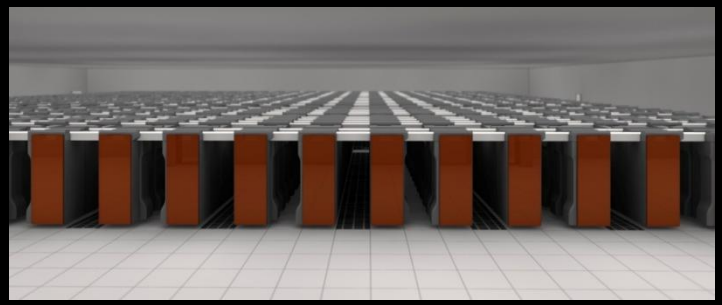
FUJITSU

OPEN PETASCALE LIBRARIES

openpetascale LIBRARIES

Advancing the development of open-source numerical libraries for the new generation of highly parallel computers

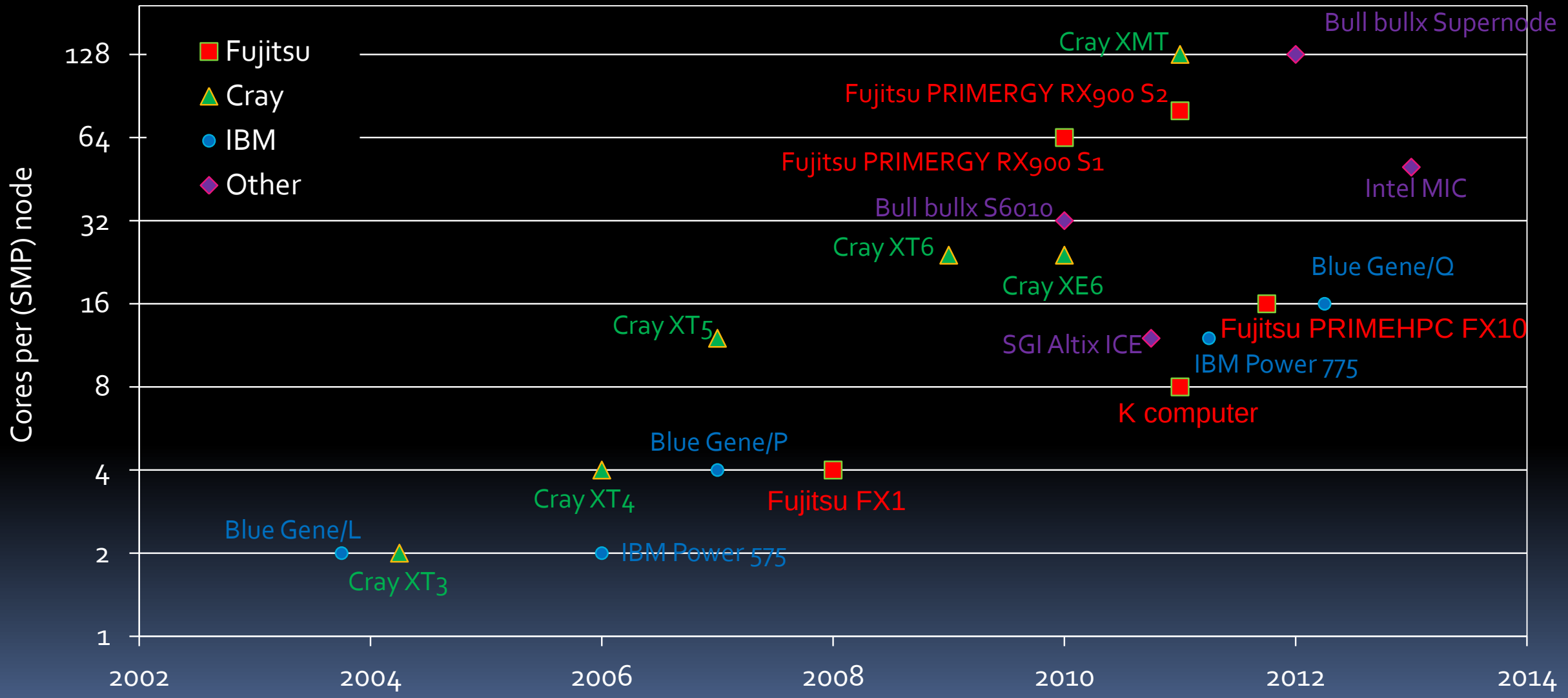


Open Petascale Libraries membership

A global collaboration…

…contributing to the computational science community

Increasing cores per node

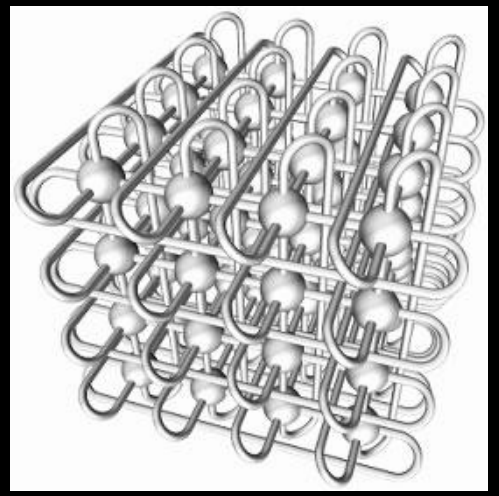


Assumed exascale architectures

System attributes	2011	"2015"		"2018"		Difference 2011 & 2018
System peak	8.7 Pflop/s	200 Pflop/s		1 Eflop/sec		O(100) 115
Power	10 MW	15 MW		~20 MW		
System memory	1.6 PB	5 PB		32-64 PB		O(10) 20
Node performance	128 GF	0.5 TF	7 TF	1 TF	10 TF	O(10) – O(100)
Node memory BW	64 GB/s	0.1 TB/sec	1 TB/sec	0.4 TB/sec	4 TB/sec	O(100) 62
Node concurrency	8	O(100)	O(1,000)	O(1,000)	O(10,000)	O(100) – O(1000)
Total Concurrency	548,352	$O(10^8)$		$O(10^9)$		O(1000) 1823
Total Node Interconnect BW	20 GB/s	20 GB/sec		200 GB/sec		O(10)
MTTI	days	O(1day)		O(1 day)		- O(10)

