

Update from Argonne

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Welcome

- Welcome to downtown Chicago!
- Special welcome to the new members of JLESC
 - Barcelona Supercomputing Center
- We look forward to Jülich and RIKEN joining the Joint Lab in the near future



Argonne is located 25 miles west of here

APS

**Protein facility
Nanoscience**

Chemical engineering

Chemistry

Accelerator physics

**Materials and
energy sciences**

Biology

**High performance
computing & data**



Mathematics and Computer Science Division Strategic Areas

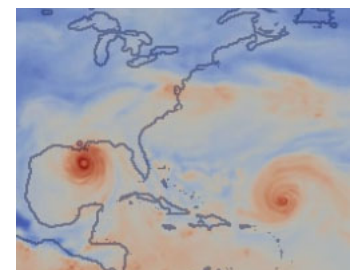
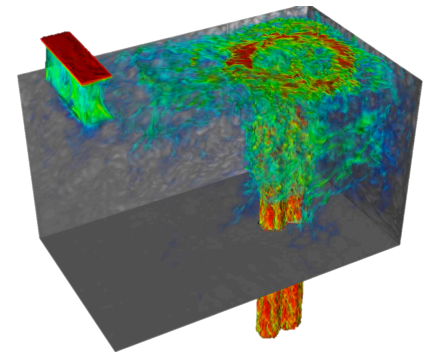
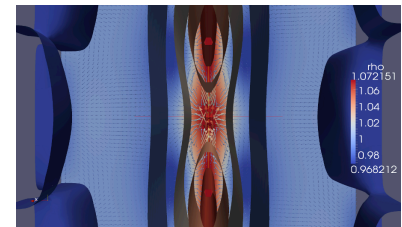
Extreme Computing: exploring new approaches to system software, fault tolerance, and innovative programming models for next-generation computers. (Lead: Pete Beckman)

Big Data: formulating novel techniques for managing, storing, analyzing, and visualizing the enormous amounts of data produced by leadership-class computers and large experimental facilities. (Lead: Rob Ross)

Applied Mathematics: formulating rigorous theory leading to fast algorithms, deployed in software on leading-edge computing platforms. (Lead: Paul Hovland)

Applications: working with scientists and engineers to apply our advanced algorithms and tools to applications critical to our society, such as life science, climate change, materials, and energy systems simulations (Lead: Ray Bair)

In addition to papers, we develop and release a lot of software.



