



Master Informatics Eng.

2020/21

A.J.Proen  a

TOP500 & MACC (online)
(most images and some slides are borrowed)

Suggestion of homework for discussion in this session

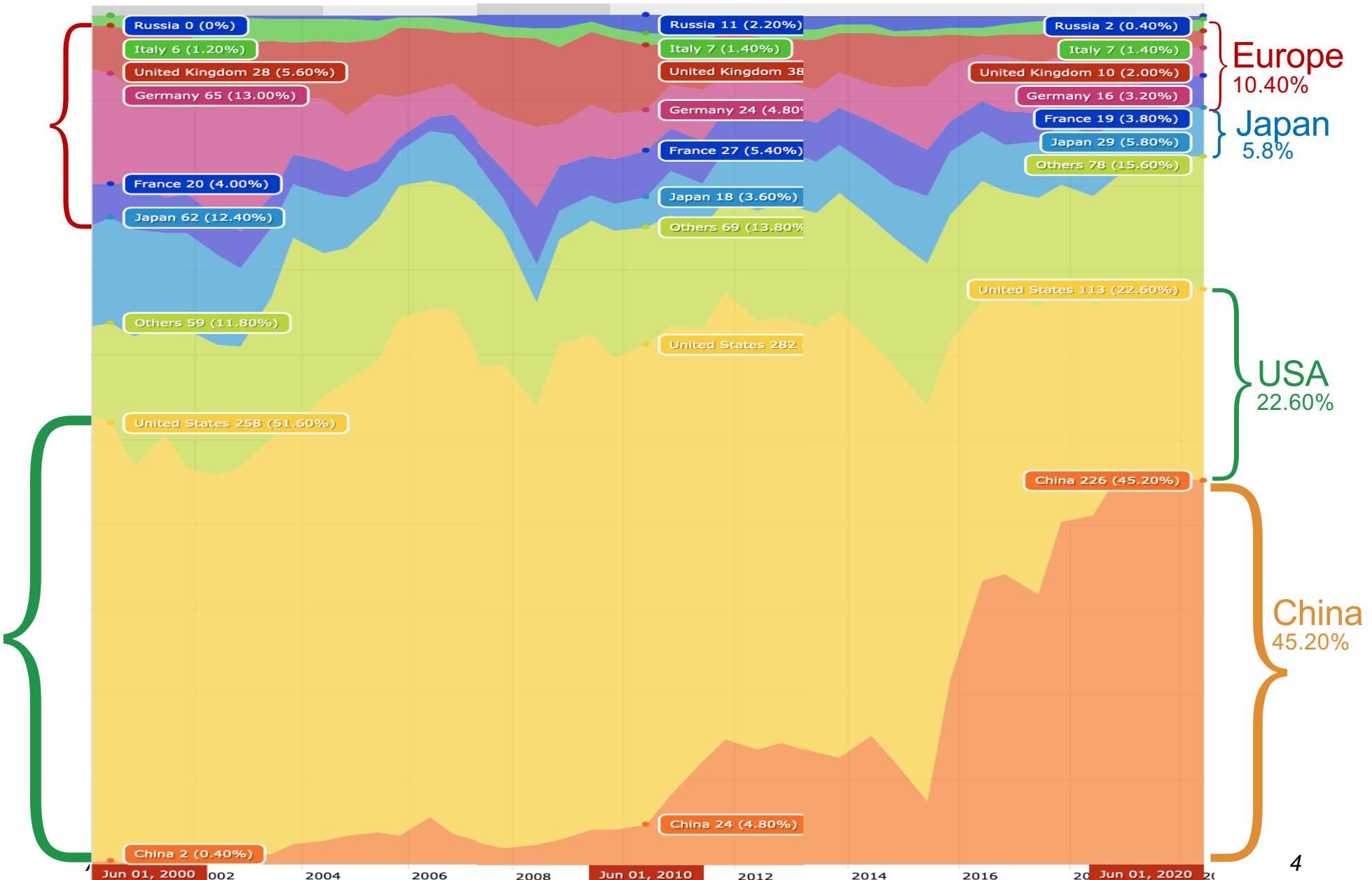


1. Go to the TOP500 website and analyse & comment:
 - i. The country distribution over the past 25 years, in #systems and aggregate performance in the TOP500 list
 - ii. The evolution of the key PU chip technologies and the accelerator families in the past 25 years
 - iii. The overall impact of each processor technology and accelerator family in the past 3 years
2. EuroHPC is funding 8 supercomputing centres selected in June 2019: 3 pre-exascale & 5 petascale
 - i. Find & identify these 8 supercomputing centres
 - ii. Characterize the architecture of Deucalion in MACC

