Cray's Expanding Presence in the EMEA Region

HPC User Forum Munich, 15/16 October 2015

Legal Disclaimer

Information in this document is provided in connection with Cray Inc. products. No license, express or implied, to any intellectual property rights is granted by this document.
Cray Inc. may make changes to specifications and product descriptions at any time, without notice.
All products, dates and figures specified are preliminary based on current expectations, and are subject to change without notice.
Cray hardware and software products may contain design defects or errors known as errata, which may cause the product to deviate from published specifications. Current characterized errata are available on request.
Cray uses codenames internally to identify products that are in development and not yet publically announced for release. Customers and other third parties are not authorized by Cray Inc. to use codenames in advertising, promotion or marketing and any use of Cray Inc. internal codenames is at the sole risk of the user.
Performance tests and ratings are measured using specific systems and/or components and reflect the approximate performance of Cray Inc. products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance.
The following are trademarks of Cray Inc. and are registered in the United States and other countries: CRAY and design, SONEXION, URIKA and YARCDATA. The following are trademarks of Cray Inc.: ACE, APPRENTICE2, CHAPEL, CLUSTER CONNECT, CRAYPAT, CRAYPORT, ECOPHLEX, LIBSCI, NODEKARE, THREADSTORM. The following system family marks, and trademarks of Cray Inc.: CS, CX, XC, XE, XK, XMT and XT. The registered trademark LINUX is used pursuant to a sublicense from LMI, the exclusive licensee of Linus Torvalds, owner of the mark on a worldwide basis.
Other names and brands may be claimed as the property of others. Other product and service names mentioned herein are the trademarks of their respective owners.

About Cray

Seymour Cray founded Cray Research in 1972

- 1972-1996, Cray Research grew to leadership in Supercomputing
- 1996-2000, Cray became a subsidiary of SGI
- 2000- present, Cray Inc. growing to $562M in revenue in 2014
- Cray Inc. formed in April 2000

Cray Inc.

- NASDAQ: CRAY
- Over 1,200 employees across 30 countries
- Headquartered in Seattle, WA