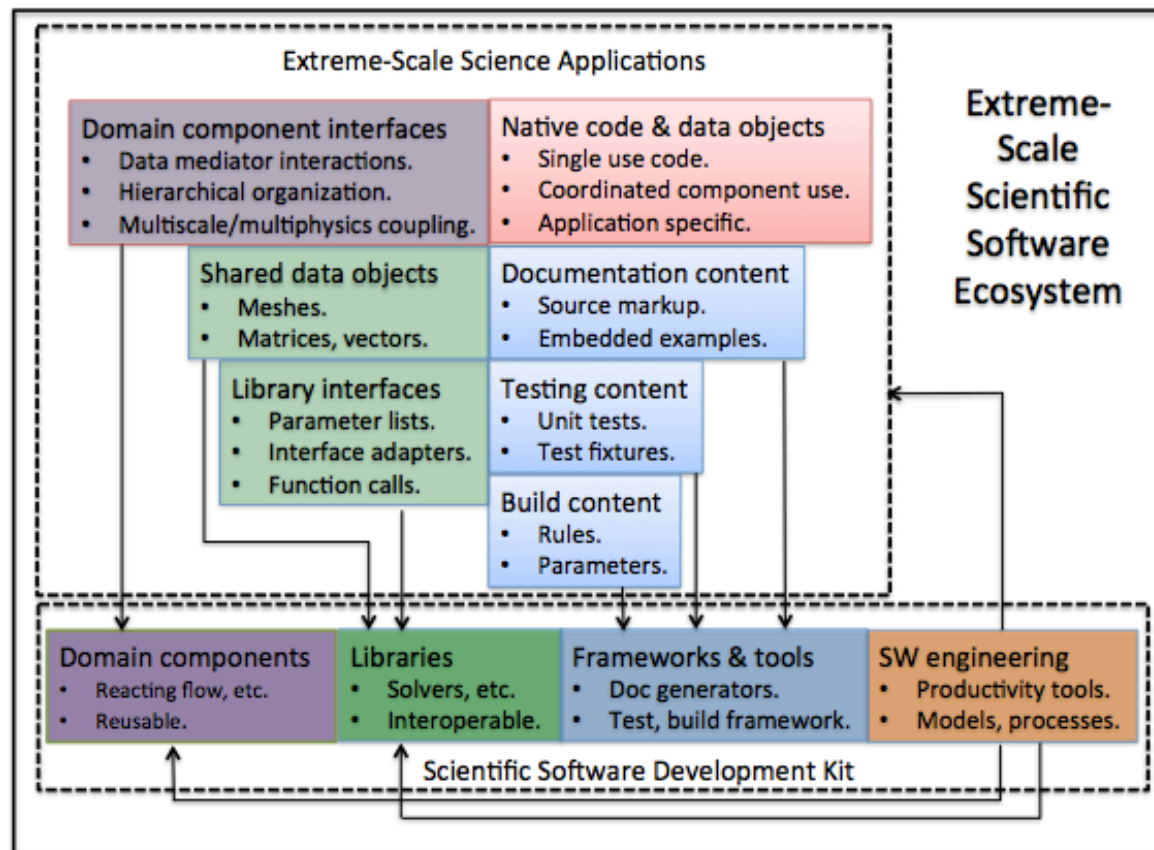


Some New (Recently Funded) Projects



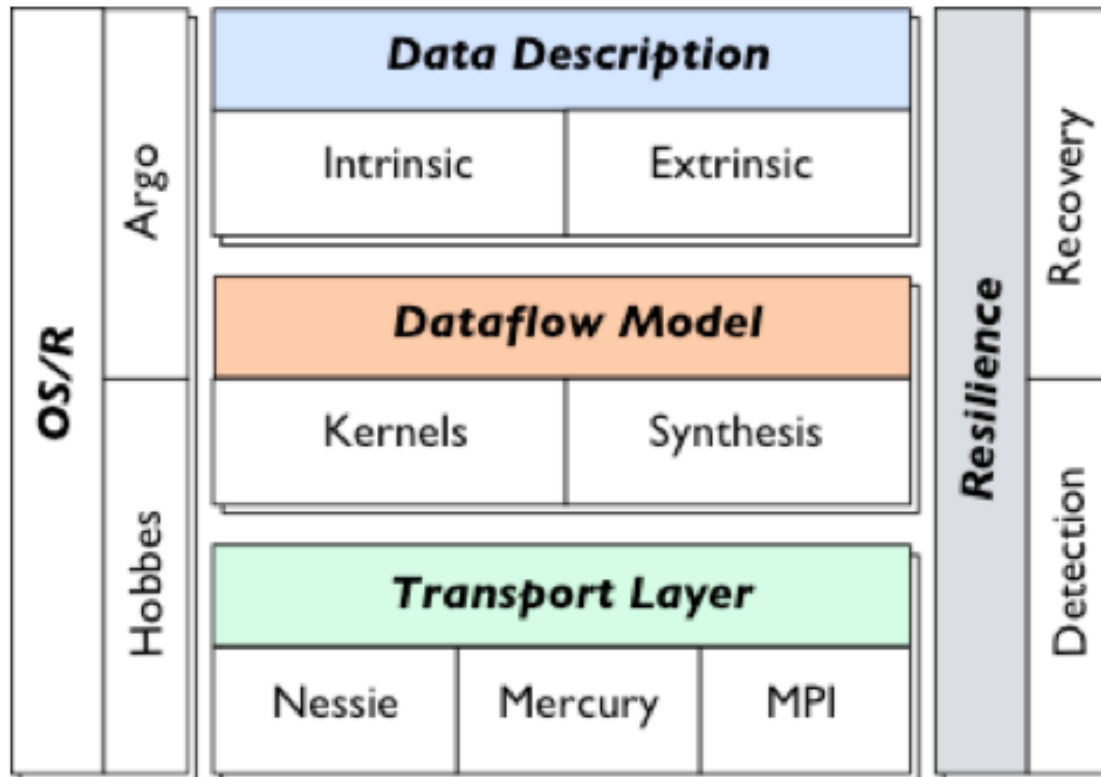
IDEAS - Interoperable Design of Extreme-Scale Application Software

