



Master Informatics Eng.

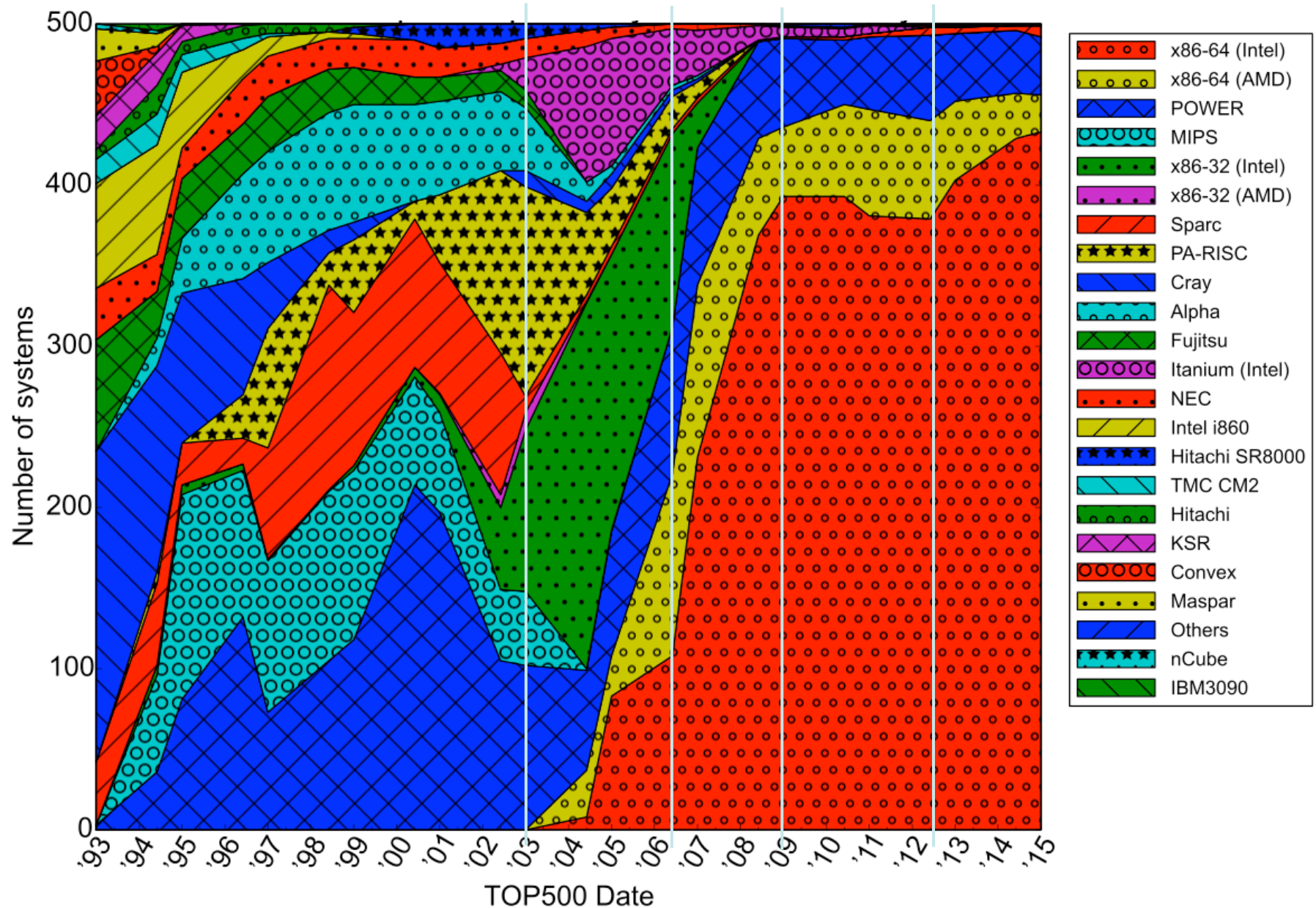
2017/18

A.J.Proença

Next generation of HPC systems

(most slides are borrowed)