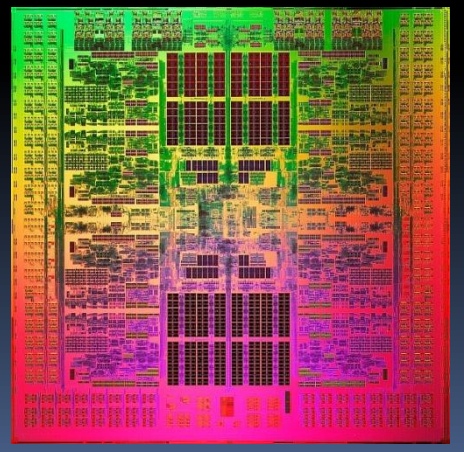
Source: Dongarra, 'What Can You Expect From Exascale Computing', ISC'11

Employ a hybrid programming model



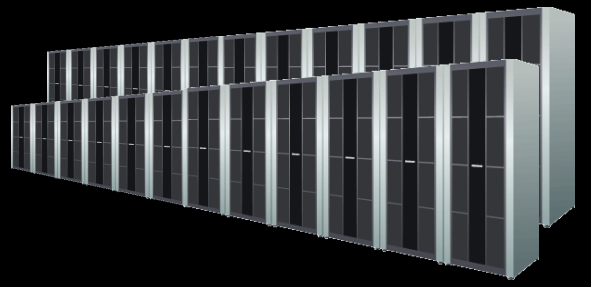
Message passing between nodes