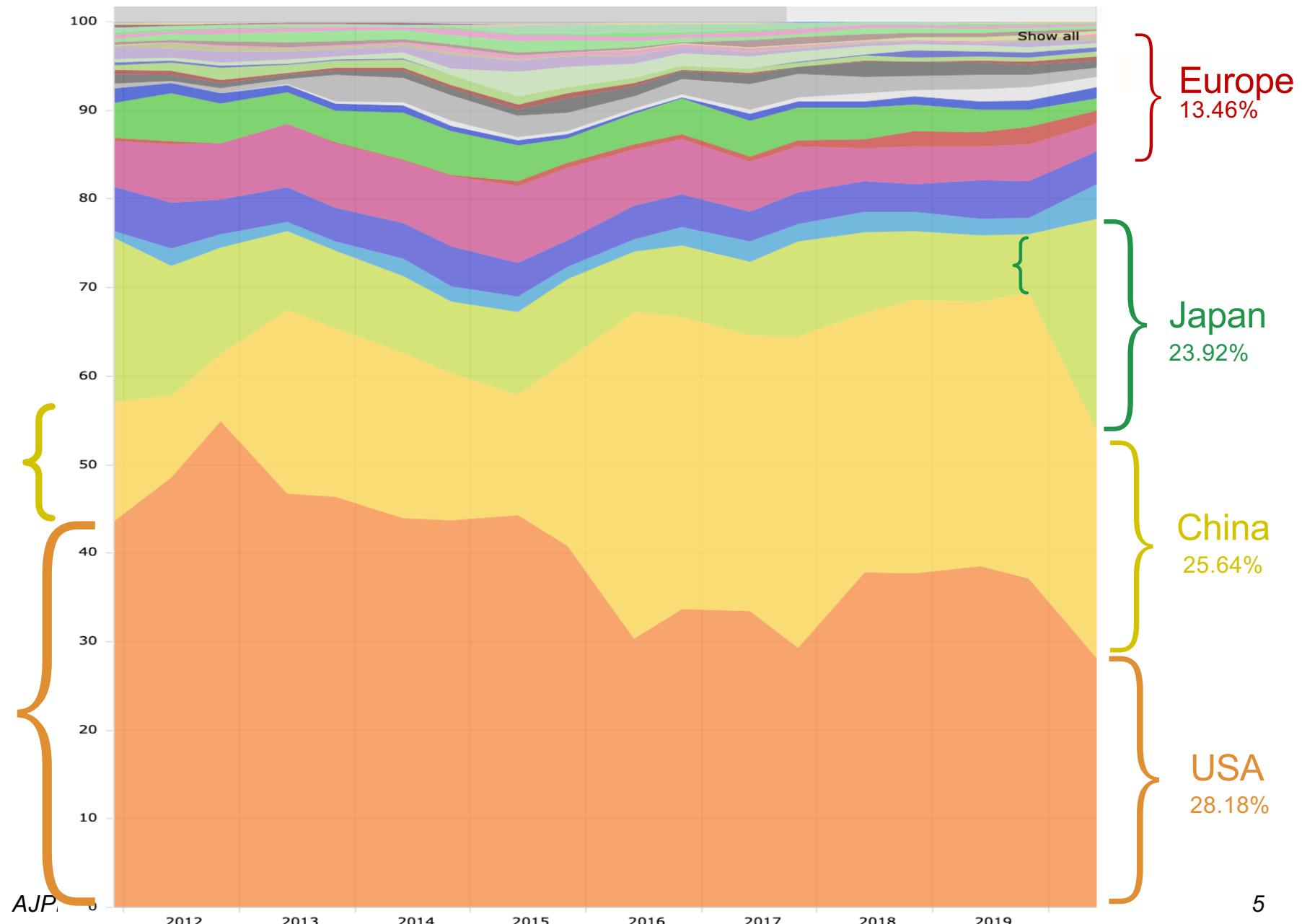
Peak performance from 1993 to 2020



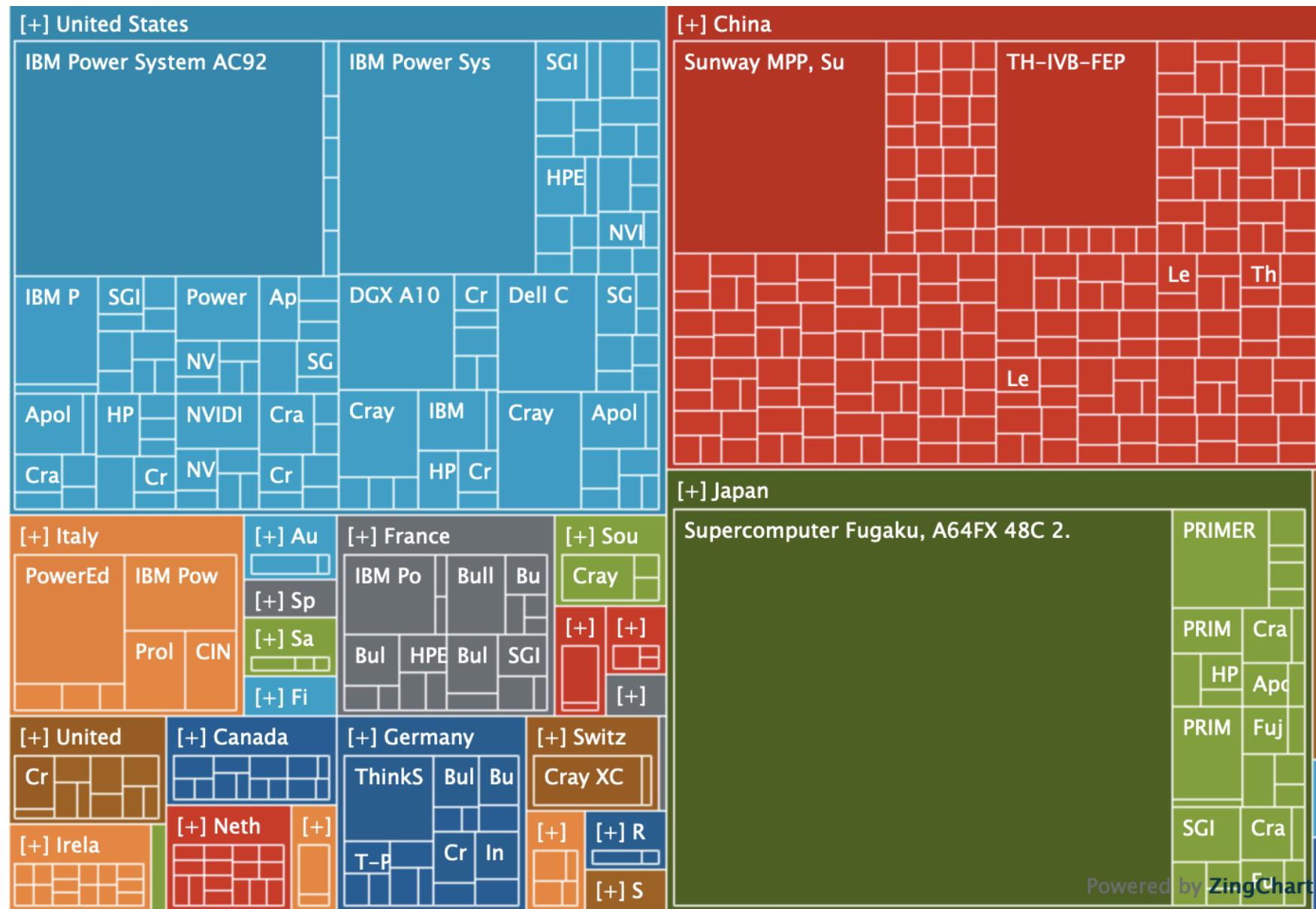
Country distribution over the past 20 years: # systems



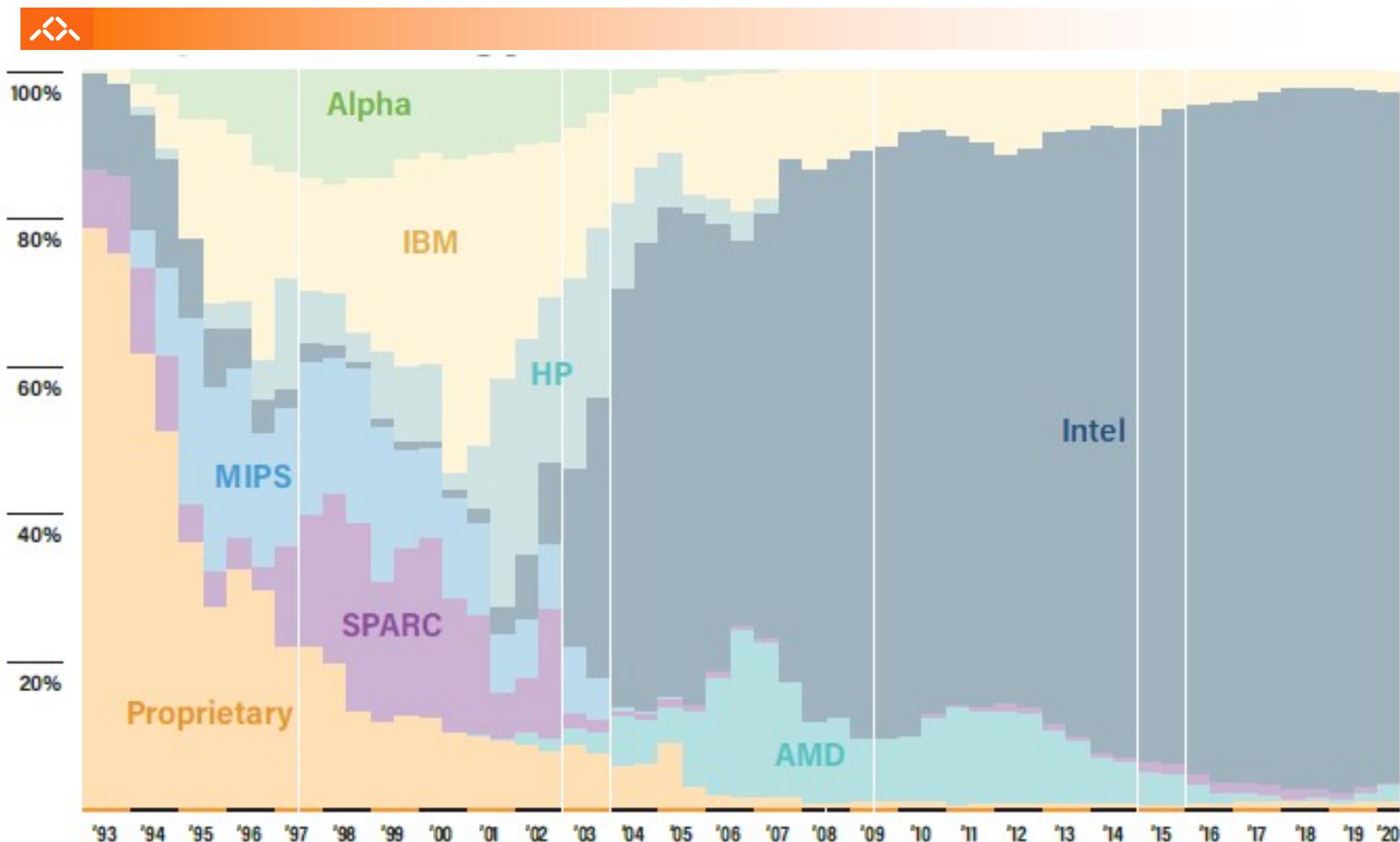
Country distribution over the past 8 years: aggregate performance