Past: processor family distribution of all systems



Current top 10 HPC systems

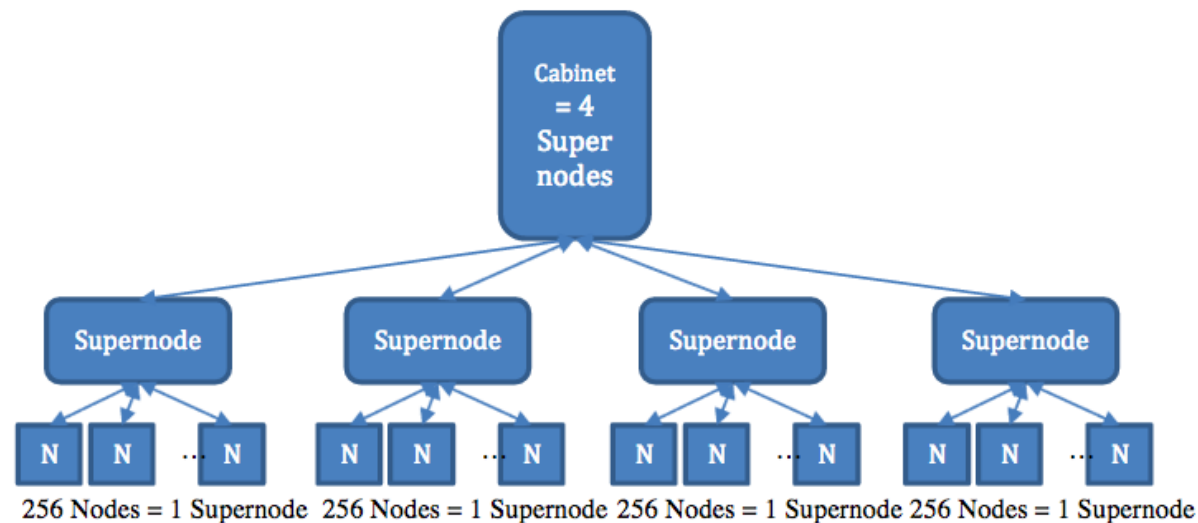
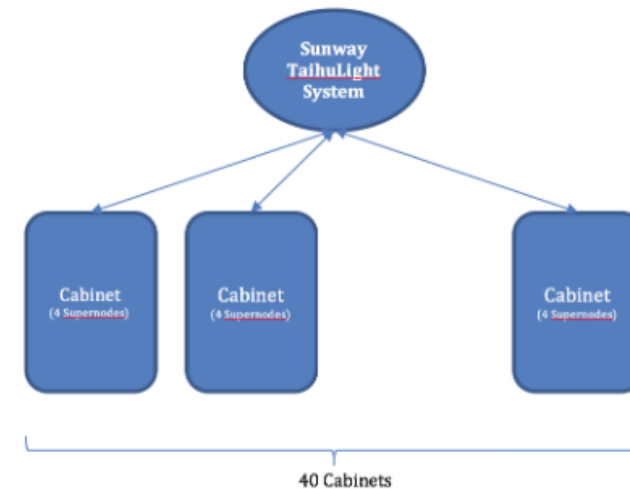
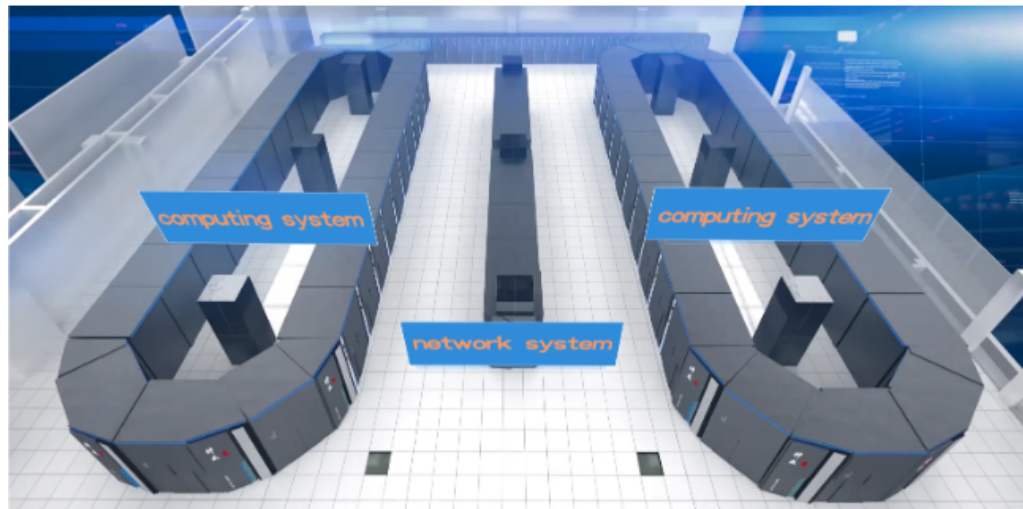
Nov'17 TOP500

Rank	System	Cores	Rmax (TFlop/s)	Rpeak (TFlop/s)	Power (kW)	
1	Sunway TaihuLight - Sunway MPP, Sunway SW26010 260C 1.45GHz, Sunway , NRCPC National Supercomputing Center in Wuxi China	10,649,600	93,014.6	125,435.9	15,371	
2	Tianhe-2 (MilkyWay-2) - TH-IVB-FEP Cluster, Intel Xeon E5-2692 12C 2.200GHz, TH Express-2, Intel Xeon Phi 31S1P , NUDT National Super Computer Center in Guangzhou China	3,120,000	33,862.7	54,902.4	17,808	
		6	Sequoia - BlueGene/Q, Power BQC 16C 1.60 GHz, Custom , IBM DOE/NNSA/LLNL United States		1,572,864	17,173.2 20,132.7 7,890
3	Piz Daint - Cray XC50, Xeon E5-2690v3 12C 2.6GHz, Aries interconnect , NVIDIA Tesla P100 , Cray Inc. Swiss National Supercomputing Centre (CSCS) Switzerland	7	Trinity - Cray XC40, Intel Xeon Phi 7250 68C 1.4GHz, Aries interconnect , Cray Inc. DOE/NNSA/LANL/SNL United States		979,968	14,137.3 43,902.6 3,844
4	Gyokkou - ZettaScaler-2.2 HPC system, Xeon D-1571 16C 1.3GHz, Infiniband EDR, PEZY-SC2 700Mhz , ExaScaler Japan Agency for Marine-Earth Science and Technology Japan	8	Cori - Cray XC40, Intel Xeon Phi 7250 68C 1.4GHz, Aries interconnect , Cray Inc. DOE/SC/LBNL/NERSC United States		622,336	14,014.7 27,880.7 3,939
5	Titan - Cray XK7, Opteron 6274 16C 2.200GHz, Cray Gemini interconnect, NVIDIA K20x , Cray Inc. DOE/SC/Oak Ridge National Laboratory United States	9	Oakforest-PACS - PRIMERGY CX1640 M1, Intel Xeon Phi 7250 68C 1.4GHz, Intel Omni-Path , Fujitsu Joint Center for Advanced High Performance Computing Japan		556,104	13,554.6 24,913.5 2,719
		10	K computer , SPARC64 VIIIfx 2.0GHz, Tofu interconnect , Fujitsu RIKEN Advanced Institute for Computational Science (AICS) Japan		705,024	10,510.0 11,280.4 12,660