Three Focus Areas

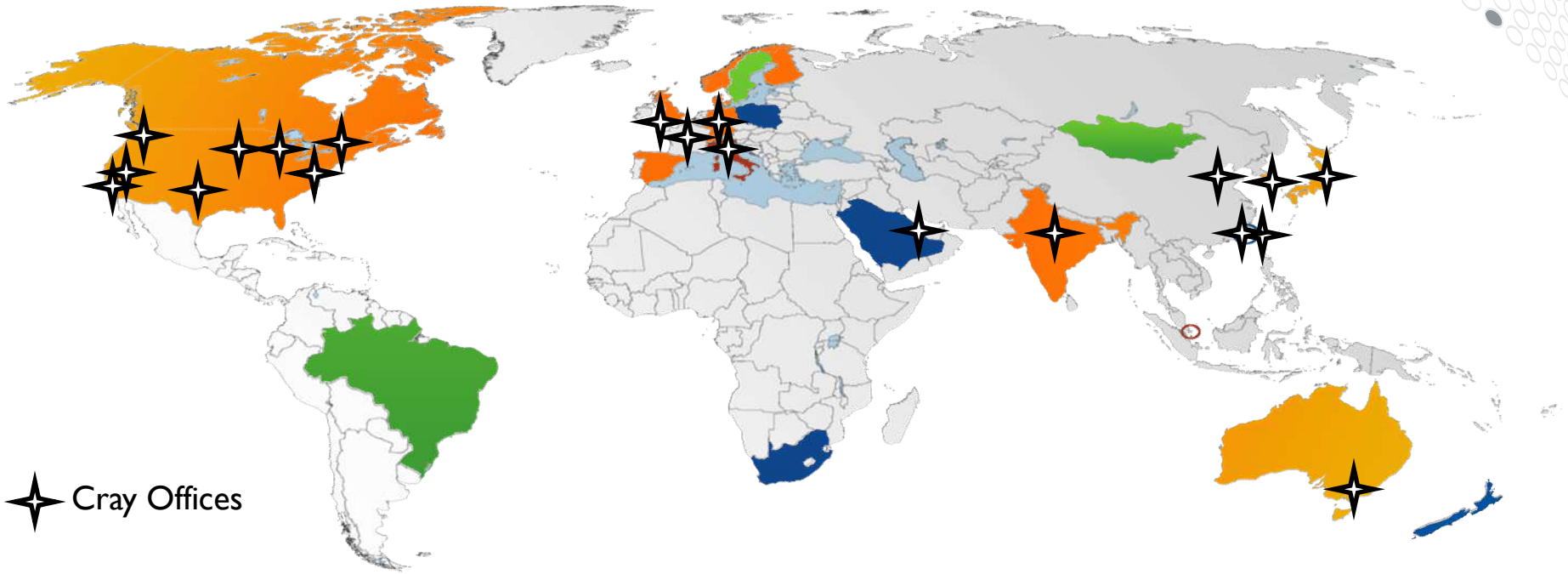
- Computation
- Storage
- Analytics

Seven Major Development Sites:

- Austin, TX
- Bristol, UK
- Chippewa Falls, WI
- Pleasanton, CA
- San Jose, CA
- Seattle, WA
- St. Paul, MN

COMPUTE | STORE | ANALYZE

Cray's Global Growth

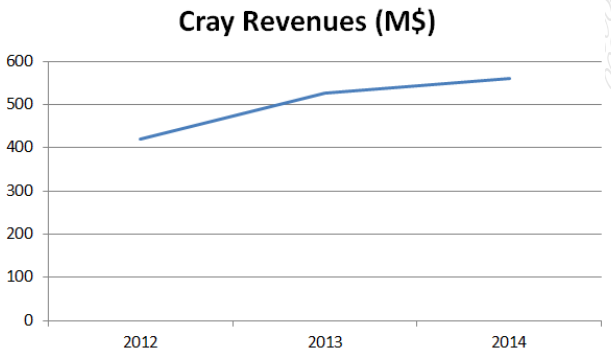


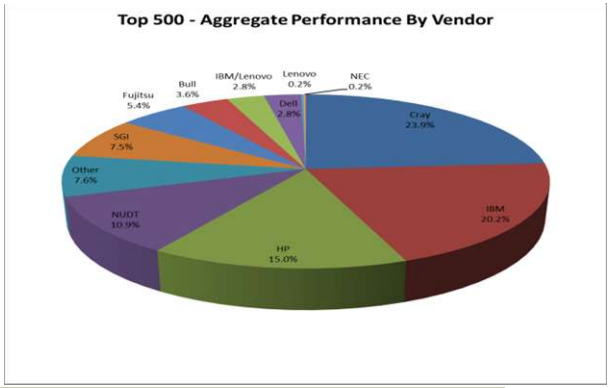
2009 | 2010-2011 | 2012-2013 | 2014-2015

COMPUTE | STORE | ANALYZE

Cray Global success

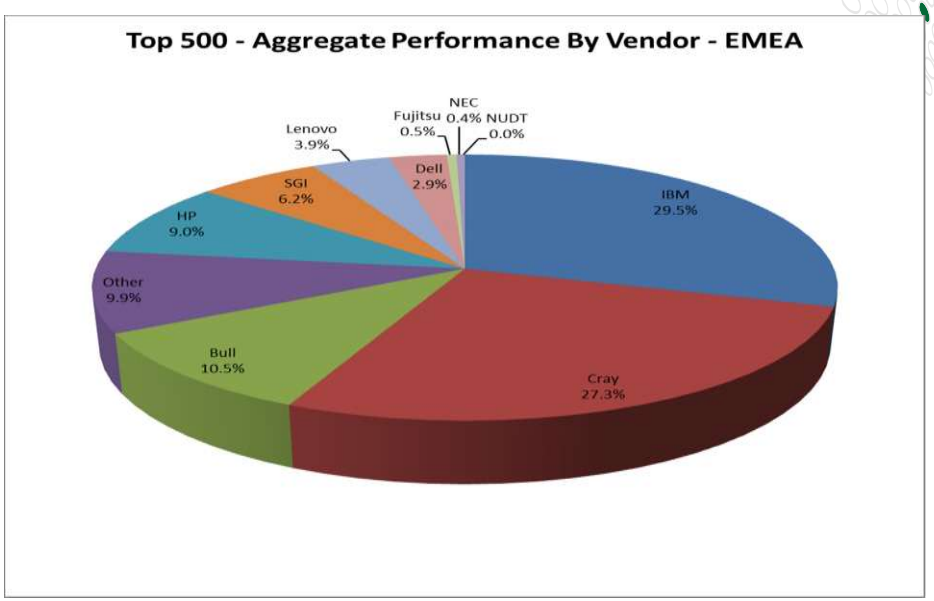
- Revenue: in 2014 Global revenue $561.6M
  - EMEA accounts for 34%
- Staff: from 2005 to 2015 increased by 62%
  - Cray EMEA staff has increased by 111%
- Dominance in very large systems: top500
  - EMEA: CSCS, KAUST, Met Office …
- New customer wins in Enterprise/Commercial
  - Energy, manufacturing, financial services