- Leads: Lois Curfman McInnes (Argonne) and Mike Heroux (Sandia)
- Collaborators: LANL, LBNL, LLNL, ORNL, PNNL, Colorado School of Mines



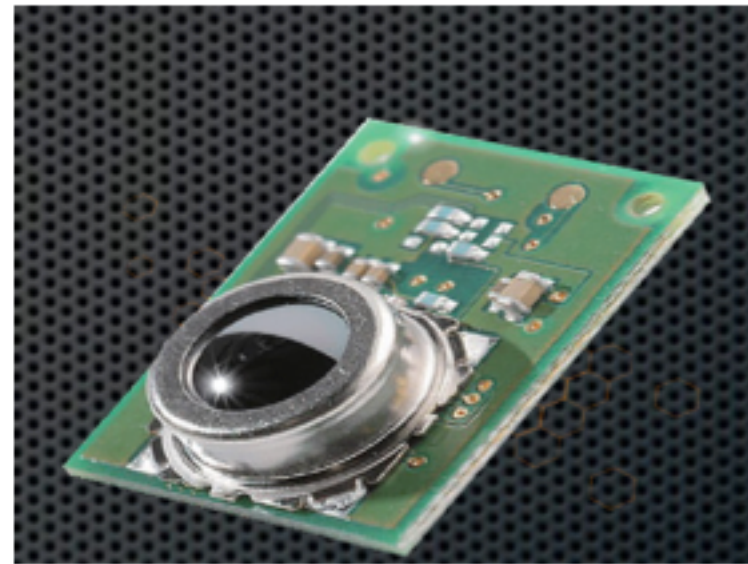
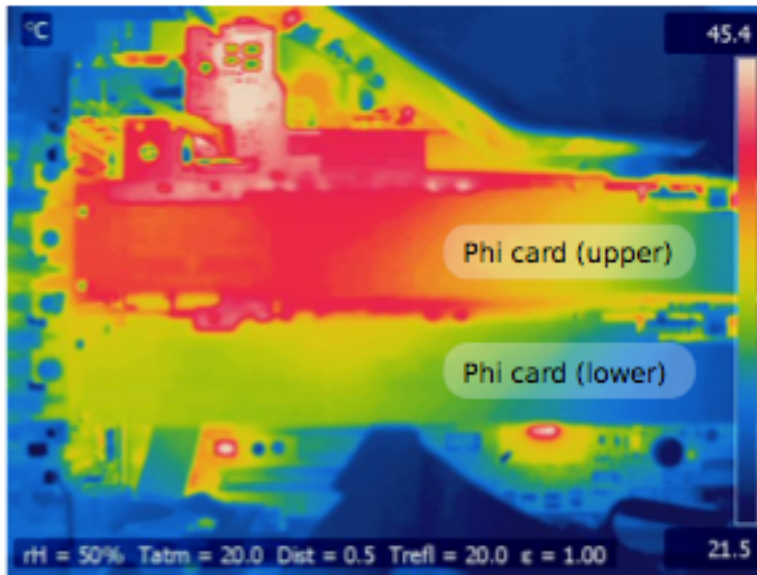
Decaf: High-Performance Decoupling of Tightly Coupled Flows

- Lead: Tom Peterka (Argonne)
- Collaborators: Franck Cappello (Argonne), Jay Lofstead (Sandia)
- See Tom's talk this afternoon



COOLr: A New System for Dynamic Thermal-Aware Computing

- Leads: Pete Beckman, Kazutomo Yoshii (Argonne)
- Collaborators: Seda Ogrenci-Memik, Gokhan Memik (Northwestern)
- Power and thermal modeling of high-performance computing architectures
- Investigation of novel thermal instrumentation techniques
- Development of a thermal-aware OS and runtime system



RAMSES: Robust Analytical Models for Science at Extreme Scales

- Argonne Participants: Ian Foster (lead), Venkat Vishwanath, Sven Leyffer, Todd Munson, Yao Zhang, Vitali Morozov
- Other Collaborators: Gagan Agarwal (Ohio State), Nagi Rao (ORNL), Brian Tierney (LBNL), Don Towsley (UMass)
- End-to-end analytical performance modeling to understand the behavior of science workflows in extreme-scale science environments
- Tools that will allow users to optimize performance metrics for the Globus Online file transfer service
- See Ian's talk on Wednesday