**#1 since June'16 TOP500:
Sunway TaihuLight**

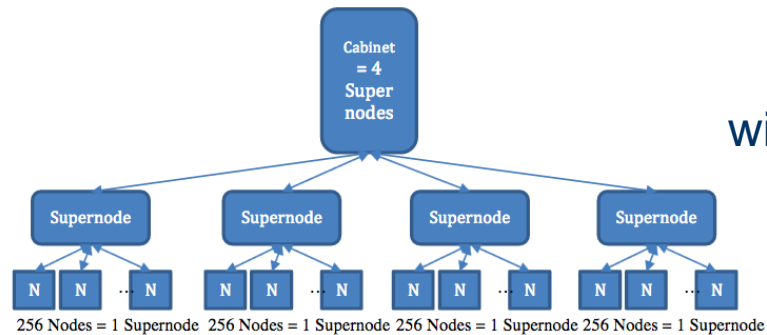
Overview of the Sunway TaihuLight System



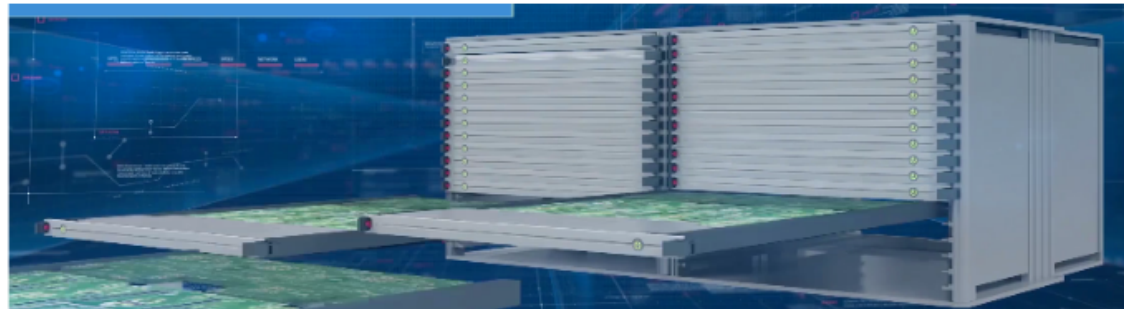
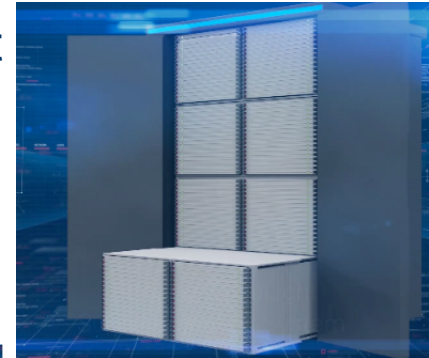
AJProença, Advanced Architectures,



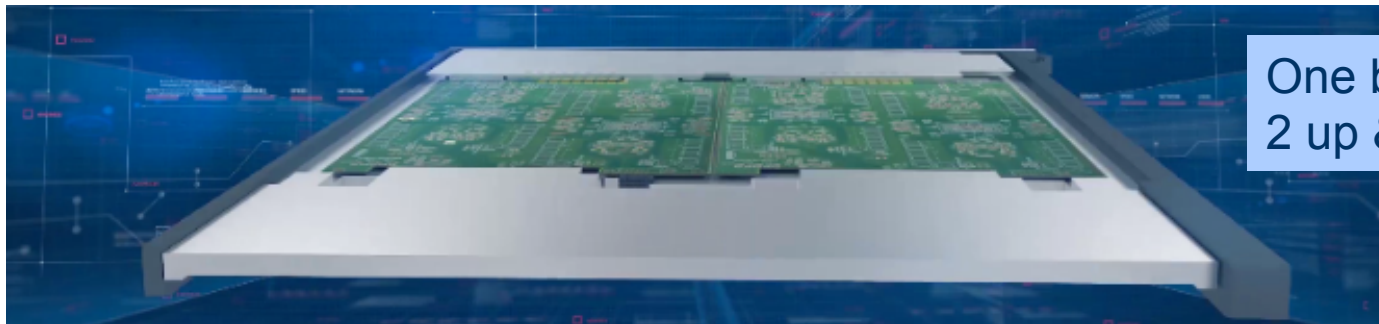
**#1 since June'16 TOP500:
Sunway TaihuLight**