TOP500

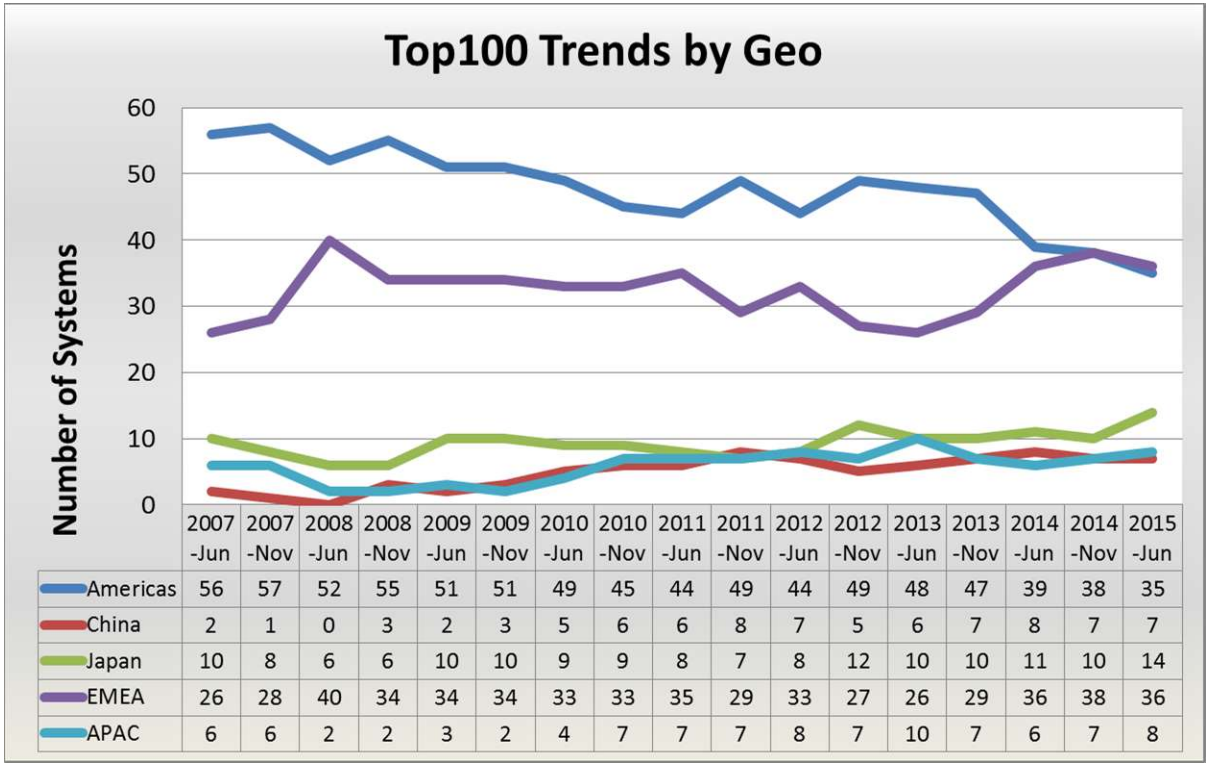
- Worldwide Cray is a clear leader in performance, claiming a 24% share of installed total performance
- In EMEA: Cray delivered 27% of the total EMEA performance in the Top500
- Cray is the most focused solution provider in EMEA for the combination of big data and supercomputing
- Cray arguably the leader in high performance computing and storage solutions in EMEA