Thread parallelism within a node



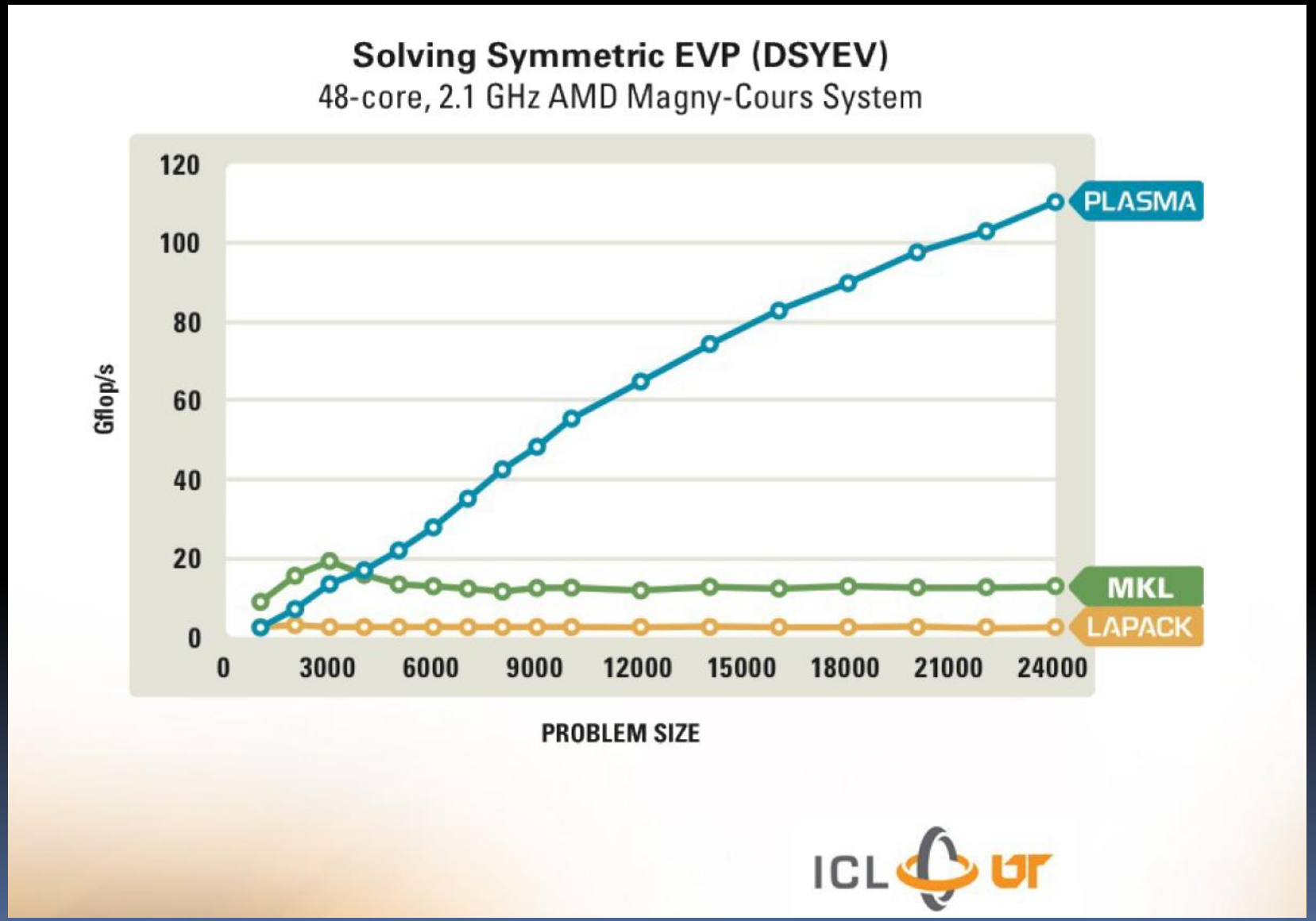
Generic software

For platforms ranging from x86 clusters…

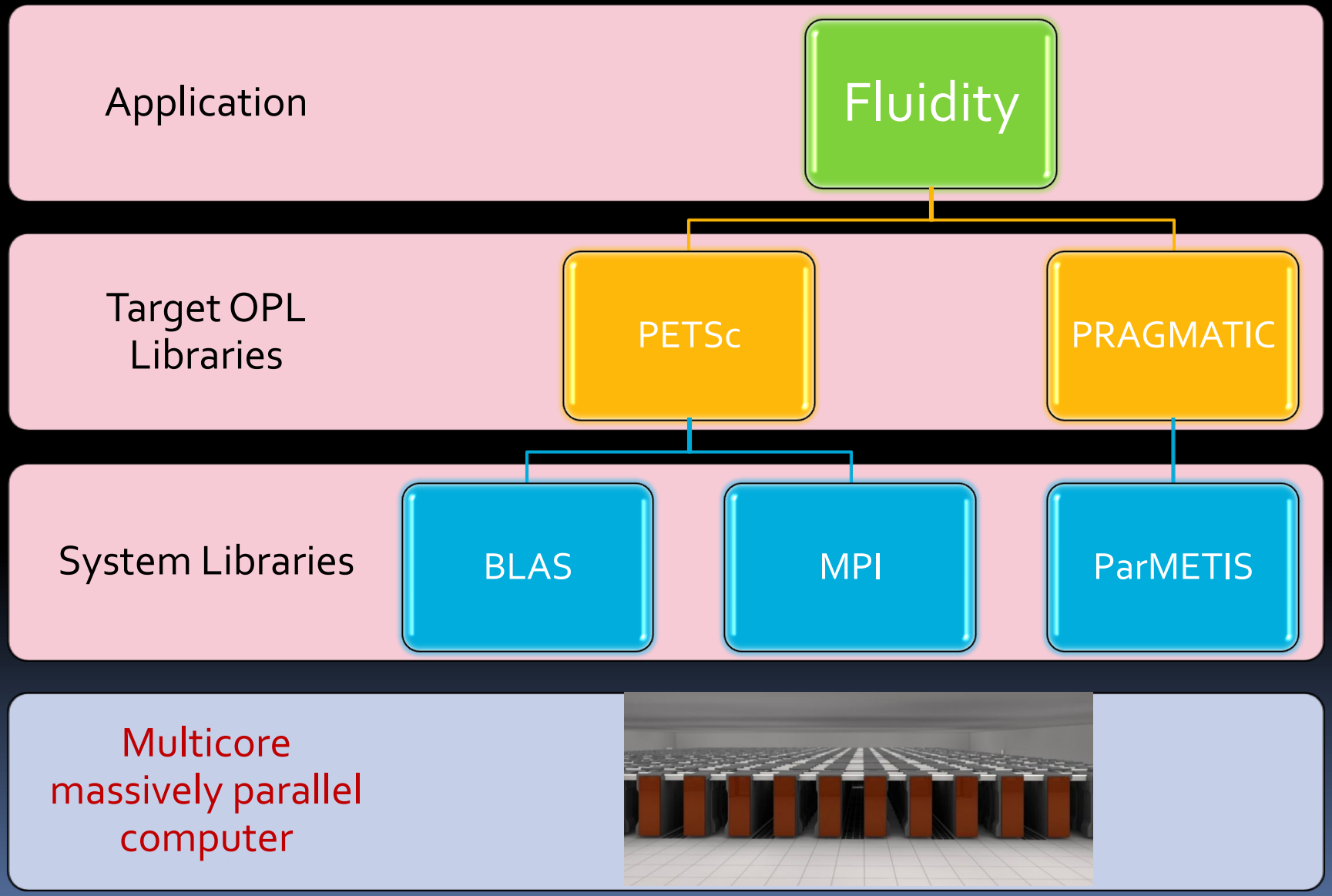


…to the K computer and PRIMEHPC FX10