One cabinet
with 4 Supernodes



One Supernode
with 32 boards

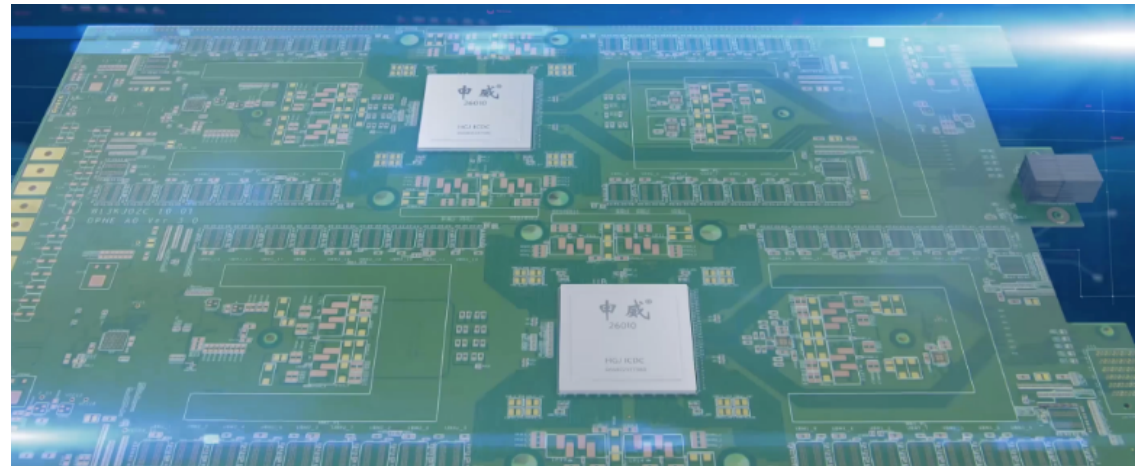


One board with 4 cards,
2 up & 2 down

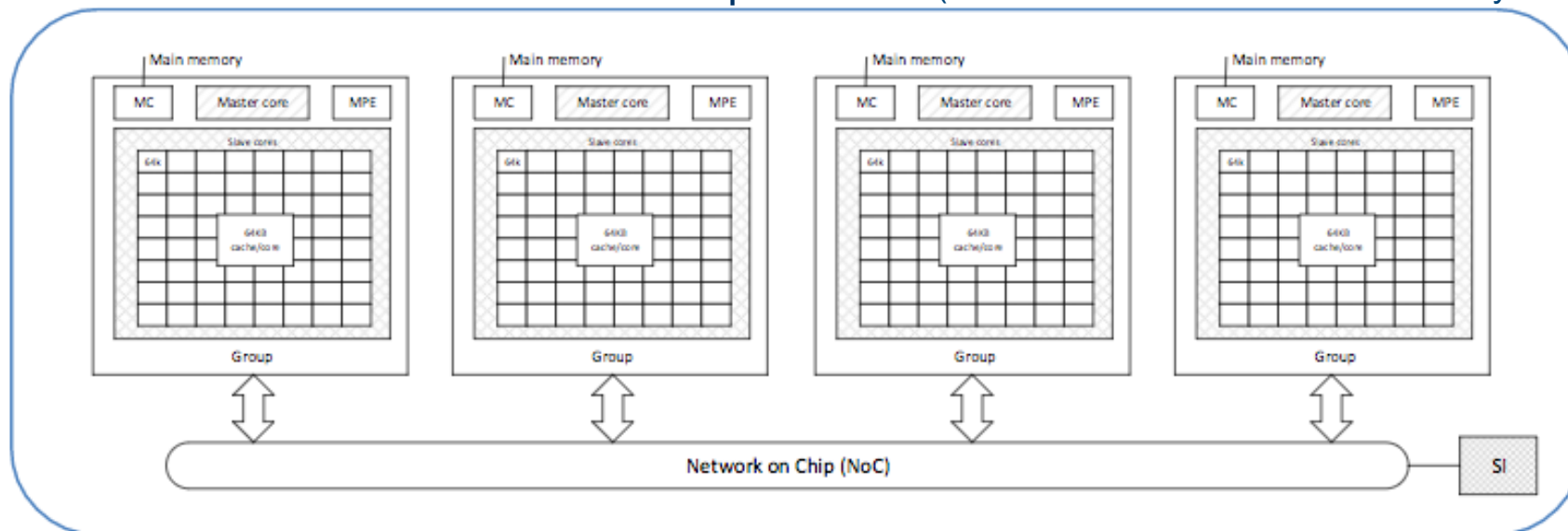


**#1 since June'16 TOP500:
Sunway TaihuLight**

One card with two nodes
(two SW26010 chips)



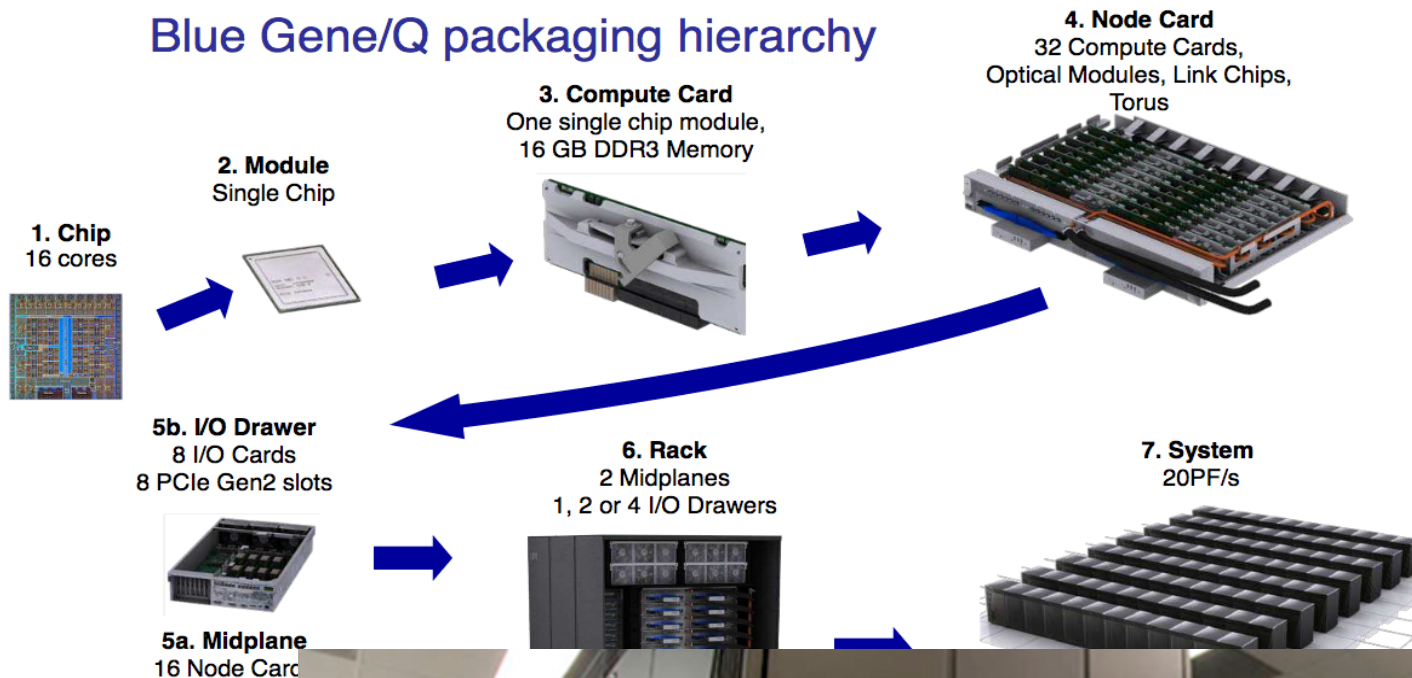
SW26010: the 4x64-core 64-bit RISC processor (w/ **256-bit vector** instructions & only cache L1)