ProVESA: Program Verification for Extreme-Scale Applications

- Argonne Participants: Paul Hovland (lead), Krishna Narayanan, Stefan Wild
- Collaborators: Steve Siegel (U Delaware), Markus Schordan and Dan Quinlan (LLNL)
- Development of new software verification technologies focused on the numerical and mathematical aspects of scientific software
- Verify correctness by using static analysis techniques based on formal verification, supplemented with dynamic analysis informed by numerical noise estimates
- Facilitate the migration of scientific software from bulk-synchronous execution on homogeneous architectures to nondeterministic, asynchronous execution on complex, hierarchical, and heterogeneous architectures





Scalable Analysis Methods and *In Situ* Infrastructure for Extreme Scale Knowledge Discovery

- Argonne Participants: Venkat Vishwanath, Nicola Ferrier
- Collaborators: LBNL, Kitware Inc., Intelligent Light Inc., Georgia Tech.
- Scaling GLEAN, ADIOS, LibSim, and Catalyst in situ infrastructures to current and upcoming supercomputing systems
- Develop “*write-once run-anywhere*” abstractions to enable analysis to run portably on the four in situ infrastructures
- Algorithmic R&D for in-situ analysis working directly with diverse extreme scale application science communities



Chameleon: An Experimental Instrument for Computer Science

- Lead: Kate Keahey
- Collaborators: Northwestern, Ohio State, UTSA, TACC
- Funded by NSF at Univ of Chicago
- Experimental testbed for cloud computing research
 - Targeting Big Data, Big Compute, Big Instrument research
 - ~14,500 cores, 5 PB disk, 2 sites (CI and TACC) connected with 100G
 - Also heterogeneous hardware including IB, FPGAs, GPUs, Xeon Phi plus ARM and Atom microservers
- Reconfigurable
 - Bare metal reconfiguration, operated as single instrument over two sites
 - Graduated approach: OpenStack and potentially other cloud software also available for ease of use
- Planned interoperability with GENI, Grid'5000, and other testbeds
- See Kate's talk this afternoon





See MCS web site for many other projects

- Many other projects in MCS have been covered in previous workshops
- See <http://www.mcs.anl.gov/research> for further information



Some Visitors/Students/Postdocs currently at MCS (1)

- Guillaume Aupy (ENS Lyon) – working with Franck Cappello
 - *Speaking tomorrow morning*
- Hadrien Croubois (ENS Lyon) – working with Franck Cappello
- Lokman Rahmani (INRIA Rennes) – working with Tom Peterka/Rob Ross
 - *Speaking this afternoon*
- Sheng Di (postdoc Grenoble) – postdoc at Argonne working with Franck Cappello
 - *Speaking tomorrow afternoon*
- Leo Bautista Gomez (Ph.D. Tokyo Tech) – postdoc at Argonne working with Franck Cappello
 - *Speaking tomorrow morning*
- Swann Perarnau (Ph.D. Grenoble, postdoc RIKEN) – postdoc at Argonne working with Kamil Iskra/Rajeev Thakur



Some Visitors/Students/Postdocs currently at MCS (2)

- Min Si (U of Tokyo) – working with Pavan Balaji
 - **Speaking tomorrow afternoon**
- Xin Zhao (UIUC) – working with Pavan Balaji
 - Presented at the last workshop in Sophia Antipolis
- Florin Isaila (Faculty at Universidad Carlos III de Madrid) – working with Rob Ross (on a two-year Marie Curie Fellowship)
 - **Speaking this afternoon**
- Antonio Peña (Ph.D., Jaume I University, Spain) – postdoc at Argonne working with Pavan Balaji
 - **Speaking tomorrow morning**
- **We look forward to hosting visitors from our new partners: BSC, JSC, and RIKEN**



Next-Generation CORAL System

- Argonne is currently engaged in the negotiation process on a next-generation supercomputing contract as part of DOE's CORAL collaboration (Collaboration of Oak Ridge, Argonne and Lawrence Livermore national laboratories).
- An announcement by Argonne is planned soon.
- Oak Ridge and Livermore announced their plans just before SC14. See this article in *Nature*:
<http://www.nature.com/news/joint-effort-nabs-next-wave-of-us-supercomputers-1.16347>