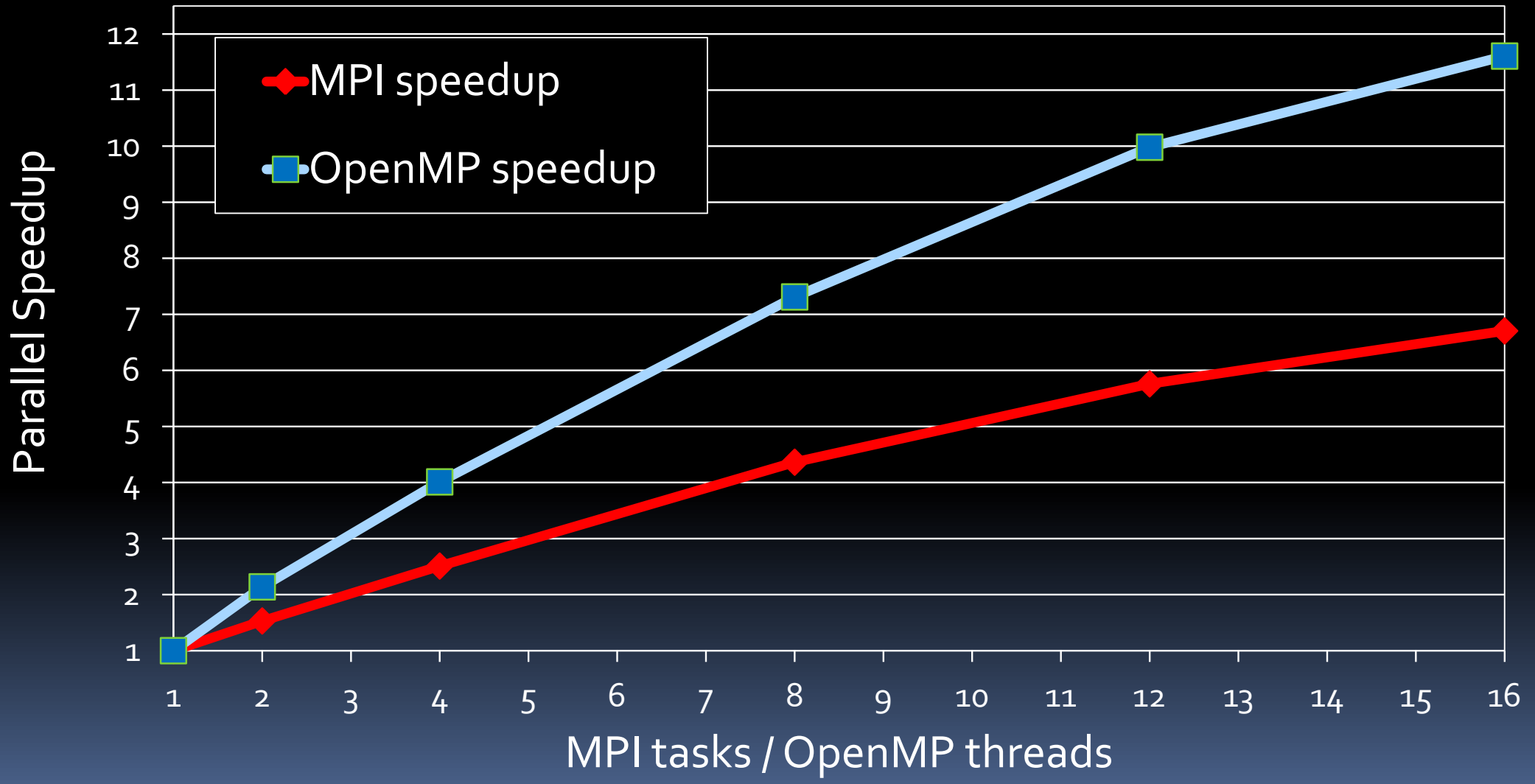
PLASMA: minimizing synchronisation



An example: Ocean modelling



PETSc: OpenMP versus MPI

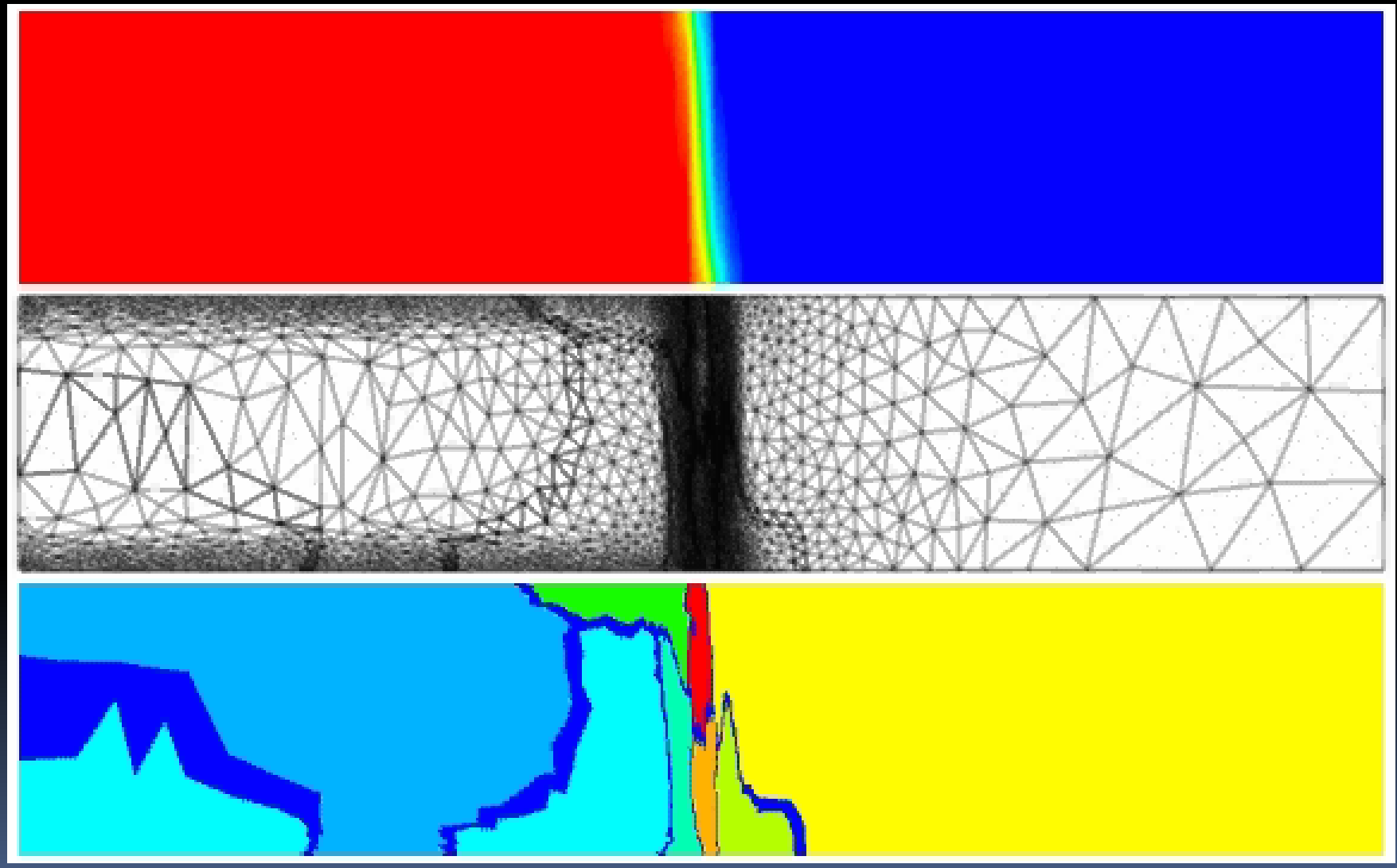


PRAGMATIC: adaptive meshing

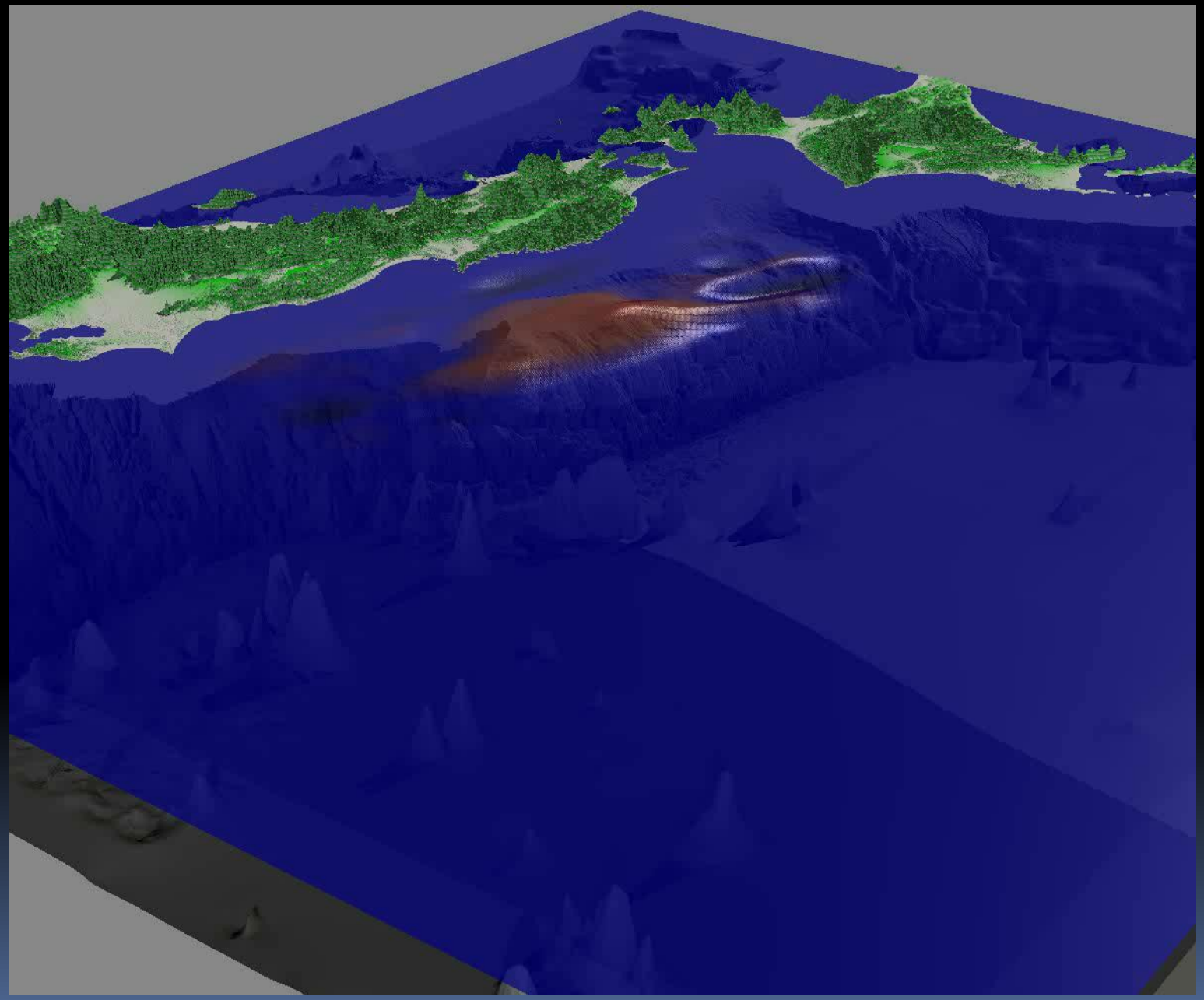
