: NSCI/ECP
- Cost: $300-500M per system, plus heavy R&D investments

EU

- Sustained ES: 2023-24
- Peak ES: 2021
- Vendors: U.S., Europe
- Processors: U.S., ARM
- Initiatives: PRACE, ETP4HPC
- Cost: $300-$350 per system, plus heavy R&D investments

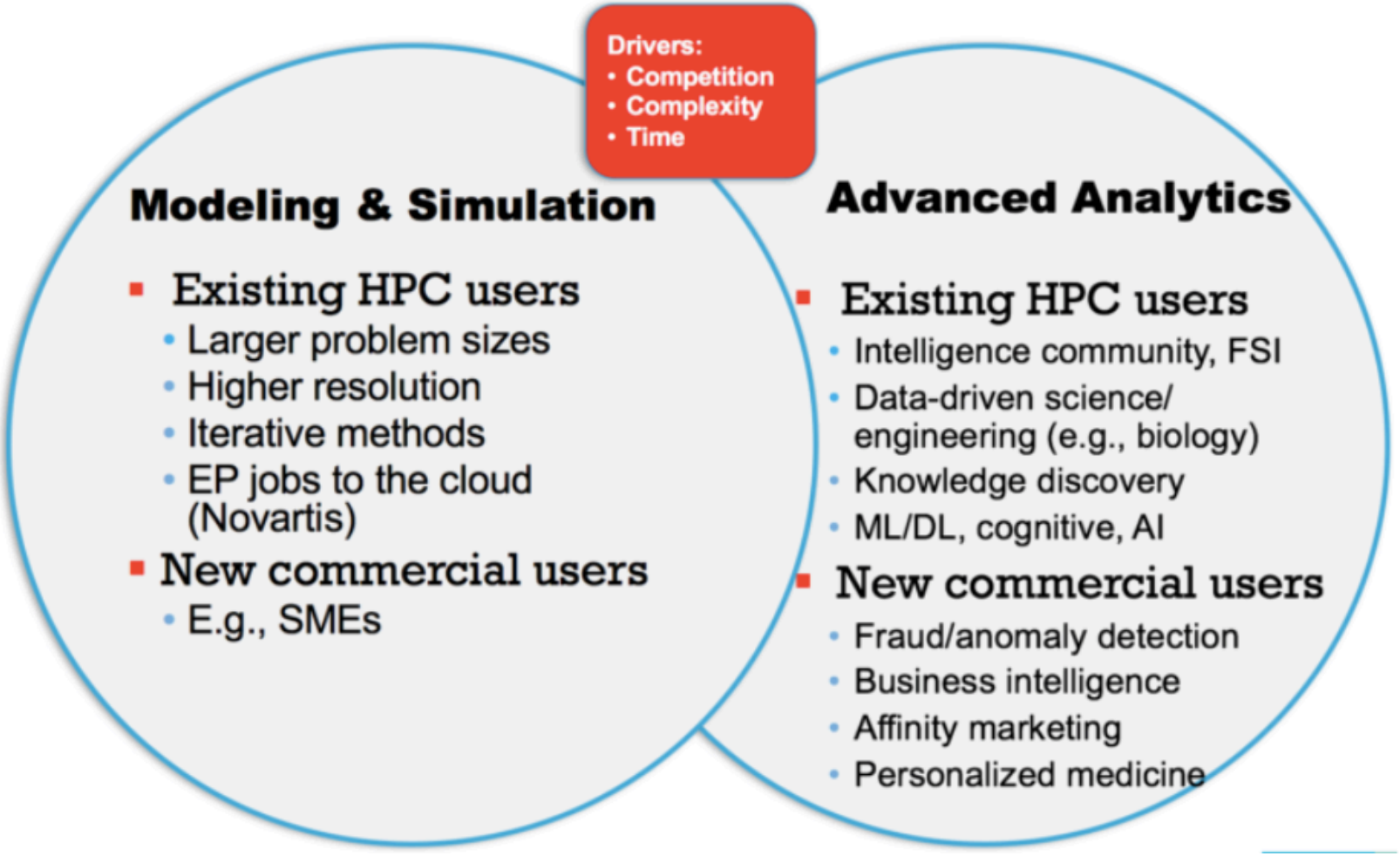
China

- Sustained ES: 2023
- Peak ES: 2020
- Vendors: Chinese
- Processors: Chinese (plus U.S.?)
- 13th 5-Year Plan
- Cost: $350-500M per system, plus heavy R&D

Japan

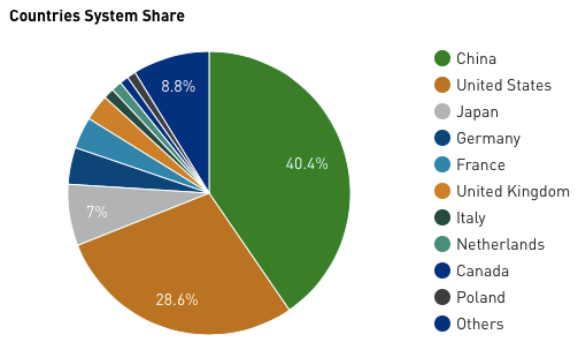
- Sustained ES: 2023-24
- Peak ES: Not planned
- Vendors: Japanese
- Processors: Japanese
- Cost: $600-850M, this includes both 1 system and the R&D costs…will also do many smaller size systems