Cray Systems and Storage in EMEA

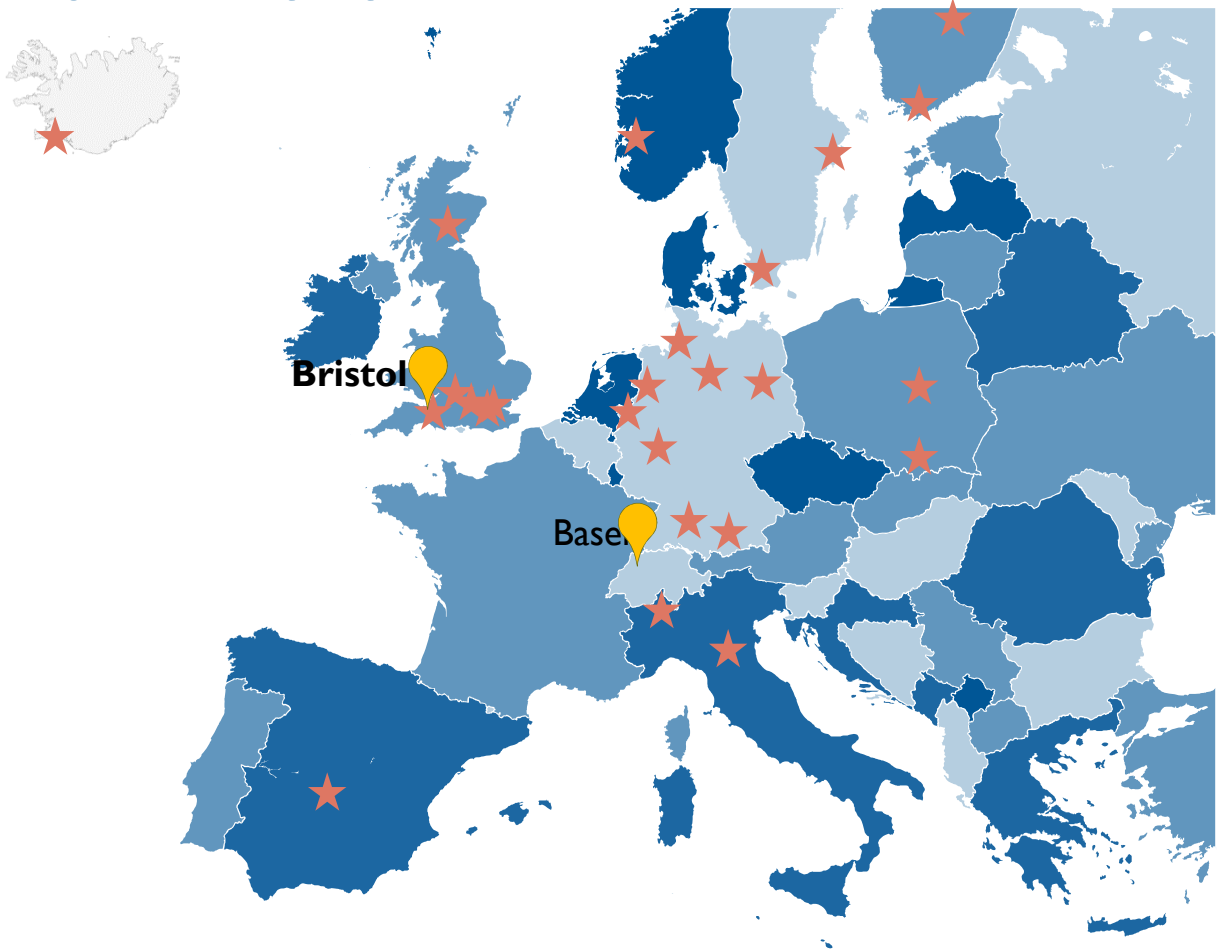
- PGS, Largest Commercial Supercomputer
- “Shaheen II”- KAUST – Saudi Arabia
- Multiphase system - UK Met Office
- “Hornet” – HLRS - Germany
- “Beskow” - KTH/PDC – Sweden
- “Sisu” - CSC – Finland
- “Piz Daint” – CSCS - Switzerland
- “ARCHER” – EPSRC - UK
- “Gottfried” – RRZN/LUIS – Germany
- “Konrad” – ZIB- Germany
- DWD
- “Ventus” & “Anemos” – ECMWF