Simulation result

Adapting mesh

Load distribution

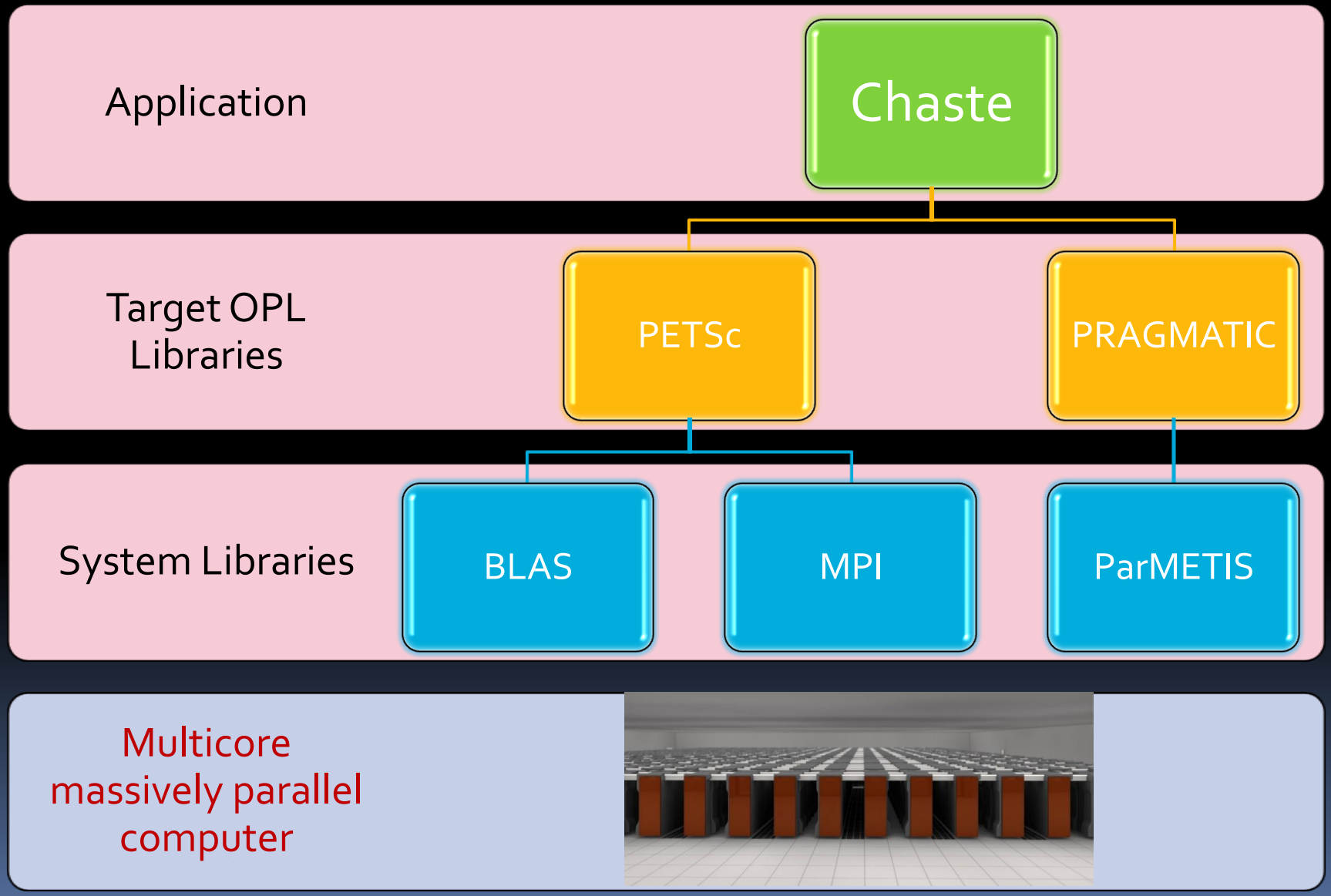


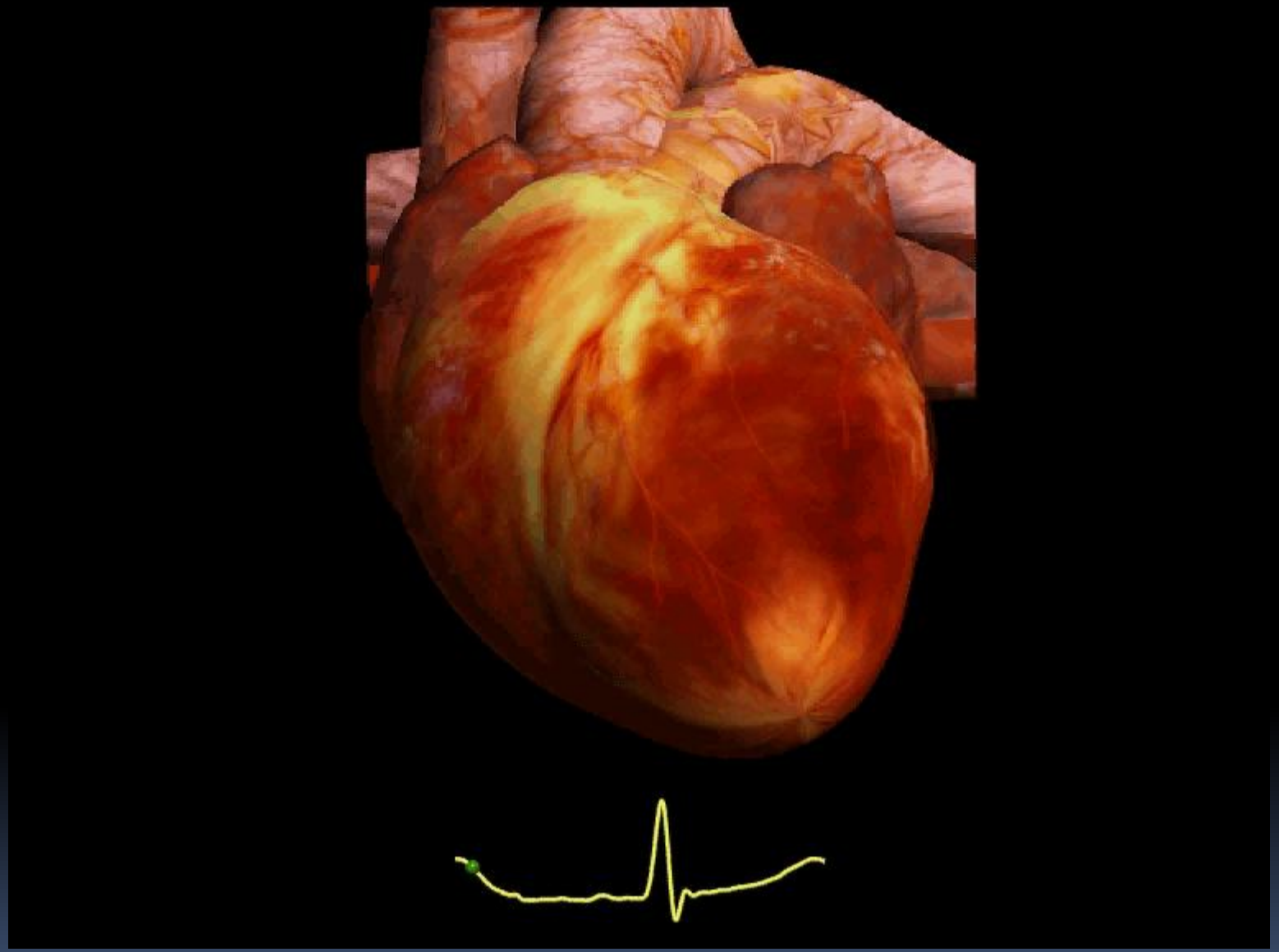
Imperial College London



Great East Japan Tsunami
March 2011

A second example: Heart modelling