Country distribution in Jun'20: #systems & performance

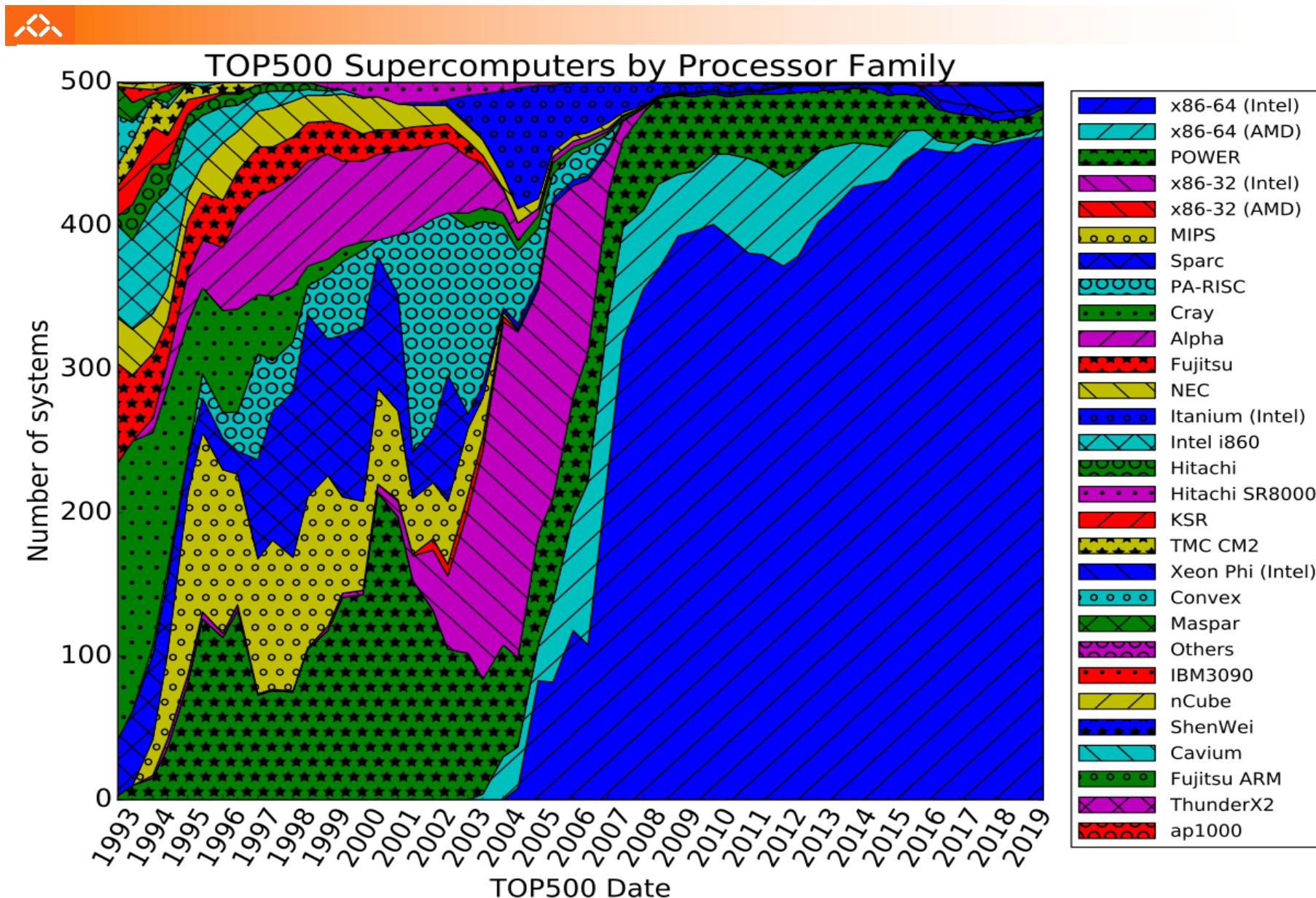


PU chip technology from 1993 to 2020





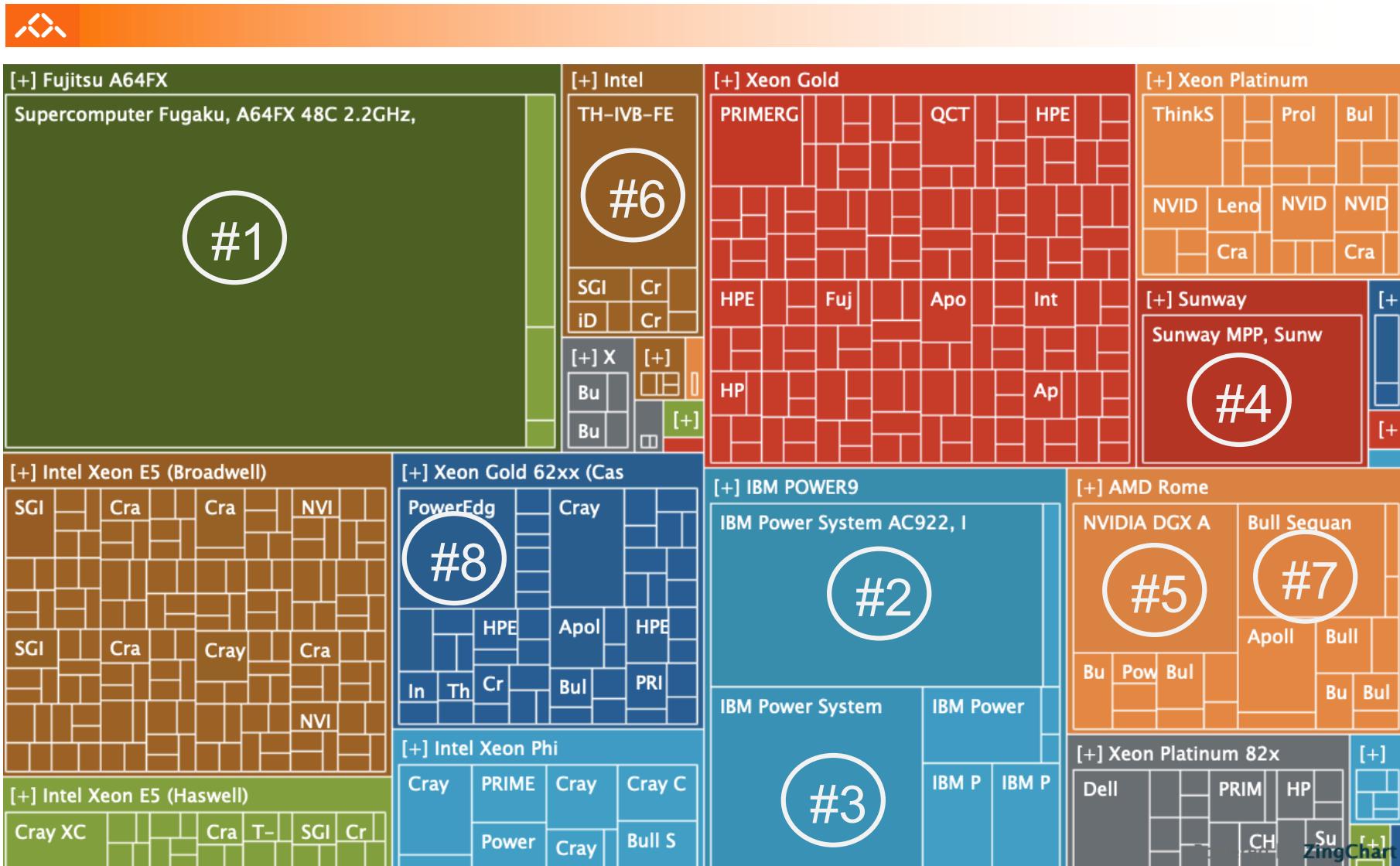
Top processor families from 1993 to 2019