IBM Power BlueGene/Q Compute (Sequoia system)



Blue Gene/Q packaging hierarchy



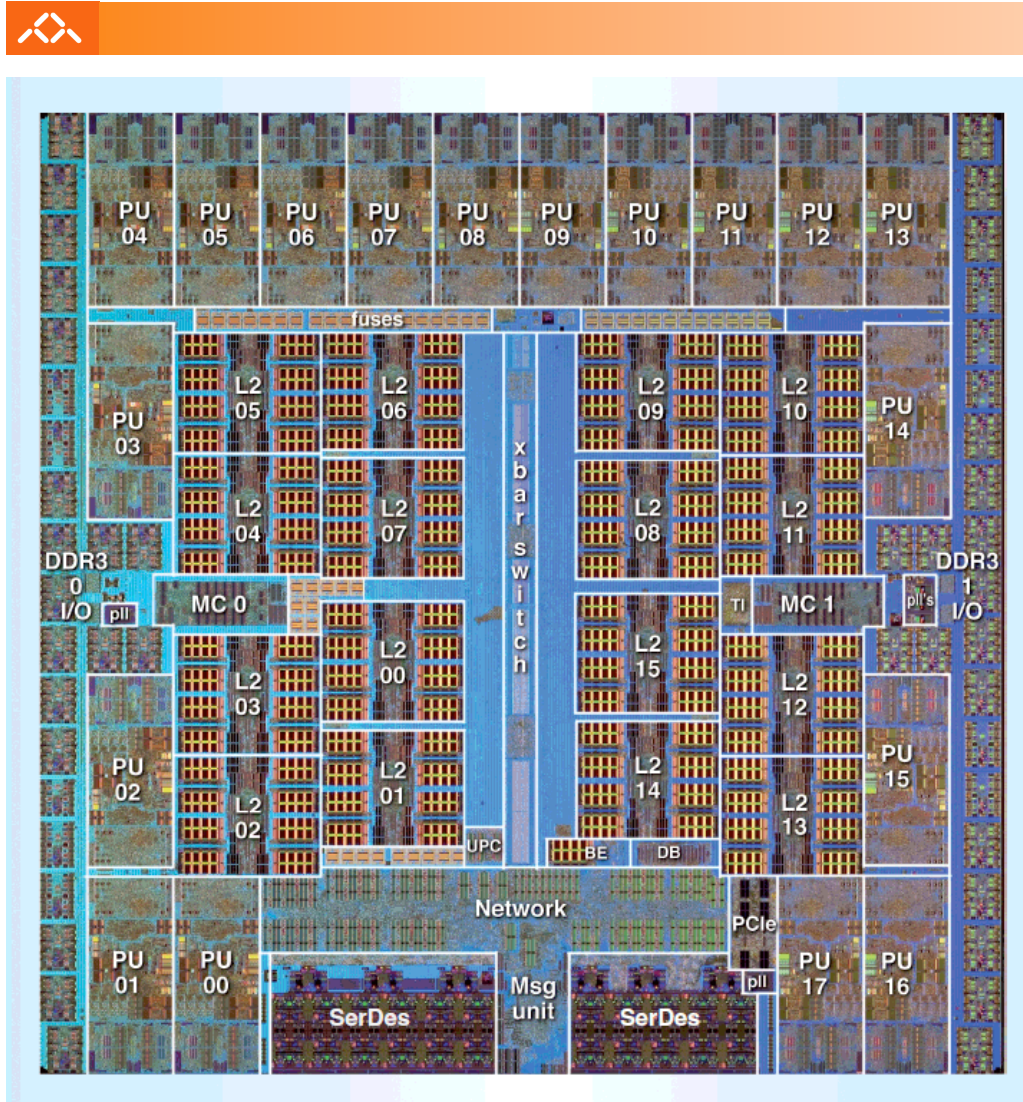
Jun'12: #1
Nov'12: #2
Jun'13: #3
Nov'13: #3
Jun'14: #3
Nov'14: #3
Jun'15: #3
Nov'15: #3
Jun'16: #4
Nov'16: #4
Jun'17: #5
Nov'17: #6