Top100 – Number of Systems by Geography



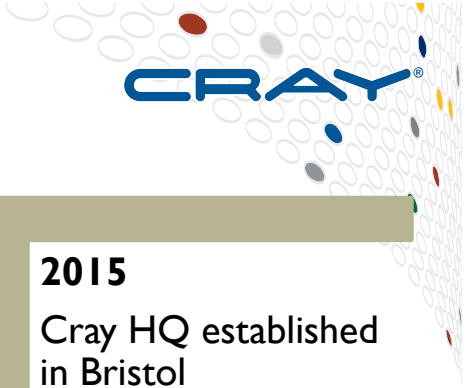
	2007 -Jun	2007 -Nov	2008 -Jun	2008 -Nov	2009 -Jun	2009 -Nov	2010 -Jun	2010 -Nov	2011 -Jun	2011 -Nov	2012 -Jun	2012 -Nov	2013 -Jun	2013 -Nov	2014 -Jun	2014 -Nov	2015 -Jun
Americas	56	57	52	55	51	51	49	45	44	49	44	49	48	47	39	38	35
China	2	1	0	3	2	3	5	6	6	8	7	5	6	7	8	7	7
Japan	10	8	6	6	10	10	9	9	8	7	8	12	10	10	11	10	14
EMEA	26	28	40	34	34	34	33	33	35	29	33	27	26	29	36	38	36
APAC	6	6	2	2	3	2	4	7	7	7	8	7	10	7	6	7	8

Map of Cray Systems and Offices in EMEA



Cray EMEA has offices in
Bristol: EMEA Headquarters
(Sales, Service, R&D, G&A)
Basel: Field Office (Sales, Service)
Dubai: Field Office (Sales, Service)

Recent History Cray in EMEA



2005-2008 :

CSCS's Cray XT3 Piz Palü

Cray wins $85M contract for UK's HECToR

Cray EMEA Staff 37

2009-2011

Cray launches Exascale Research Initiative in Europe

University of Stuttgart/HLRS Places first WW order for a Cray XC Series

2012-2014

Cray acquires Gnodal & Expands R&D in Europe

Fastest System in Europe - Cray XC30 at CSCS "Piz Daint"

Significant wins at KAUST and Met Office

Cray provides 28% of all EMEA Top500 performance

2015

Cray HQ established in Bristol

PGS buys largest commercial supercomputer

MidEast Office opening

Cray EMEA Staff 91

Formation of the Cray EMEA Research Lab

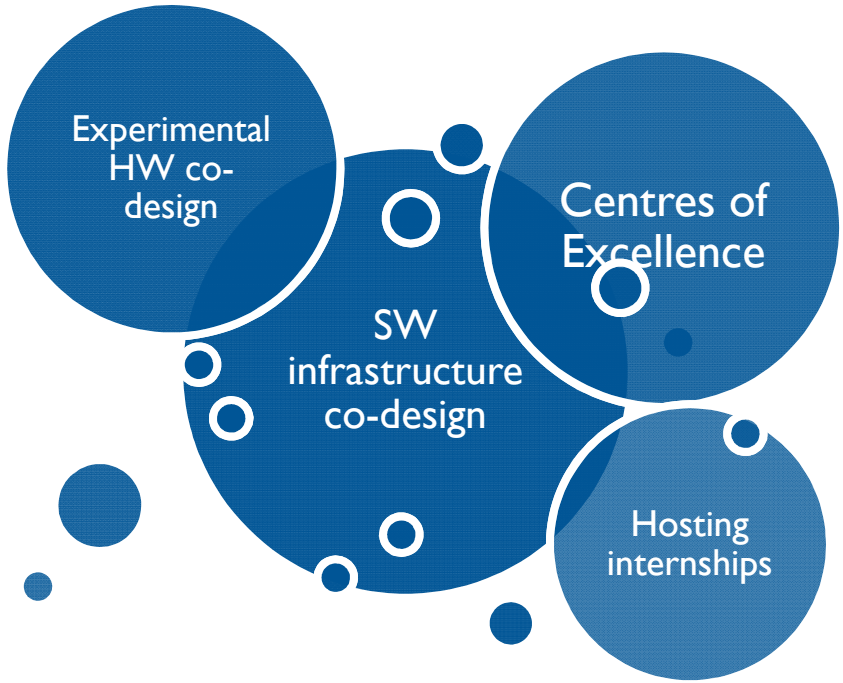
Cray Builds Computational Tools that Help our Customers Solve the World's Most Challenging Problems