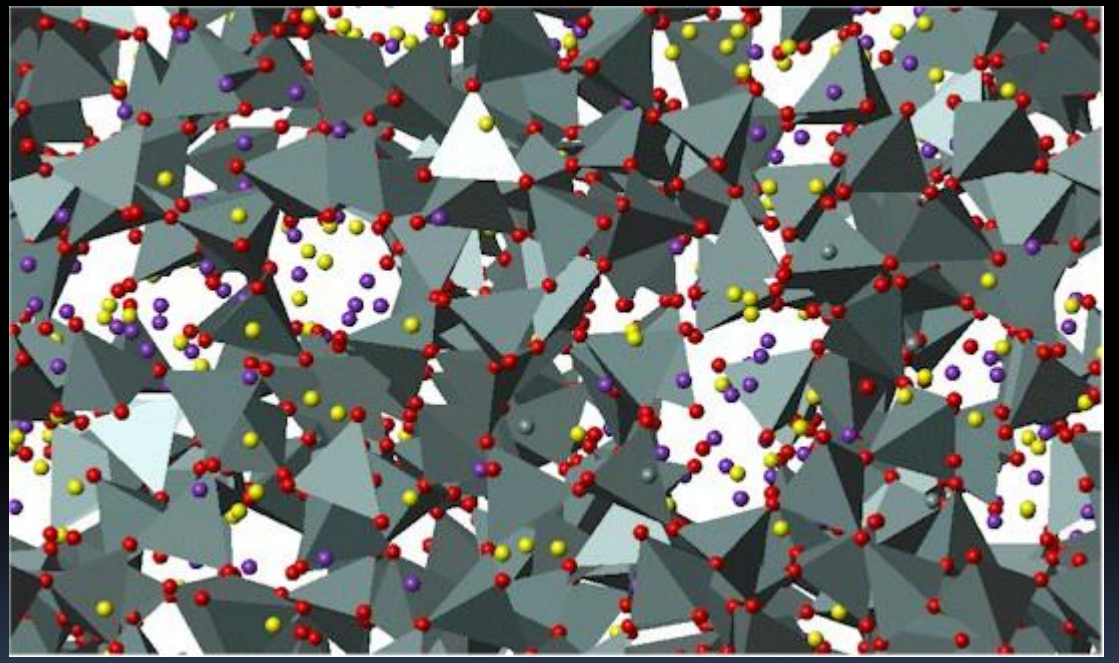


Electrophysiology of the heart

Drug side effects

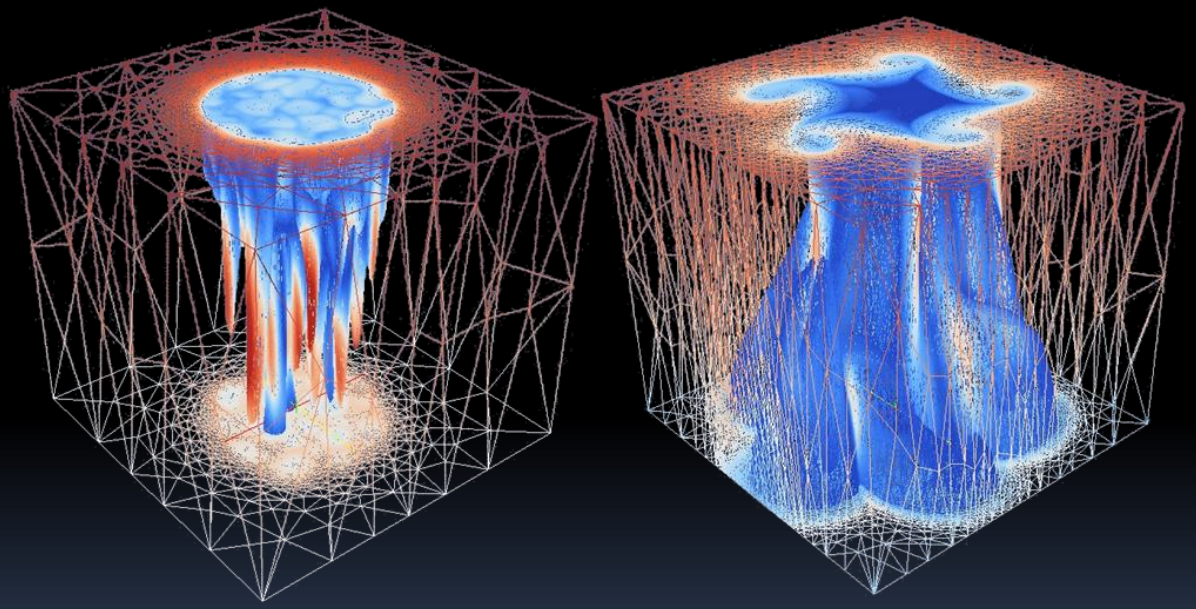
Contributing to many application areas

New materials



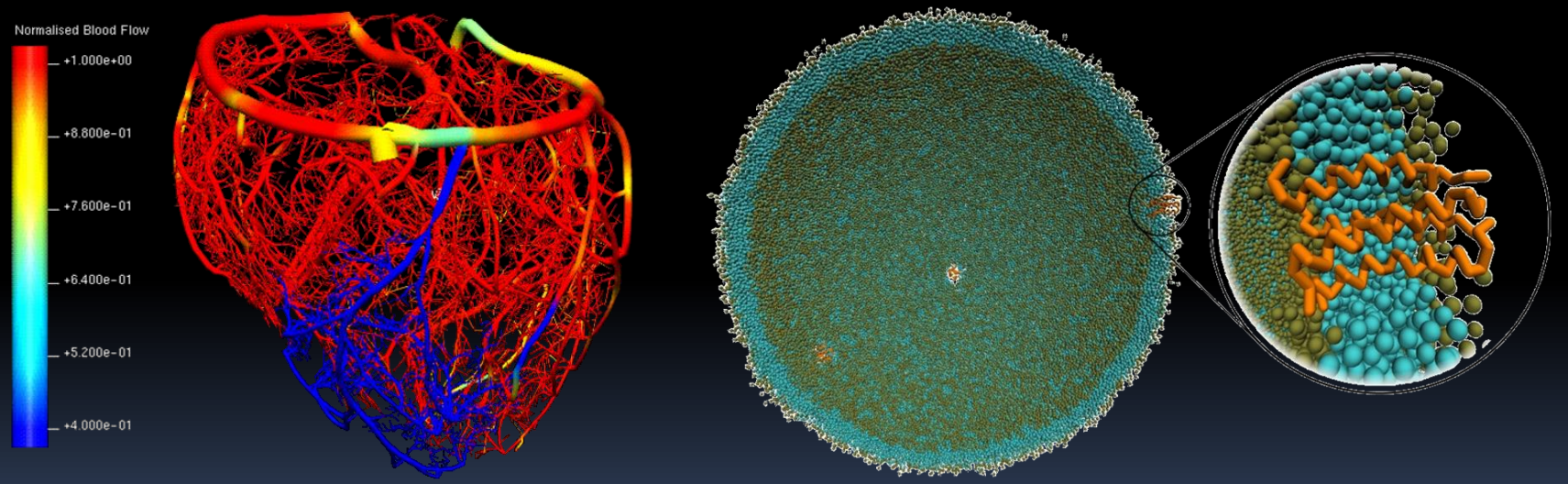