Ref: SC2010

AJProença, Adv



IBM Power BlueGene/Q Compute (chip)



Features:

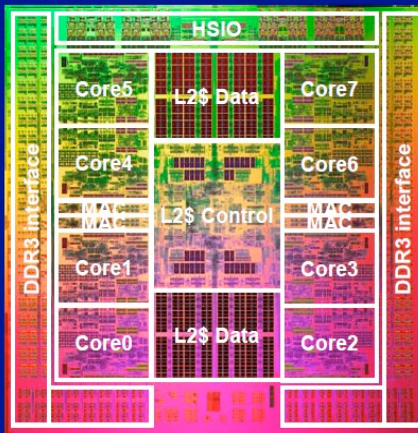
- launched in 2010/11
(TOP500: #1 in Jun12, #4 in Jun16)
- 18-cores
 - 16 compute,
1 OS support, 1 redundant
 - 64 bits PowerISA
 - 1.6 GHz
 - L1 I/D cache => 16 kB / 16 kB
 - **each core: quad-FPU**
(4-wide double precision SIMD)
 - each core: 4-way multi-threaded
- shared L2 cache: 32 MB
- dual memory controller
- IBM ended development of BlueGene project in 2015...

Fujitsu K computer

(the Japanese word "kei" (京), means 10 quadrillion, 10^{16})



SPARC64™ VIIIfx Chip Overview



- **Architecture Features**
 - 8 cores
 - Shared 5 MB L2\$
 - Embedded Memory Controller
 - 2 GHz
- **Fujitsu 45nm CMOS**
 - 22.7mm x 22.6mm
 - 760M transistors
 - 1271 signal pins
- **Performance (peak)**
 - 128GFlops
 - 64GB/s memory throughput
- **Power**
 - 58W (TYP, 30°C)
 - Water Cooling – Low leakage power and High reliability

SPARC64™ VIIIfx

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		K computer
CPU	Name	SPARC64™ VIIIfx
	Performance	128GFlops@2GHz
	Architecture	SPARC V9 + HPC-ACE extension
	Cache configuration	L1(I) Cache:32KB/core, L1(D) Cache:32KB/core L2 Cache: 6MB(shared)
	No. of cores/socket	8
	Memory band width	64 GB/s.
Node	Configuration	1 CPU / Node
	Memory capacity	16 GB
System board	Node/system board	4 Nodes
Rack	System board/rack	24 System boards
	Performance/rack	12.3 TFlops