<https://en.wikipedia.org/wiki/TOP500>

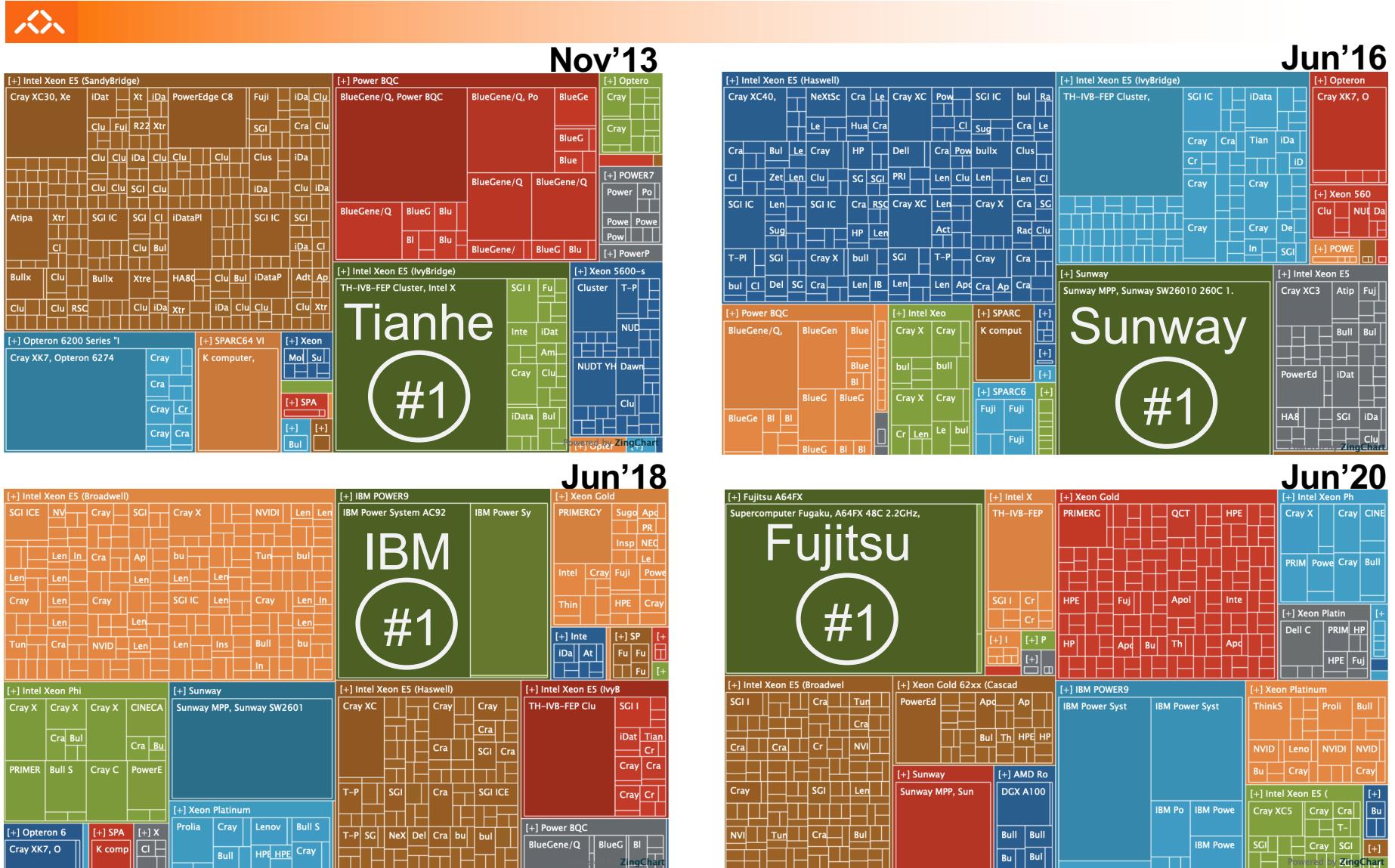
Processor distribution

Nov'20

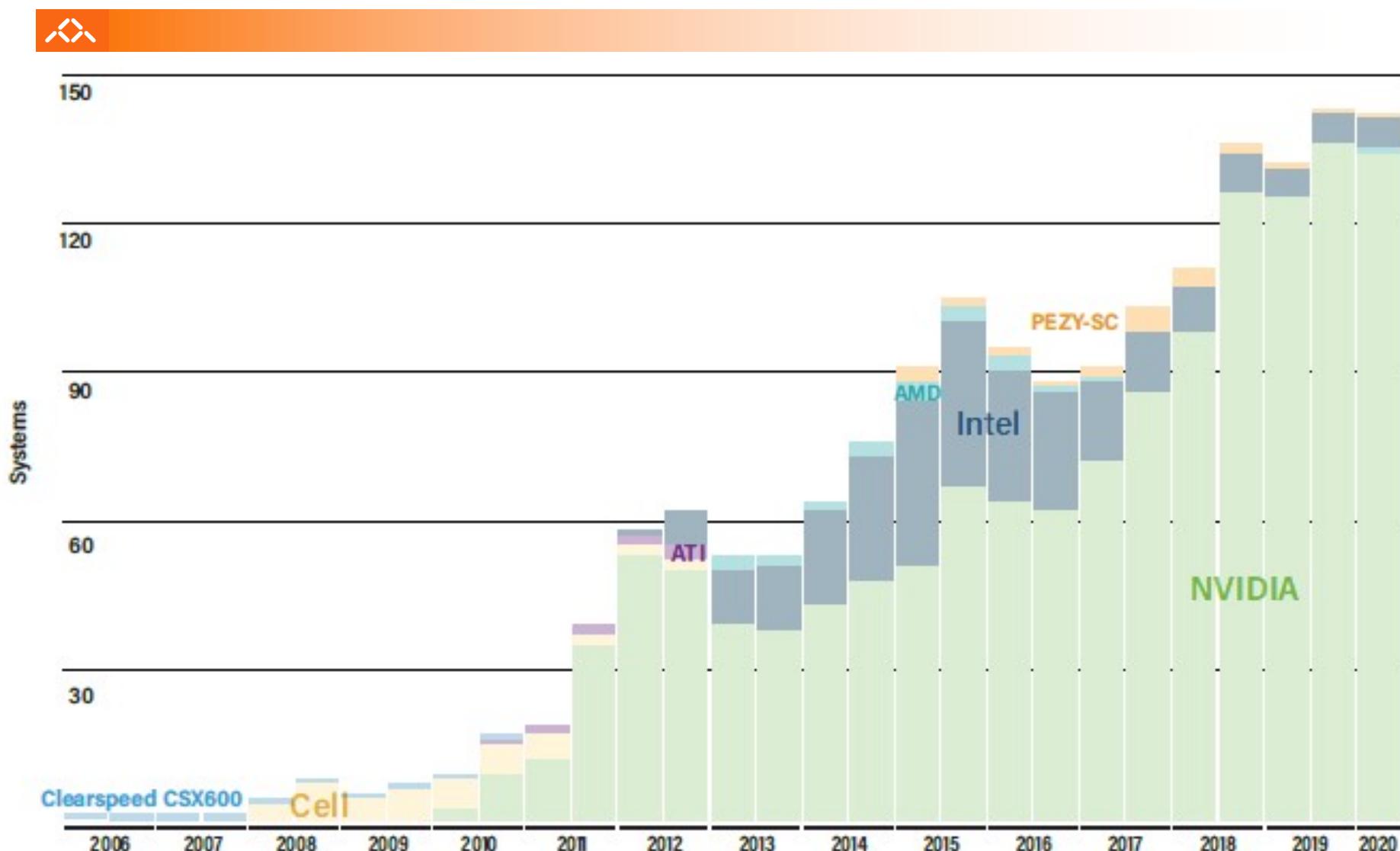


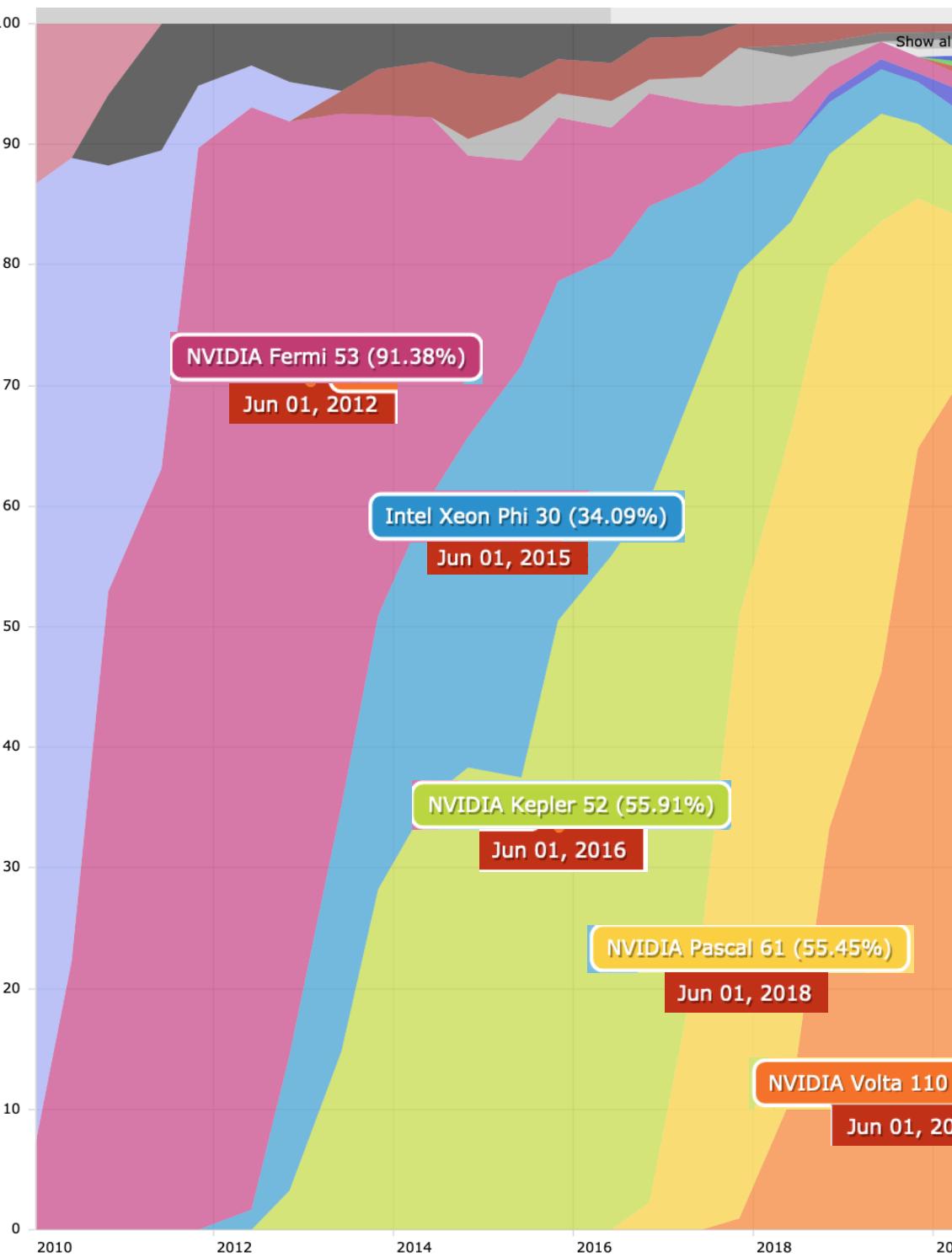


Architecture family of key #1's: from Nov'13 to Nov'20



Accelerator families from 2006 to 2020





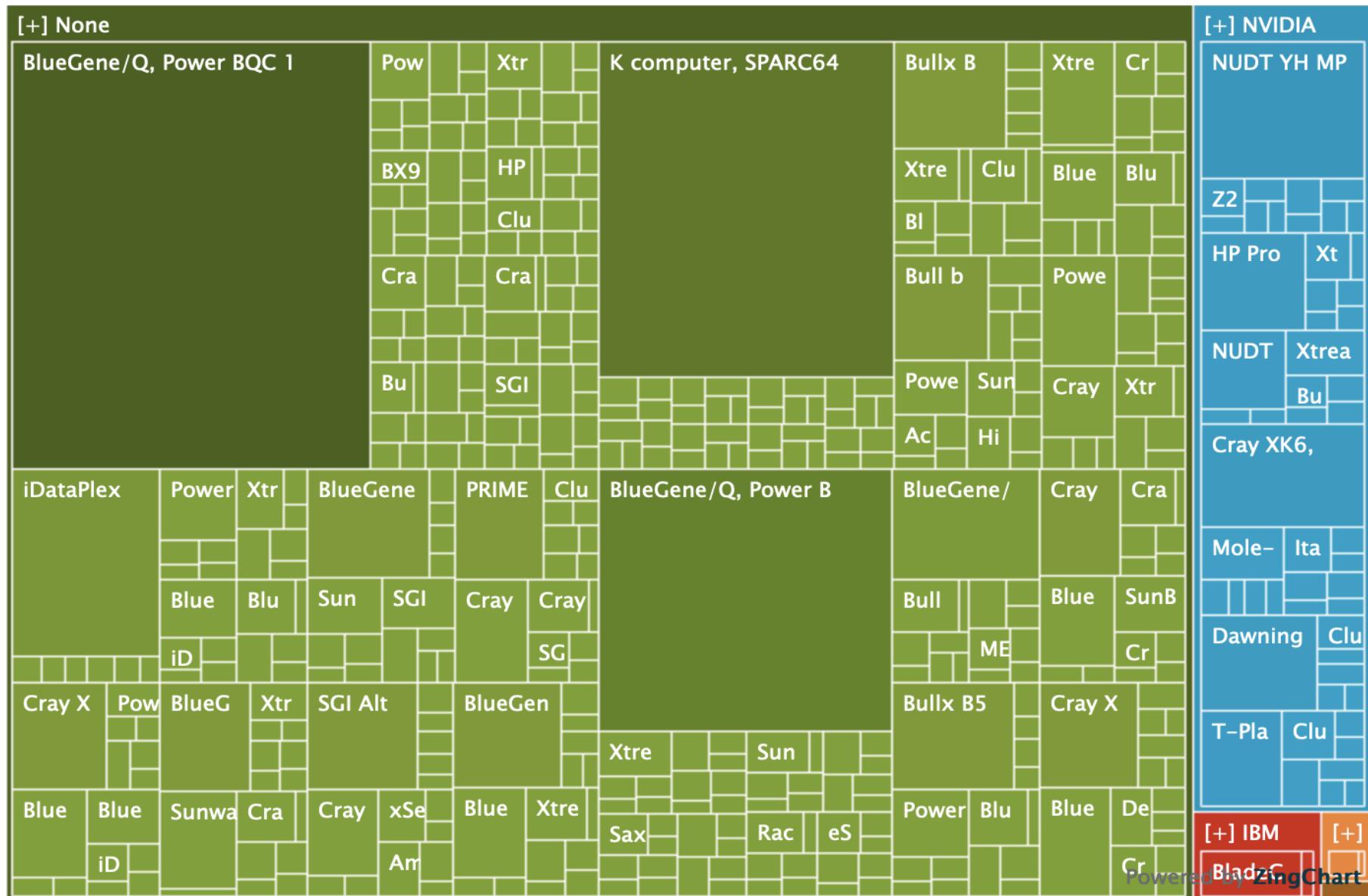
Accelerators:
#systems
Jun'10-Jun'20

Jun 01, 2020



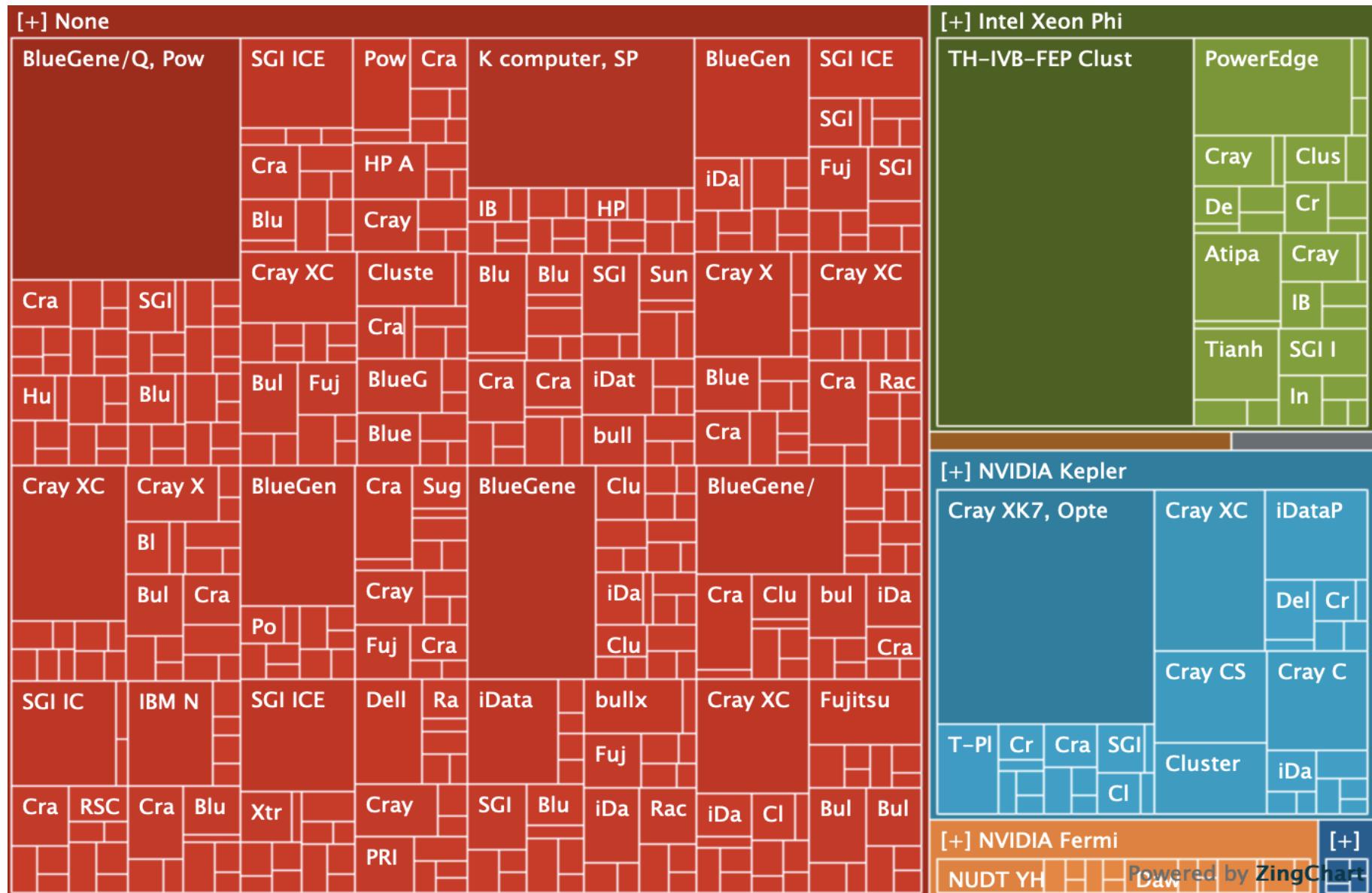
Accelerator family distribution

Jun'12



Accelerator family distribution

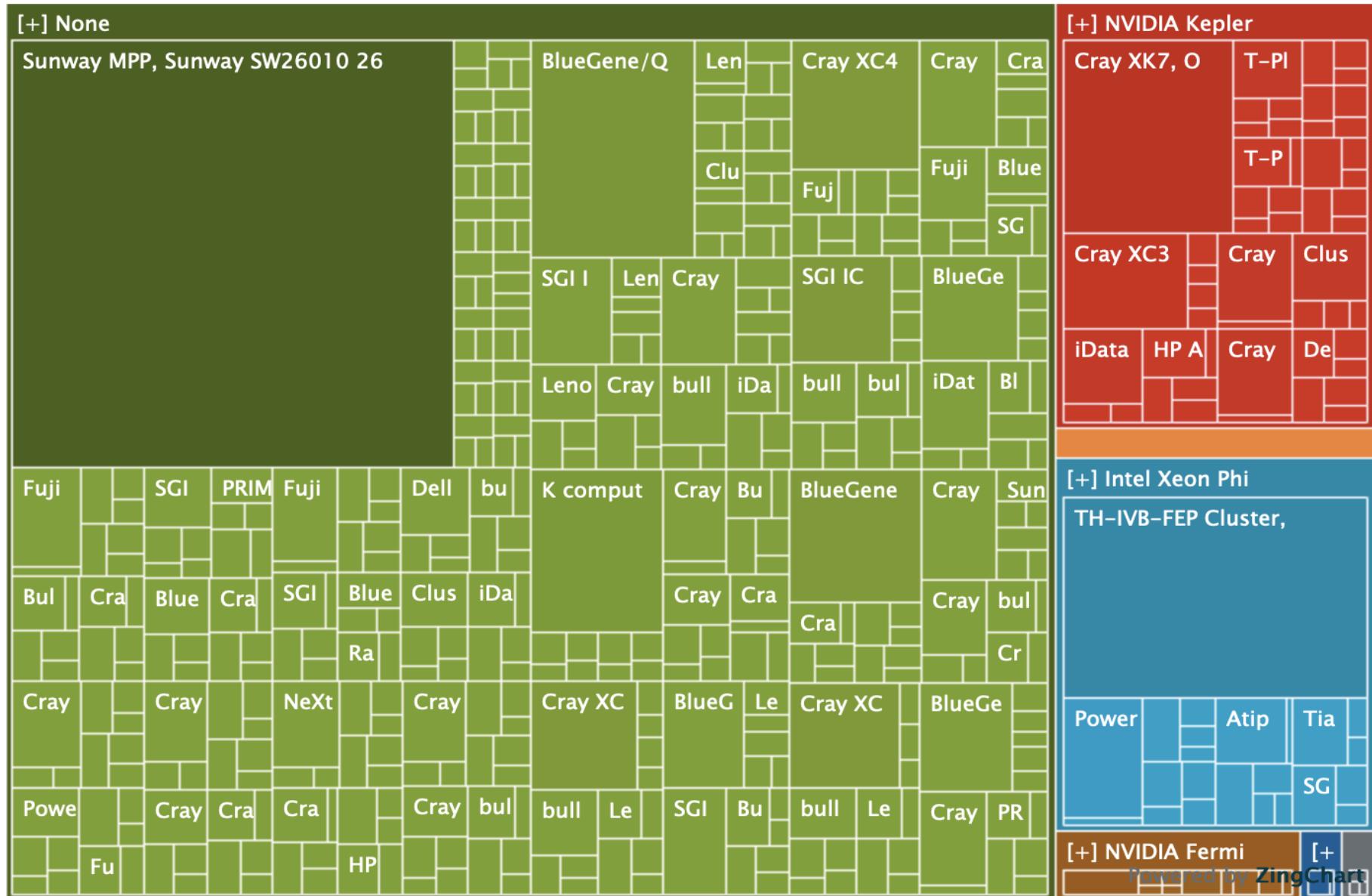
Jun'15





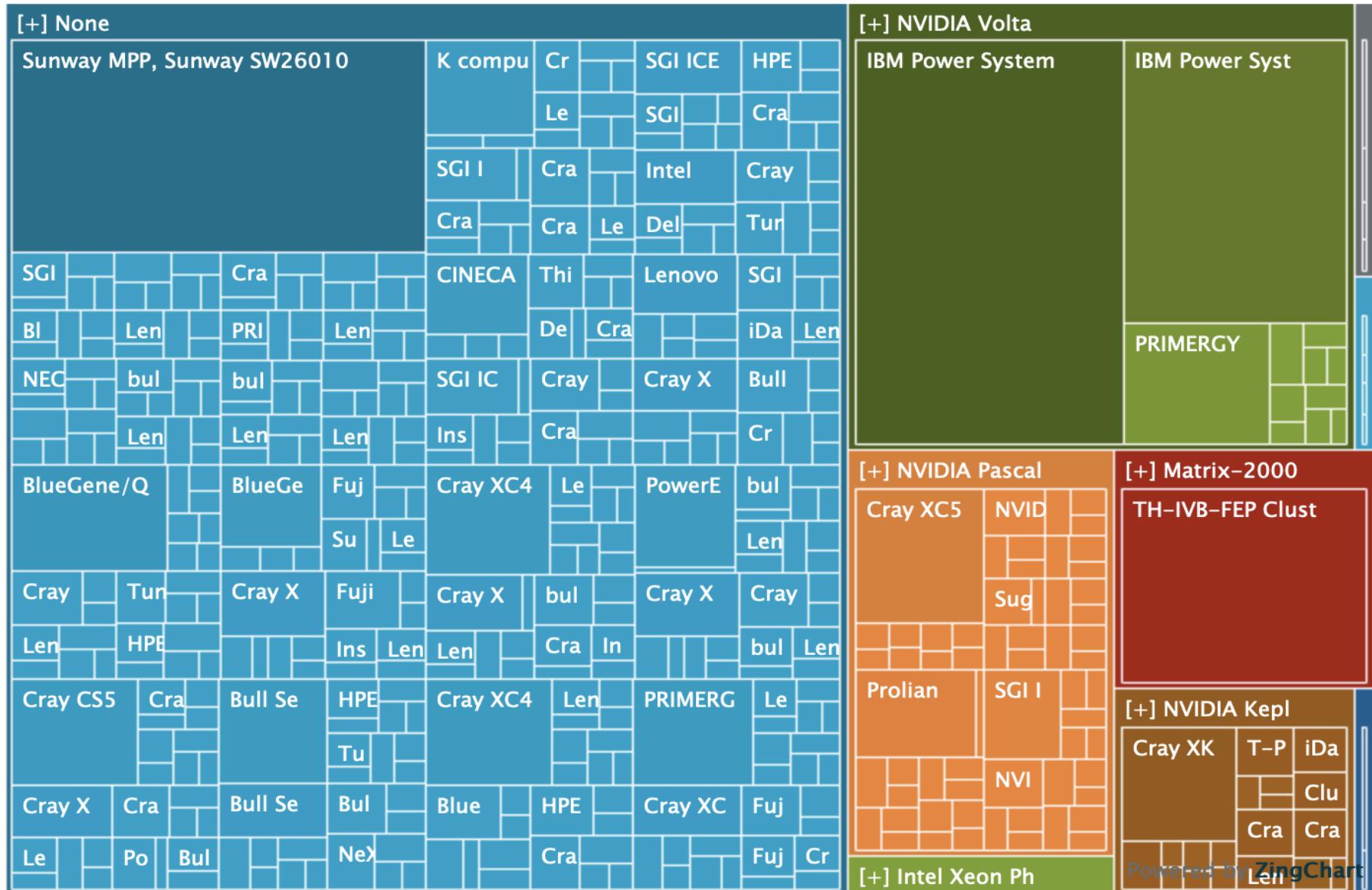
Accelerator family distribution

Jun'16



Accelerator family distribution

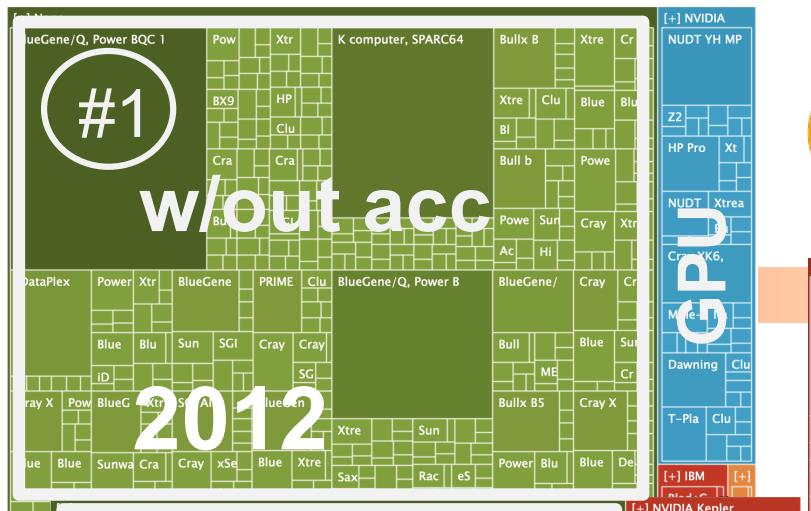
Jun'18



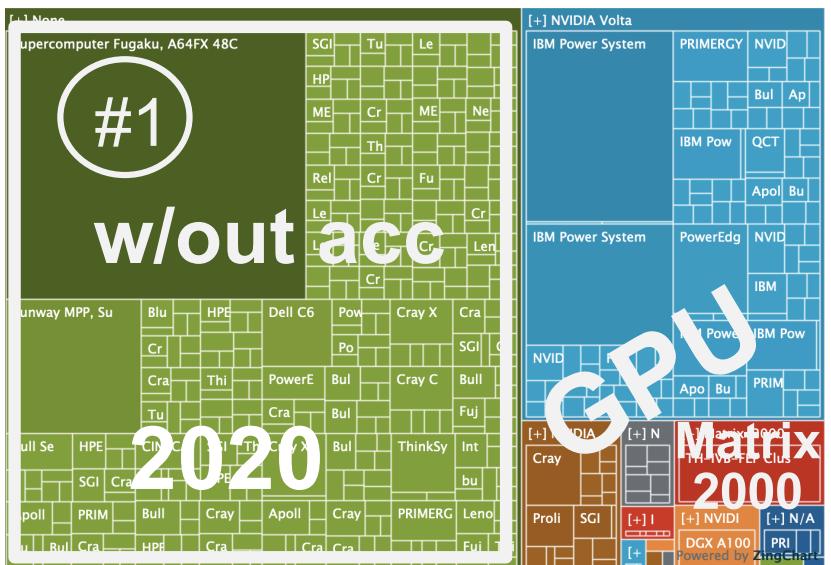
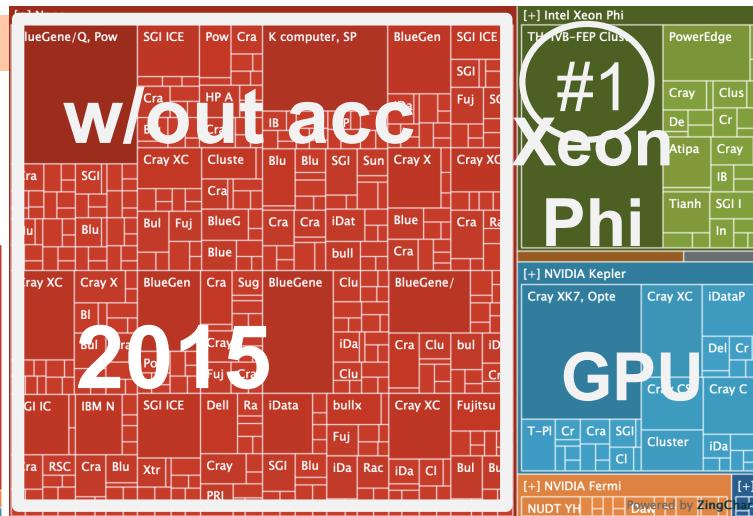
Accelerator family distribution

Nov'20





Accelerator families evolution 2012 - 2020



AJProençá,

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PRACE: Best Practice Guide



Best Practice Guide - Modern Processors

Processor manufacturers are continuously pushing the performance limits for delivering more computational capabilities to the end users. These efforts, however, typically imply new architectural modifications requiring corresponding guidance for the efficient utilization of the underlying platform by application developers.