A Workflow Approach for a Data-Intensive World | ANALYZE

Cray EMEA Research Lab: Co-Design in EMEA

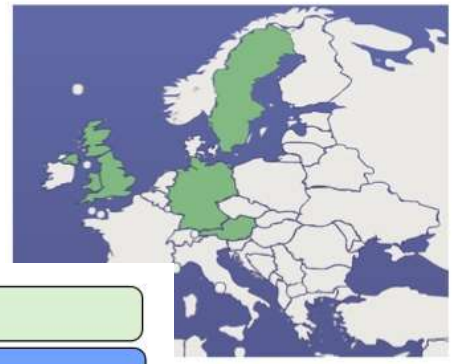
The Cray EMEA Research Lab has been created for deep technical and strategic engagements with customers in EMEA:

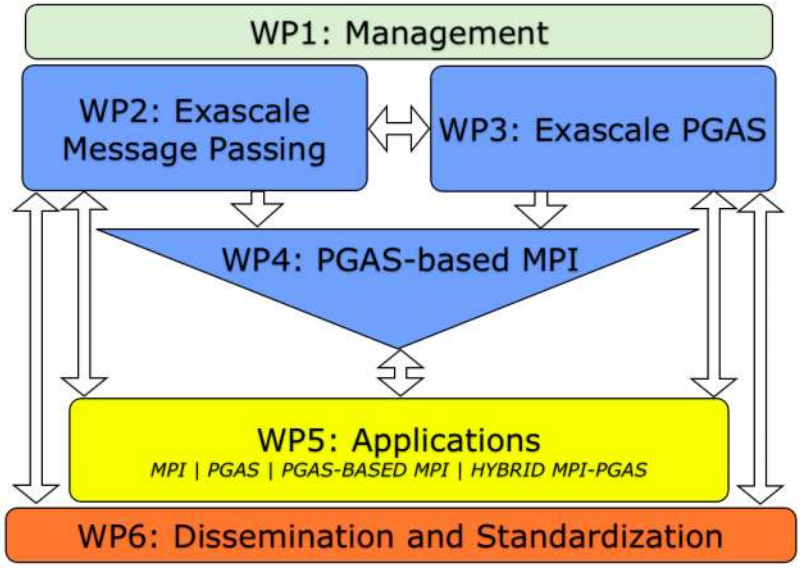
- **Centres of Excellence**
- **Joint research projects**
- **Hosting of internships**



Exascale ProGRAmming Models

- Addressing the main current limitations of programming models for exascale systems (Message Passing and PGAS) and providing prototype implementations for MP and PGAS concepts
- Exascale MPI
- Exascale PGAS
- Programming models for diverse memory spaces
- Exascale PGAS-based MPI
- Exascale-ready application