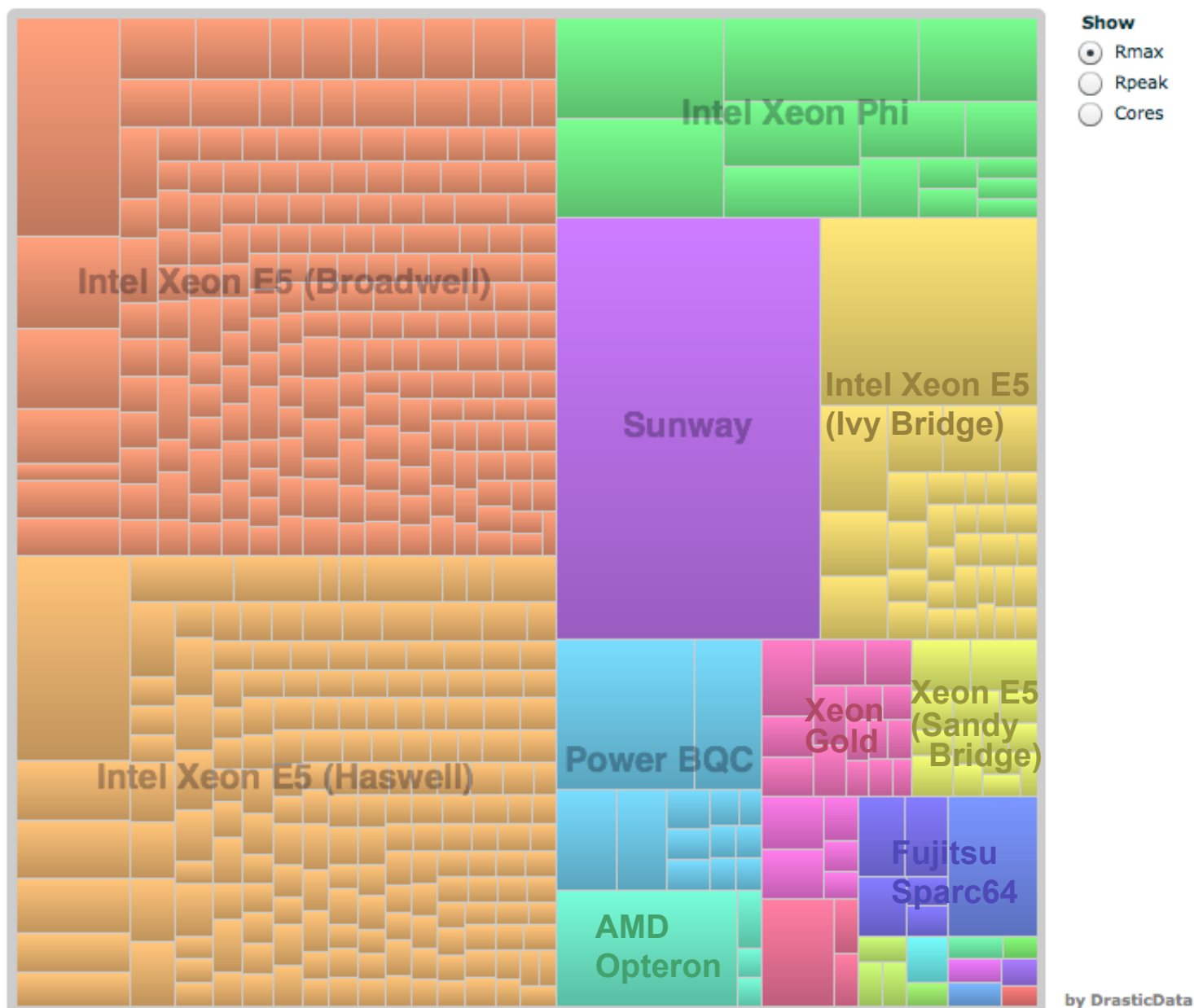


Jun'11: #1
Nov'11: #1
Jun'12: #2
Nov'12: #3
Jun'13: #4
Nov'13: #4
Jun'14: #4
Nov'14: #4
Jun'15: #4
Nov'15: #4
Jun'16: #5
Nov'16: #7
Jun'17: #8
Nov'17: #10

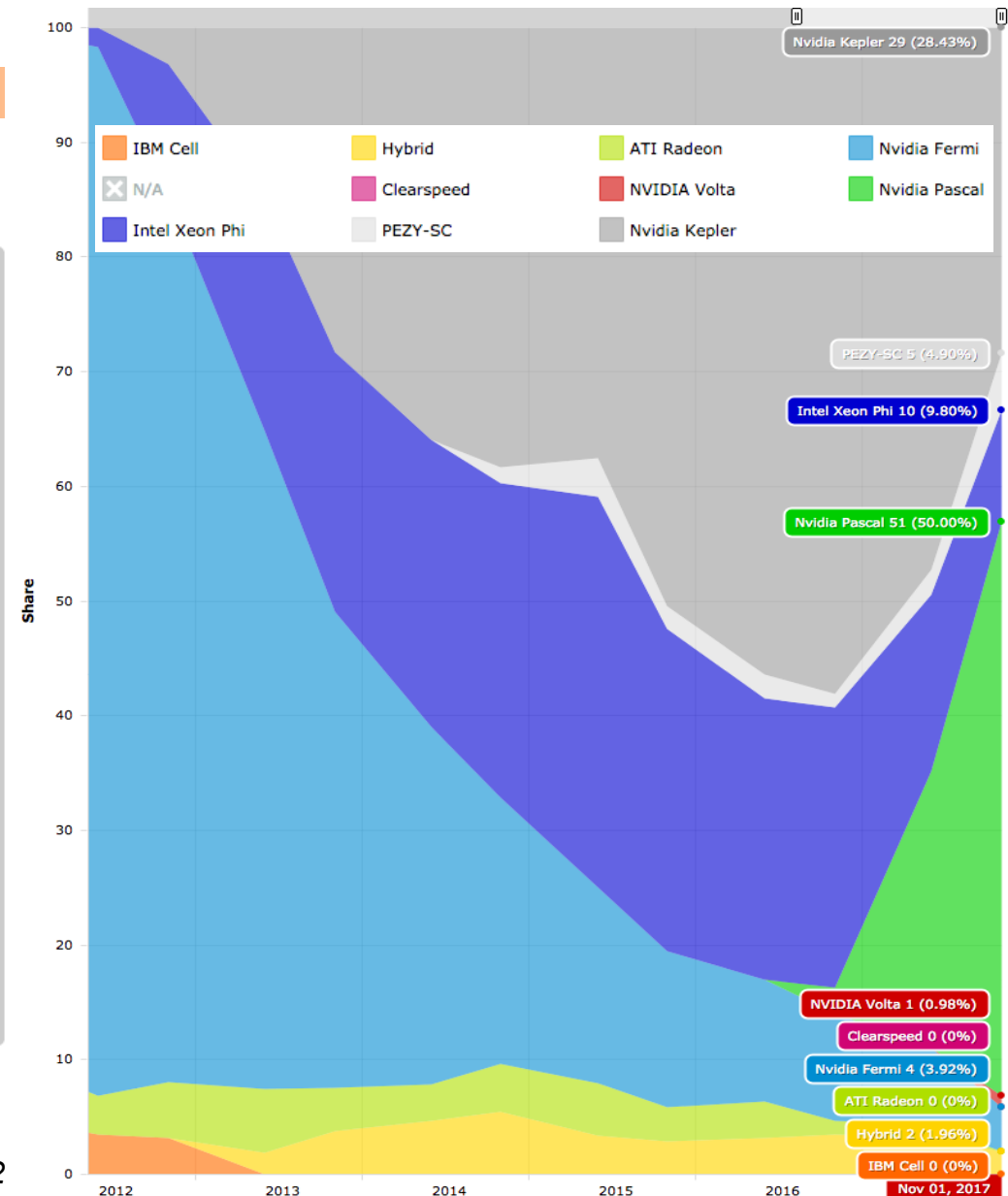
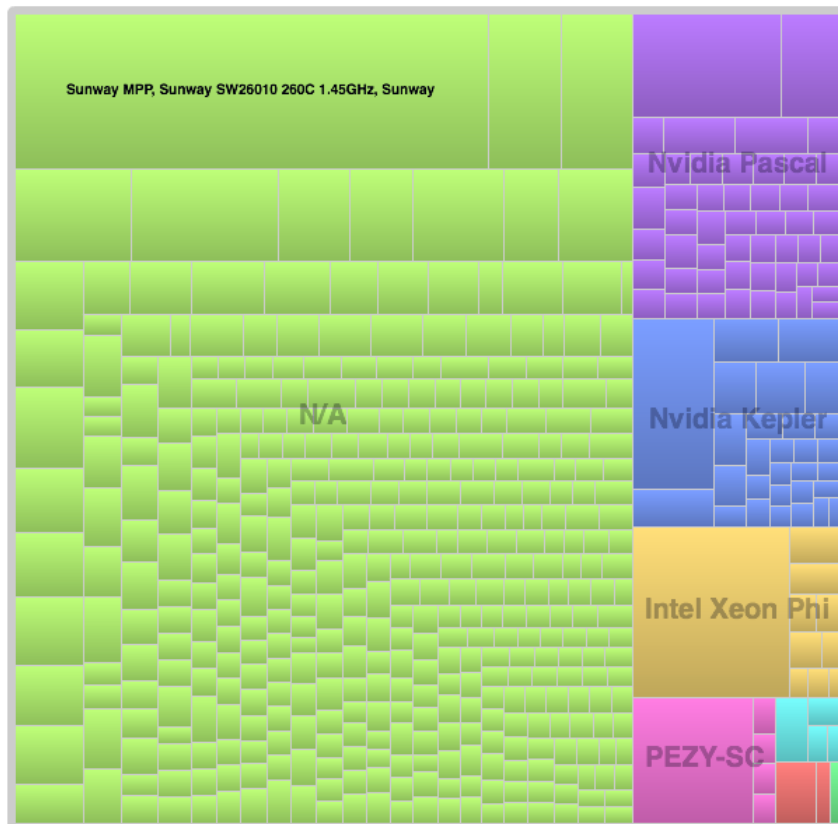