Recently, PRACE (Partnership for Advanced Computing Europe) released its “Best Practice Guide – Modern Processors” that extends the previously developed series of BPGs (<https://prace-ri.eu/training-support/best-practice-guides/>) by providing an update on a selection of recent processors, namely: ARM64 (Huawei/HiSilicon and Marvell) and x86-64 (AMD and Intel). More specifically the guide provides information on the available programming models and development environment as well as outlines guidelines on application performance analysis and improvement, accompanied with examples tailored for scientists not deeply involved into the art of HPC programming.

This guide also provides an overview on recently deployed European flagship supercomputing systems that rely on the discussed processor architectures, namely:

- **Fulham** at Edinburgh Parallel Computing Centre (EPCC), UK
- **MareNostrum** at Barcelona Supercomputing Center (BSC), Spain
- **SuperMUC-NG** at Leibniz Supercomputing Centre (LRZ), Germany
- **Hawk** at High-Performance Computing Center Stuttgart (HLRS), Germany
- **Betzy** at SIGMA2, Norway

The complete PRACE “**Best Practice Guide - Modern Processors**” can be accessed via the following link:

- <https://prace-ri.eu/training-support/best-practice-guides/modern-processors/>



EuroHPC selected 8 supercomputer centres for funding

- **3 exascale** supercomputers:
 - **MareNostrum 5** (BSC, Spain): **200** peak PFLOPS
 - **Leonardo** (CINECA, Italy): **200** peak PFLOPS
 - **LUMI** (CSC, Finland): **200** peak PFLOPS
- **5 petascale** supercomputers:
 - **Meluxina** (LuxConnect, Luxembourg): **18** peak PFLOPS
 - **EURO IT4I** (IT4 Innov. Nat. Superc. Center, Czech Rep.):
 - current #2 in TOP500**
 - 15.2** peak PFLOPS
 - **Deucalion** (MACC, Portugal):
 - current #29 in TOP500**
 - 10** peak PFLOPS
 - **Vega** (IZUM, Slovenia): **6.8** peak PFLOPS
 - **PetaSC** (Sofiatech, Bulgaria): **4** peak PFLOPS

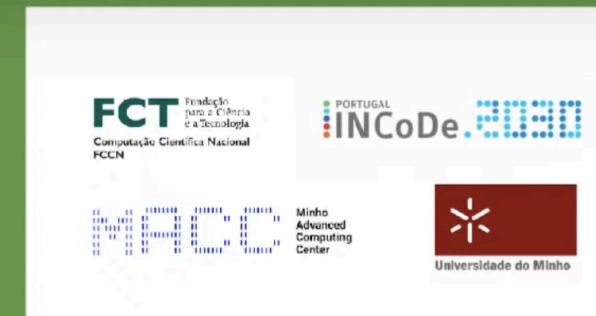
Advanced Computing Portugal 2030 (1)



Advanced Computing Portugal 2030: Progress achieved and new challenges

From the Declaration of Rome,
2017, to the installation of
the petascale machine
Deucalion, 2021

> Entramos em direto em breve



23rd October 2020

11am – 1pm

Venue: University of
Minho – Guimarães

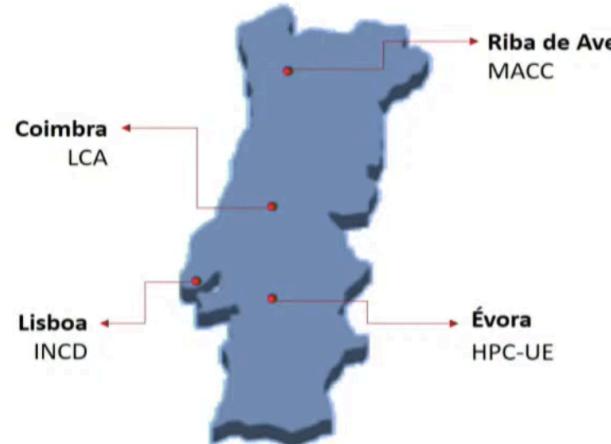
Advanced Computing Portugal 2030 (2)



Advanced Computing Portugal 2030

INFRASTRUCTURE | OC

Advanced Computing Operation Centres (OC)



A map of Portugal with red dots indicating the locations of Advanced Computing Operation Centres (OC). The locations are labeled: Coimbra LCA, Lisboa INCD, Riba de Ave MACC, and Évora HPC-UE.