Contributing to many application areas

The environment



Contributing to many application areas

Life sciences



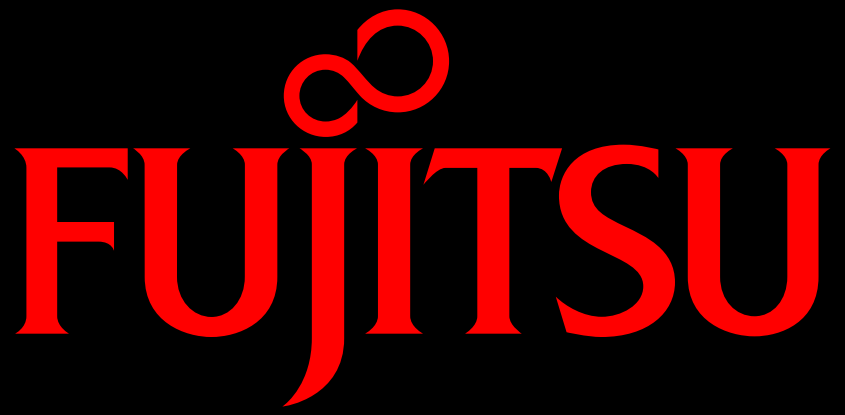
Initial software release…

- PLASMA (dense linear algebra)
- PETSc (sparse solvers)
- PRAGMATIC (adaptive meshing)
- FFTE
- 2DECOMP&FFT
- spBLAS (sparse BLAS library)

www.openpetascale.org/index.php/public/page/download

For more information...

www.openpetascale.org



shaping tomorrow with you