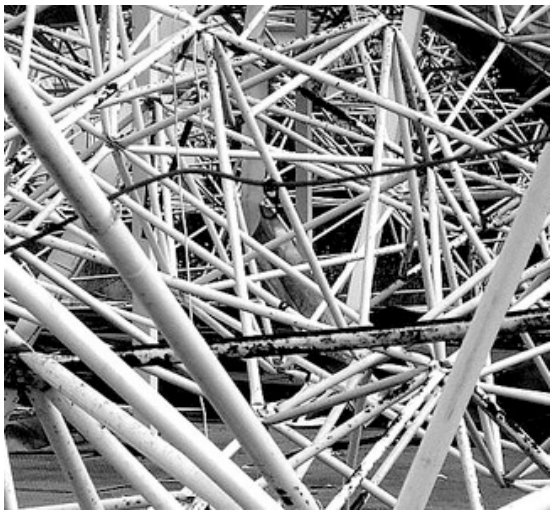


EPiGRAM

http://www.epigram-project.eu

CRAY

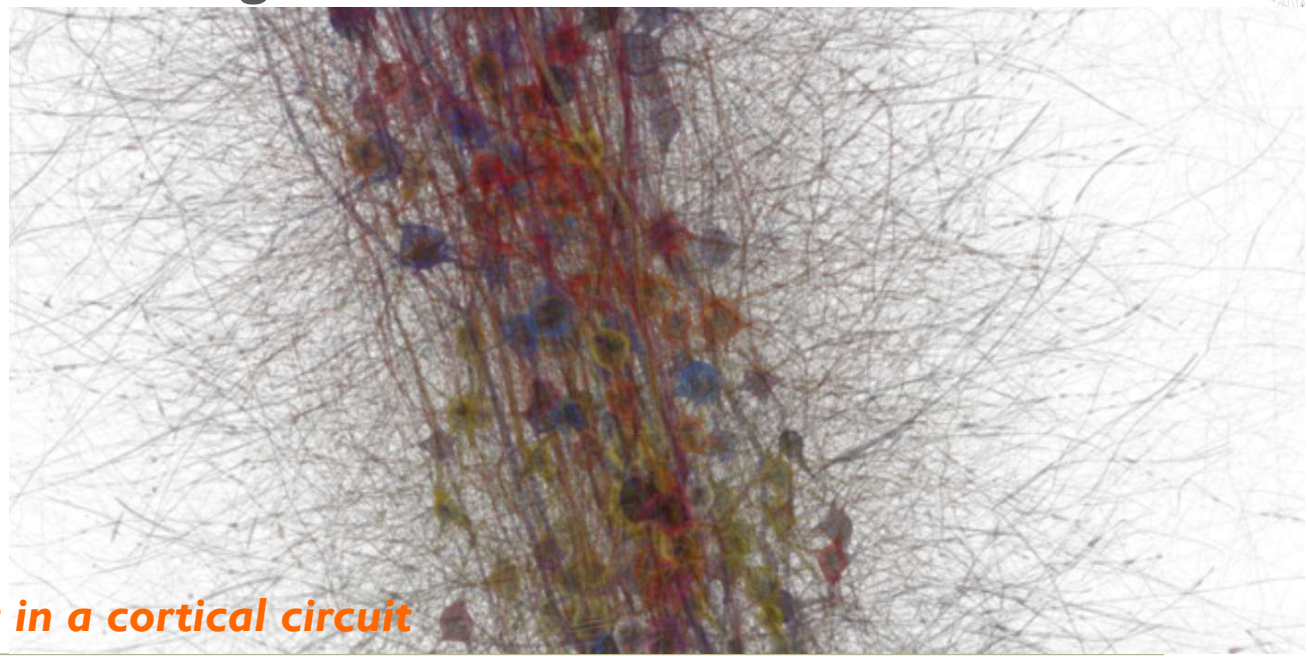
- **EU FP7 Network: Exascale ProGRAmming Models**
- **Consortium has**
  - Leading European HPC centers
    - PDC/KTH, EPCC, CSC-Fi
  - Hardware partner
    - Cray
  - Communication model specialists
    - Fraunhofer, TU-Wien
- **Continues co-design approach**
  - Focussing on MPI and GASPI
  - 2 apps: Nek5000, iPIC3D
- **EPiGRAM builds on the CRESTA work**
  - Three year project, finishing in Sep. 2016



Human Brain Project: Co-design for a new application class

- **Develop a blueprint and prototype of a custom-designed system for neuroscientific grand-challenge simulations**

  - *Different memory/compute ratio than standard HPC*
  - *Support super-massively parallel computation*
  - *System designed for interactive simulation and visualisation*
  - *Workload manager for complex scientific workflows*