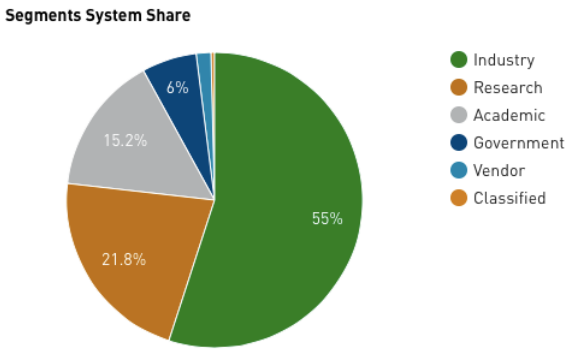
HPDA = Data-Intensive Computing Using HPC

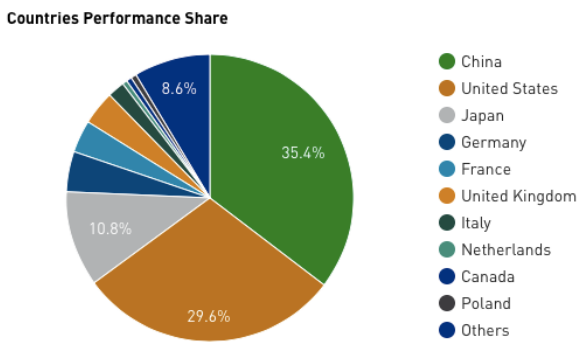


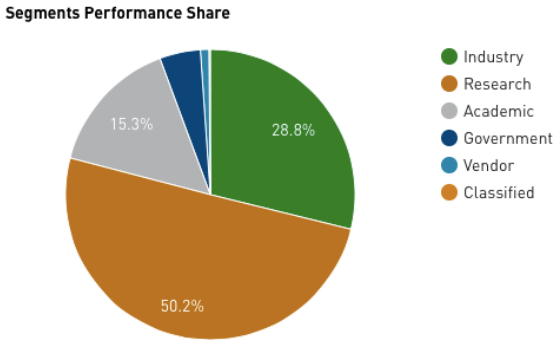
Supercomputing Conference (SC)

- TOP500 (1993) -> Green500 (SC06) -> Graph500 (SC10)
- SC17: 12-17 Nov 2017, Denver, Colorado - US
  - IO-500
  - Fog/Edge computing for smart cities







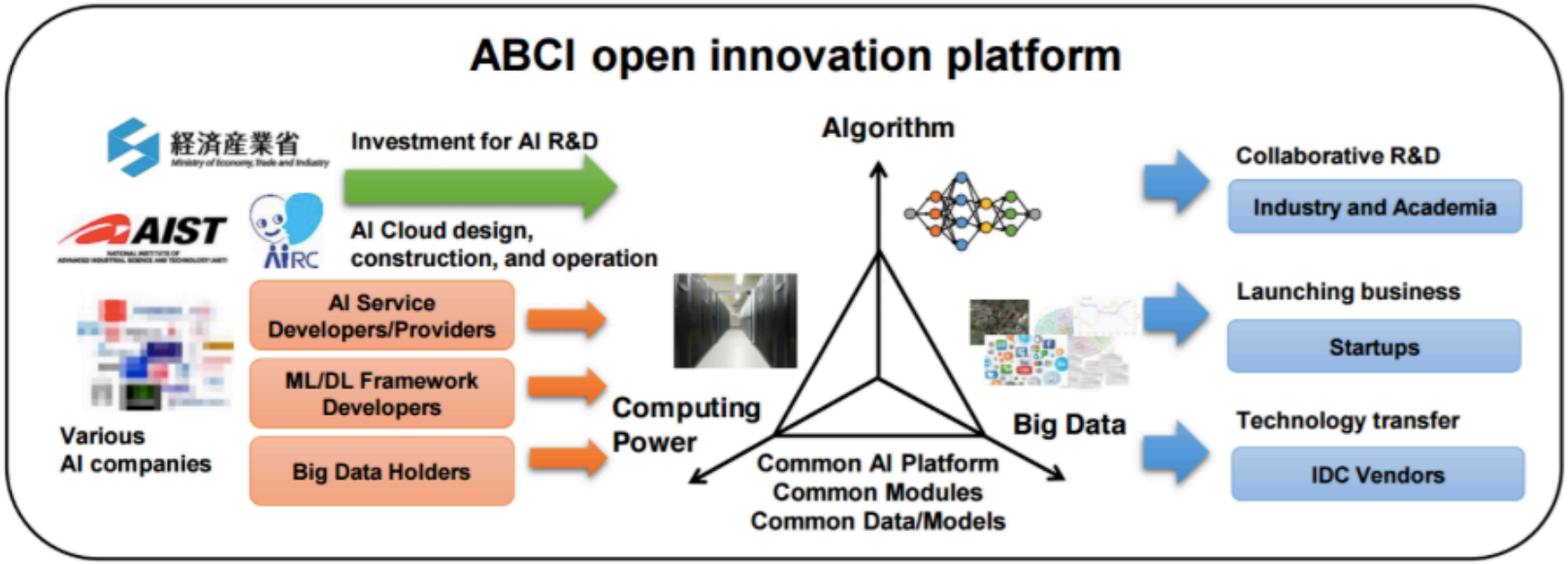


Japan Plans Super-Efficient AI Supercomputer

By Tiffany Trader

November 28, 2016

Editor's note: a source familiar with the project is reporting that the target of 130 petaflops is actually half-precision (16-bit). The target for double precision (64-bit) is 33 petaflops. Additionally, the budget of 19.5 billion yen is for the machine and the building and facility. The target for installation is now 2018 Q1. The story has been updated to reflect these changes and we will report further as it develops.



Source: AIST document