MACC → Bob
LCA → Navigator(+)
UPC-UE → Oblivion
INCD → Stratus, Cirrus



Nuno Feixa Rodrigues
Vice-Presidente FCT

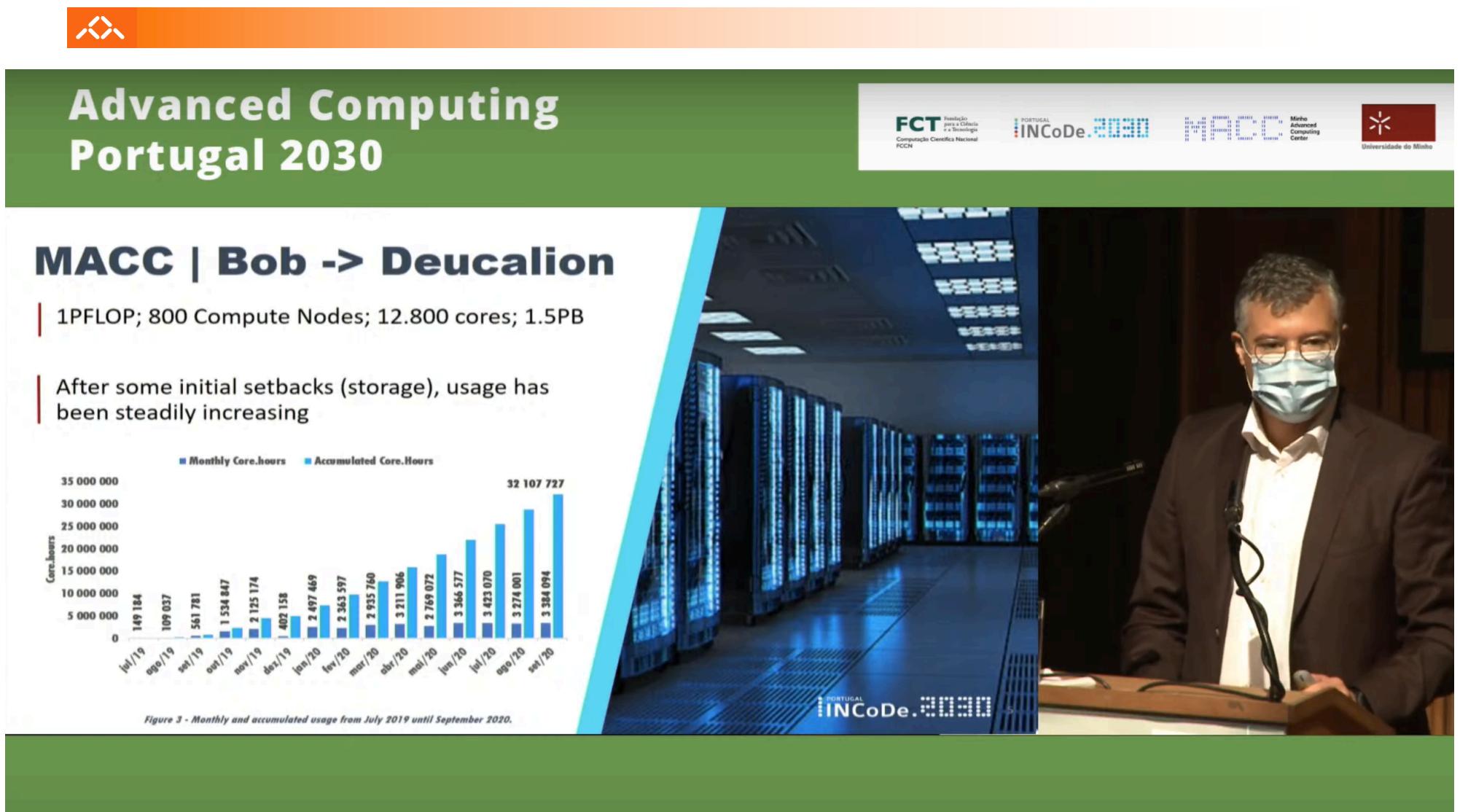
FCT Fundação para a Ciência e a Tecnologia
Computação Científica Nacional FCCN

PORTUGAL INCoDe.2030

MINHO Advanced Computing Center

Universidade do Minho

Advanced Computing Portugal 2030 (3)



The slide features a green header bar with the text "Advanced Computing Portugal 2030" and a logo consisting of three upward-pointing arrows. The main content area has a white background. At the top right, there are logos for FCT (Fundação para a Ciência e a Tecnologia), INCoDe.2030, MACC, and Universidade do Minho. Below these, a large image shows a man in a suit and mask speaking at a podium in a server room. To the left of the image is a bar chart titled "Monthly Core.hours" and "Accumulated Core.Hours" showing usage from July 2019 to September 2020.

Advanced Computing Portugal 2030

MACC | Bob -> Deucalion

1 PFLOP; 800 Compute Nodes; 12.800 cores; 1.5PB

After some initial setbacks (storage), usage has been steadily increasing

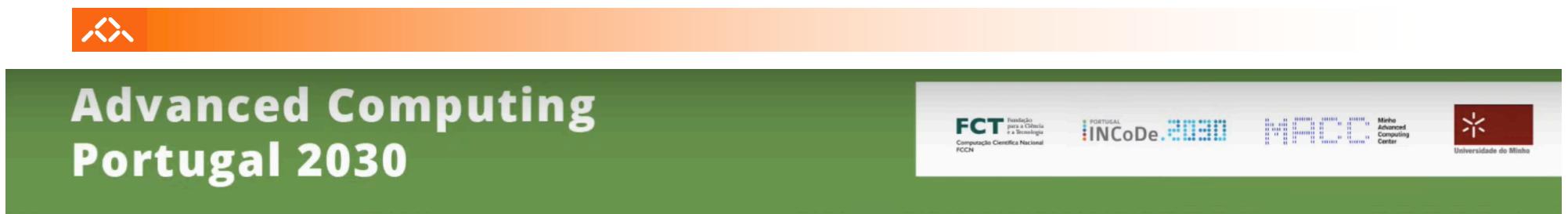
■ Monthly Core.hours ■ Accumulated Core.Hours

Mês	Monthly Core.hours	Accumulated Core.Hours
jul/19	149 184	149 184
ago/19	109 037	258 221
set/19	561 781	819 992
out/19	1 134 847	1 954 839
dez/19	2 125 174	4 079 013
jan/20	402 158	4 481 171
fev/20	2 497 469	6 978 640
mar/20	2 343 597	9 322 237
abr/20	2 935 760	12 257 997
mai/20	3 211 906	15 469 893
jun/20	2 769 072	18 238 965
jul/20	3 366 577	21 605 542
ago/20	3 423 070	25 028 612
set/20	3 274 001	28 302 613
	3 384 094	32 107 727

Figure 3 - Monthly and accumulated usage from July 2019 until September 2020.



Advanced Computing Portugal 2030 (4)



Advanced Computing Portugal 2030

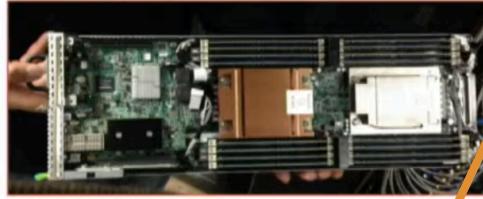
FCT Fundação para a Ciência e a Tecnologia
Computação Científica Nacional
FCCN

PORTUGAL INCoDe.2030

MACC - Marques Advanced Computing Center

Universidade do Minho

BOOTSTRAPPING MACC WITH BOB



UTAustin Portugal

PART OF TACC'S STAMPEDE SUPERCOMPUTER

800 DUAL INTEL XEON + XEON PHI NODES

1.5 EB HIGH PERFORMANCE STORAGE

1PF PEAK PERFORMANCE

6 Stampede - PowerEdge C8220, Xeon E5-2680 8C 2.700GHz, Infiniband FDR, Intel Xeon Phi SE10P, Dell EMC

462,462

Texas Advanced Computing Center/Univ. of Texas United States

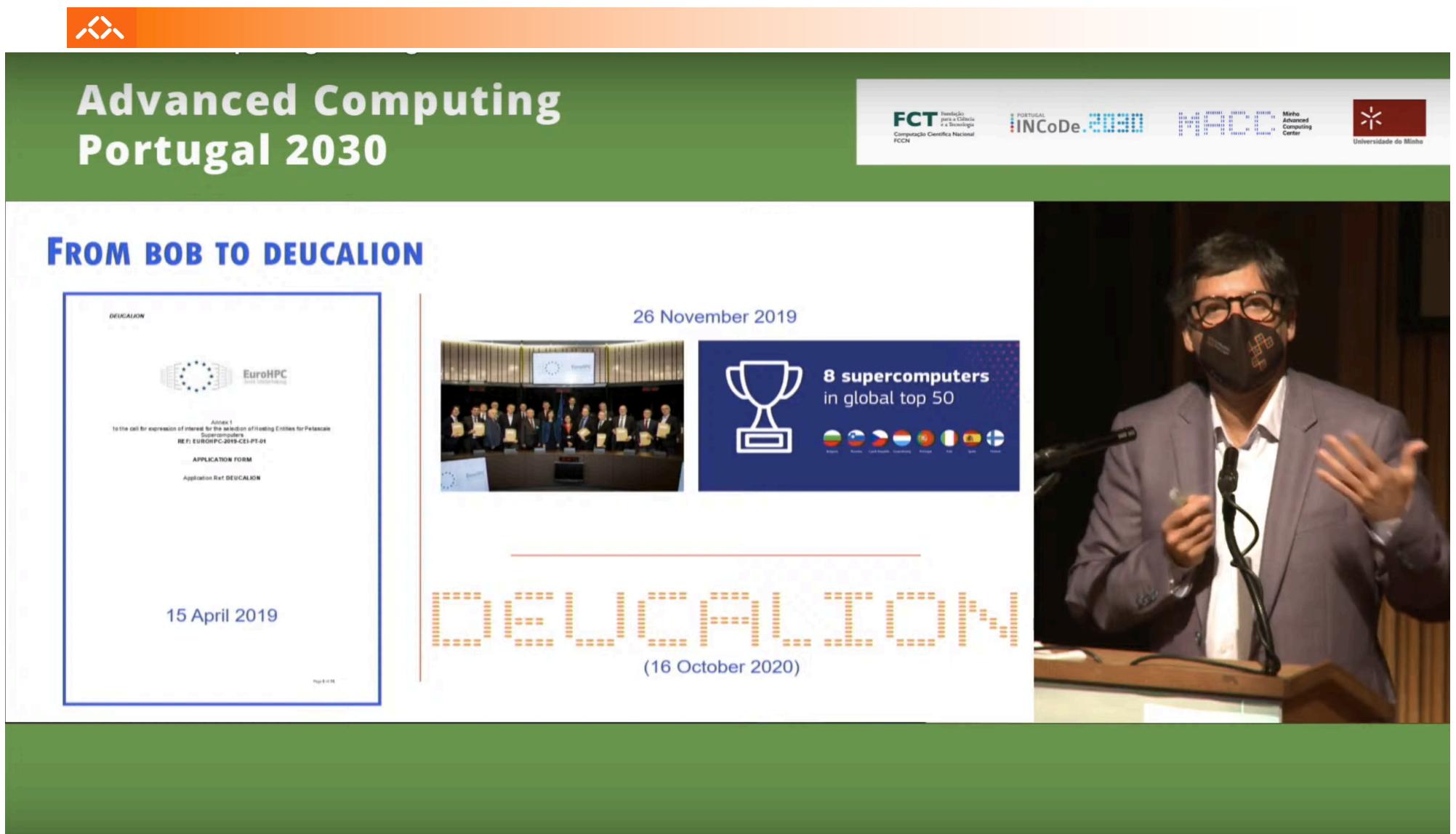
June 2013

Rui Carlos Oliveira
Diretor do MACC

2020/21

25

Advanced Computing Portugal 2030 (5)



The slide features a green header bar with the text "Advanced Computing Portugal 2030" in white. Below the header, there's a section titled "FROM BOB TO DEUCALION" with a blue border. Inside this section, there's a screenshot of a EuroHPC application form for the DEUCALION project, dated 15 April 2019. To the right of this, there's a photo of a group of people on stage at a ceremony on 26 November 2019, with a graphic showing "8 supercomputers in global top 50" from various countries. Below these, the word "DEUCALION" is written in a stylized orange font, with "(16 October 2020)" underneath. The background of the slide is a light beige color with some faint text and logos.