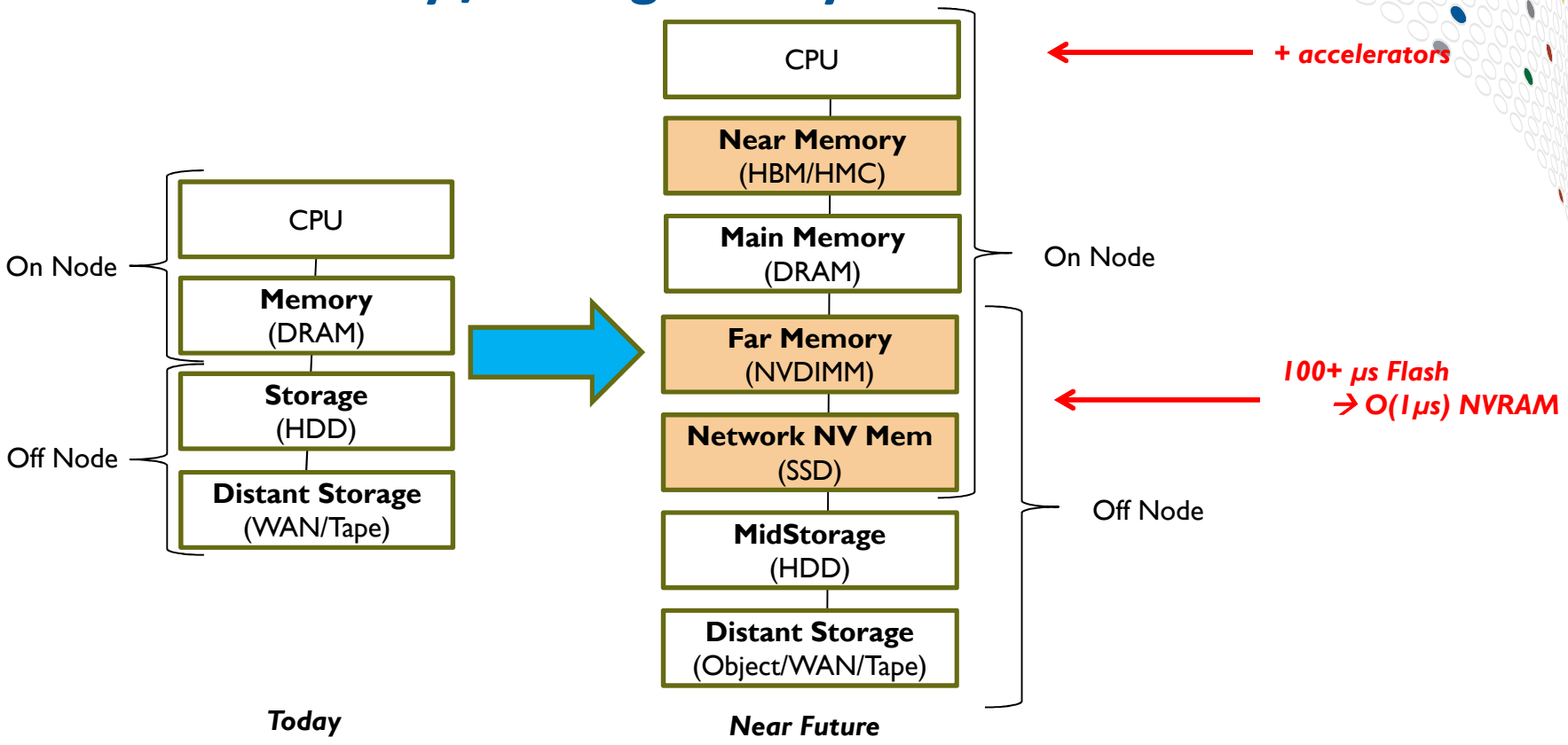


Visualisation of 1000 cells in a cortical circuit

QPACE4 – Co-design for ARM technology exploration

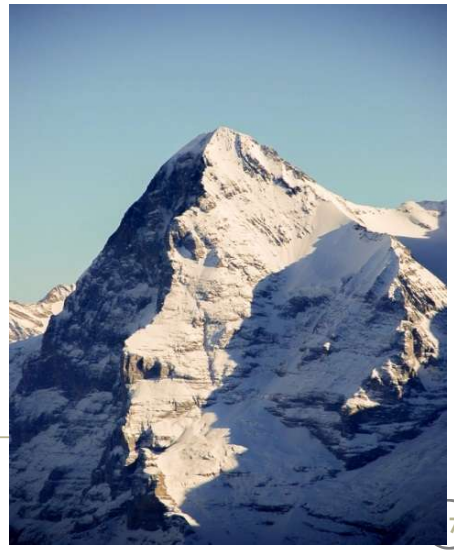
- Cray announced at SC'14 that we will "[…] evaluate alternative processor design points, including the potential use of 64-bit ARM®"
- QPACE is a series of co-design projects of the Universities of Regensburg and Wupppertal for QCD codes
- The Universities and Cray plan to submit a proposal to the German Research Foundation evaluating 64-bit ARM with a prototype Cray SW environment
- CERL will temporarily host students of the Universities for the purpose of the project

Trends in the Memory / Storage Subsystem



Eiger : A new approach for complex memory hierarchies

- **Minimize bytes of data moved in memory hierarchy**
  - What new SW tools, approaches and maths are required?
  - Collaboration between Cray, ETH Zürich, CSCS.
- **SW Tools : Compiler alone can't solve the data problem**
  - Need new SW intelligence that adapts your code to the system architecture
- **Approaches : "Model-Based optimization"**
  - Auto-tuning is effective but not useful
  - We believe "Memory hierarchy can be modeled"
- **Maths : Use Mathematical Optimization**
  - No longer rely solely on expert hand-tuning




Our Vision…
Build a world-class integrated supercomputing environment that enables transformational computing across a broad set of science, engineering and advanced analytics (big data) applications


CRAY®


CRAY®
THE SUPERCOMPUTER COMPANY