Processor generations in November'17



Accelerator family distribution over all systems Nov'17



Next PU generations for HPC: Intel® Xeon® Processor Scalable Family (formerly code-named Skylake-SP)

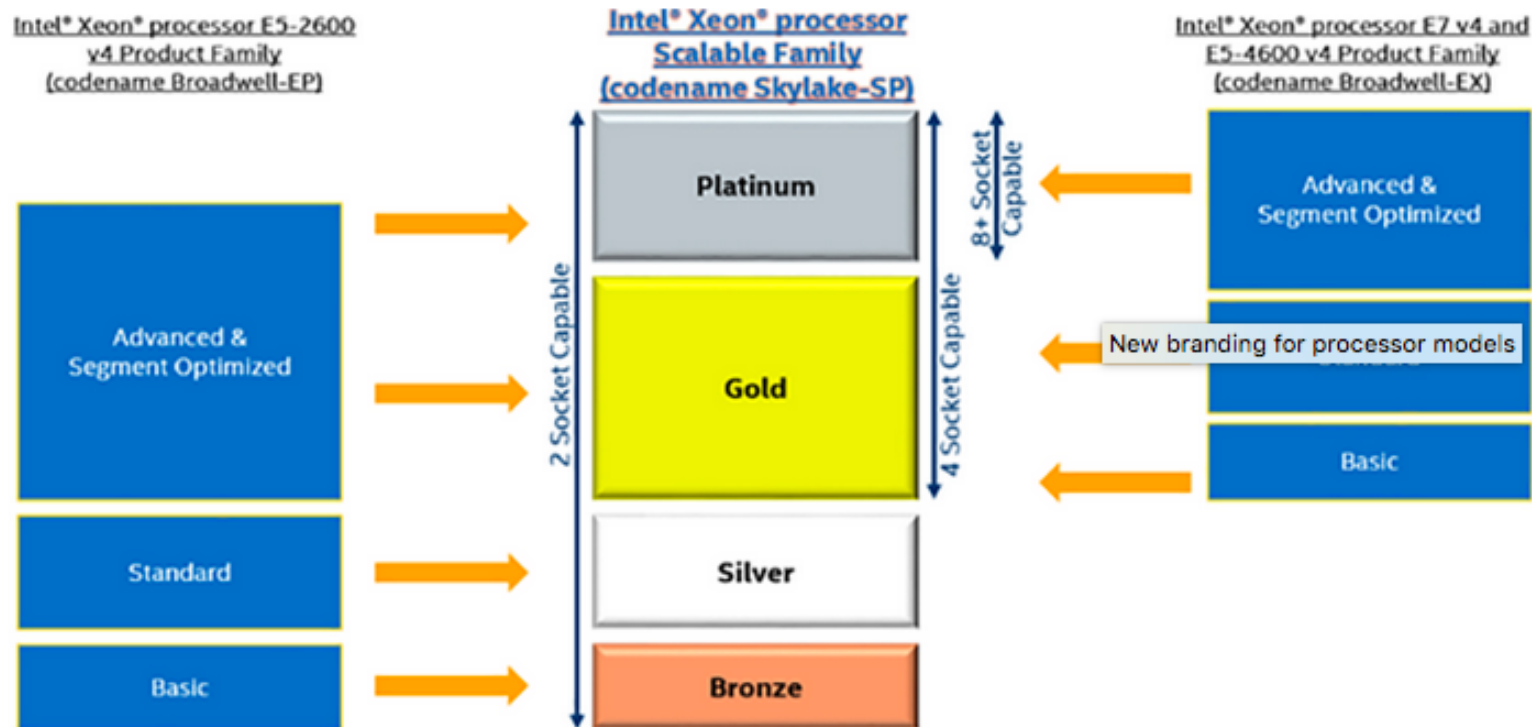


Figure 2. New branding for processor models.