Advanced Computing Portugal 2030

FROM BOB TO DEUCALION

15 April 2019

26 November 2019

DEUCALION (16 October 2020)

FCT Fundação para a Ciência e a Tecnologia
Computação Científica Nacional
FCN

PORTUGAL INCoDe.2030

MiNho Advanced Computing Center

Universidade do Minho

Advanced Computing Portugal 2030 (6)

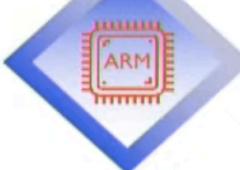


GROWING WITH DEUCALION

WORLD-CLASS 10 PF SUPERCOMPUTER



NEXT GENERATION X86
GENERAL PURPOSE
SYSTEM AS THE
POWERHOUSE FOR
CONVENTIONAL DIGITAL
SIMULATIONS



STATE-OF-THE-ART ARM
GENERAL PURPOSE
SYSTEM WITH THE SHORT-
TERM OBJECTIVE OF
BUILDING HPC SCIENCE
AND ENGINEERING
CAPACITY



GGPU ACCELERATORS ON
10% OF THE X86
SUBSYSTEM MAINLY
DEVOTED TO DATA
SCIENCE APPLICATIONS



EXPERIMENTAL
TECHNOLOGIES TOWARDS
INNOVATIVE
ARCHITECTURES WITH
POTENTIAL FOR EXASCALE



HIGH PERFORMANCE
DEPENDABLE STORAGE
SYSTEM WITH 10 PB NET
CAPACITY

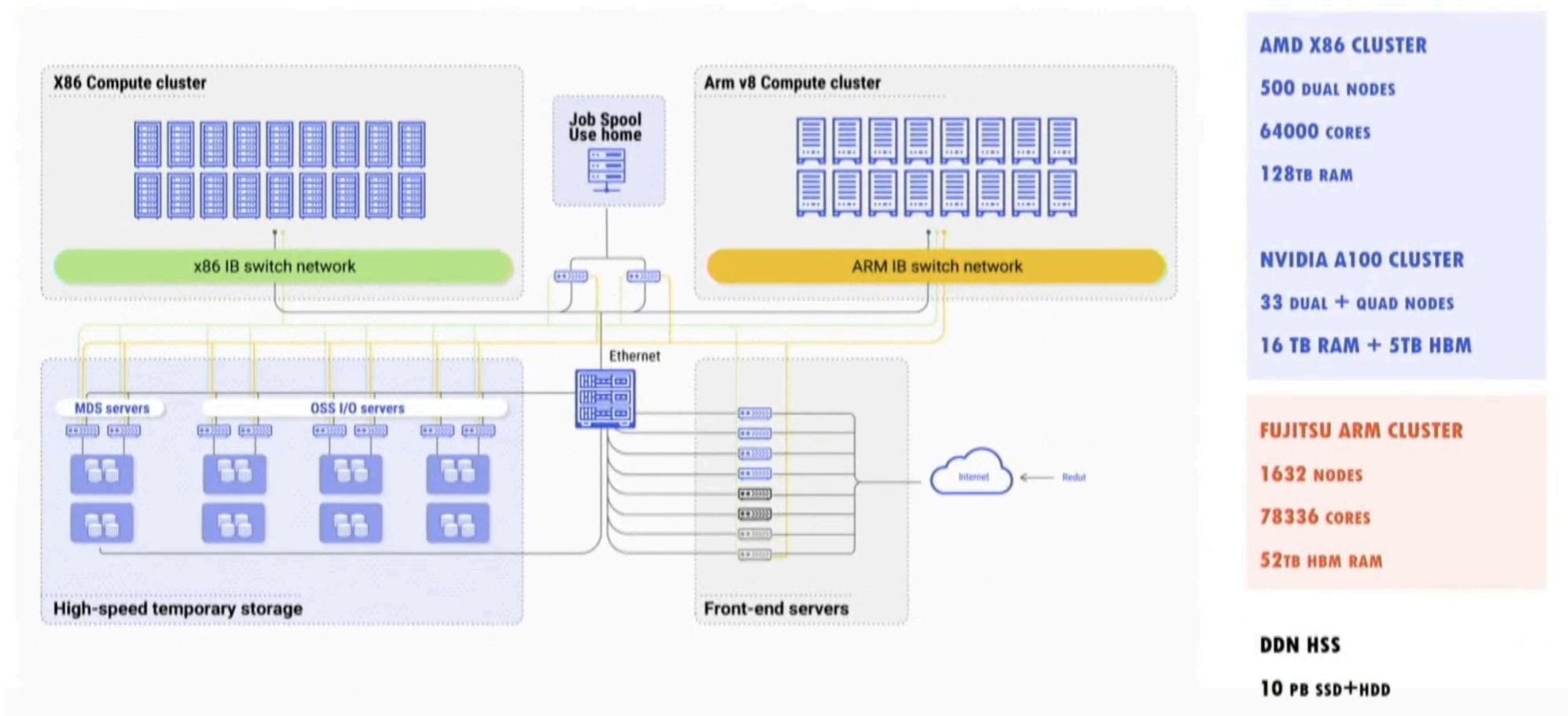


AMBITIOUS POWER
USAGE EFFECTIVENESS
(PUE) OF 1.1

Advanced Computing Portugal 2030 (7)



DEUCALION OVERALL ARCHITECTURE



Advanced Computing Portugal 2030 (8)

The slide features a green header bar with the text "Advanced Computing Portugal 2030". Below the header is a white section containing the title "MACC TIMELINE" and a 3D bar chart. The chart shows four milestones: "DECAULION CONTRACT" (2S 2020), "MACC DATACENTER" (1S 2021), "DEUCALION INSTALLATION" (2S 2021), and "DEUCALION GO LIVE" (1Q 2022). It also includes "ACCESS TO FUJITSU ARM CLUSTER" twice. To the right of the chart is a photograph of a man wearing a mask and glasses, speaking at a podium.

Advanced Computing Portugal 2030

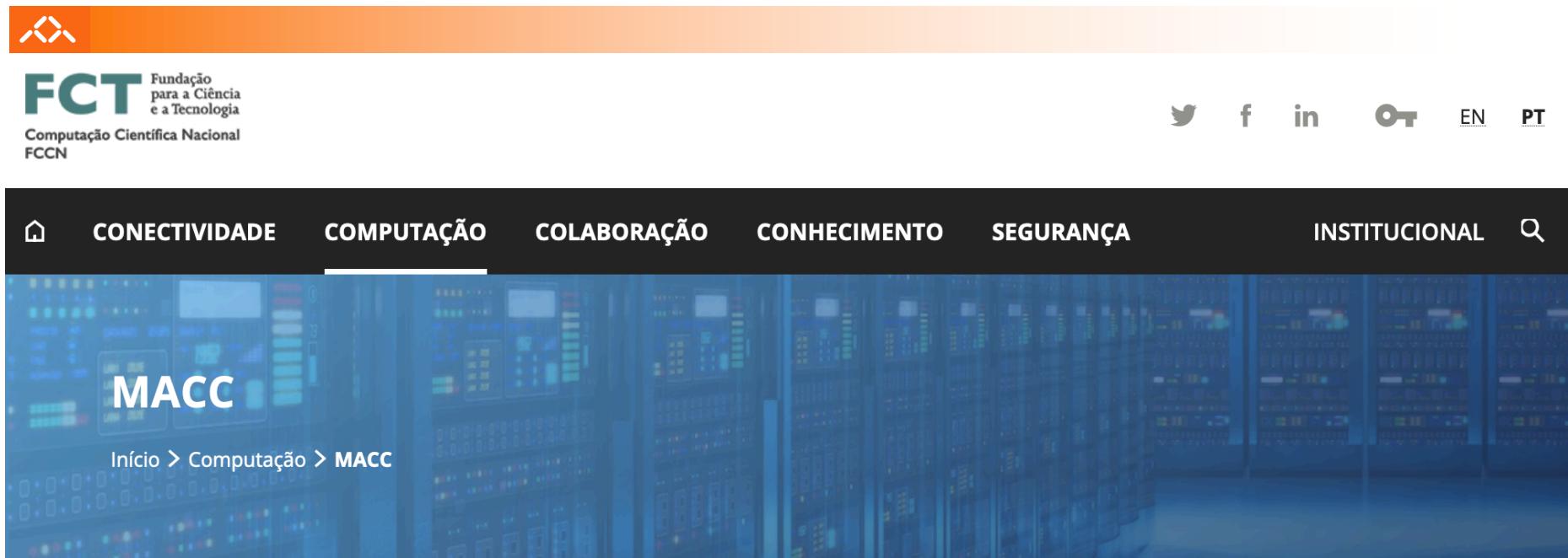
MACC TIMELINE

- DECAULION CONTRACT (2S 2020)
- MACC DATACENTER (1S 2021)
- DEUCALION INSTALLATION (2S 2021)
- DEUCALION GO LIVE (1Q 2022)
- ACCESS TO FUJITSU ARM CLUSTER
- ACCESS TO FUJITSU ARM CLUSTER

FCT Fundação para a Ciência e a Tecnologia
Portugal INCoDe.2030
Minho Advanced Computing Center
Universidade do Minho

MACC:

<https://www.fccn.pt/computacao/macc/>



The screenshot shows the official website for the Minho Advanced Computing Center (MACC). The top navigation bar includes links for various scientific fields and institutional information. The main content area is currently a placeholder image of a server room.



O MACC é uma infraestrutura colaborativa nacional para promover e apoiar iniciativas de Ciência Aberta em supercomputação, ciência de dados e visualização.