Open MPI for Exascale (OMPI-X)
part of the DOE Exascale Computing Project
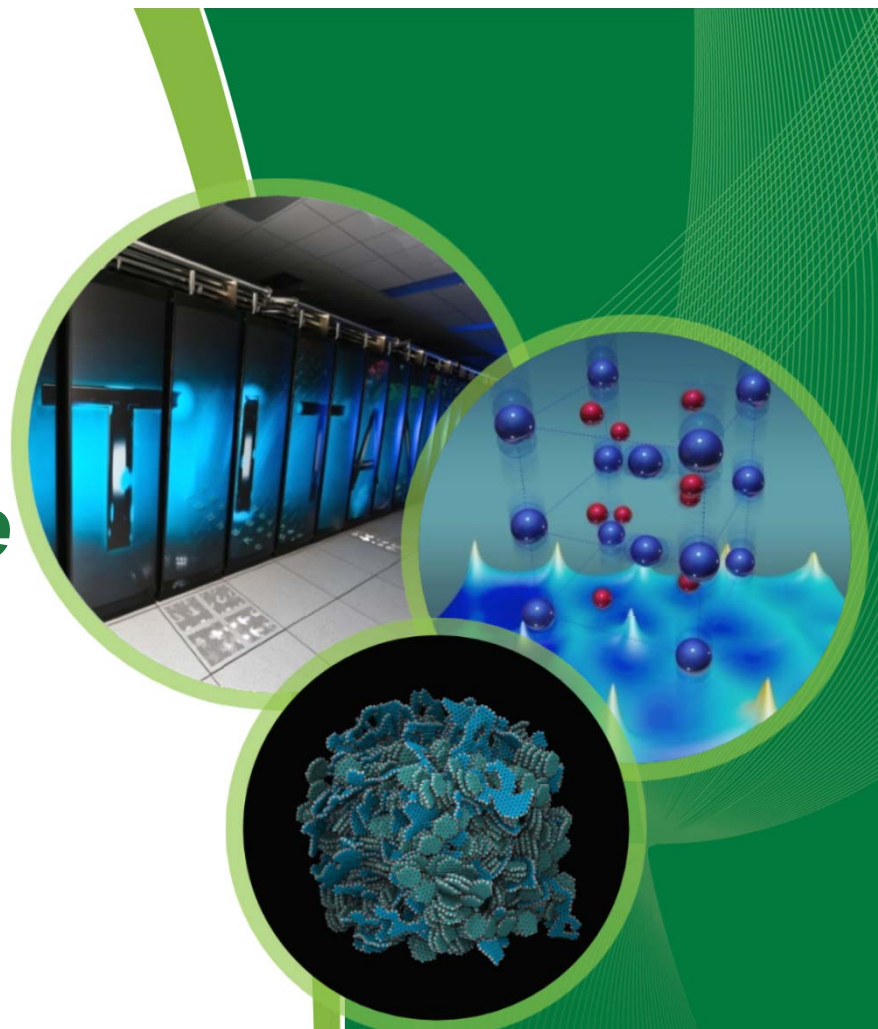
David E. Bernholdt, ORNL
for the team

ECP: Exascale Computing Project

- From https://exascaleproject.org...
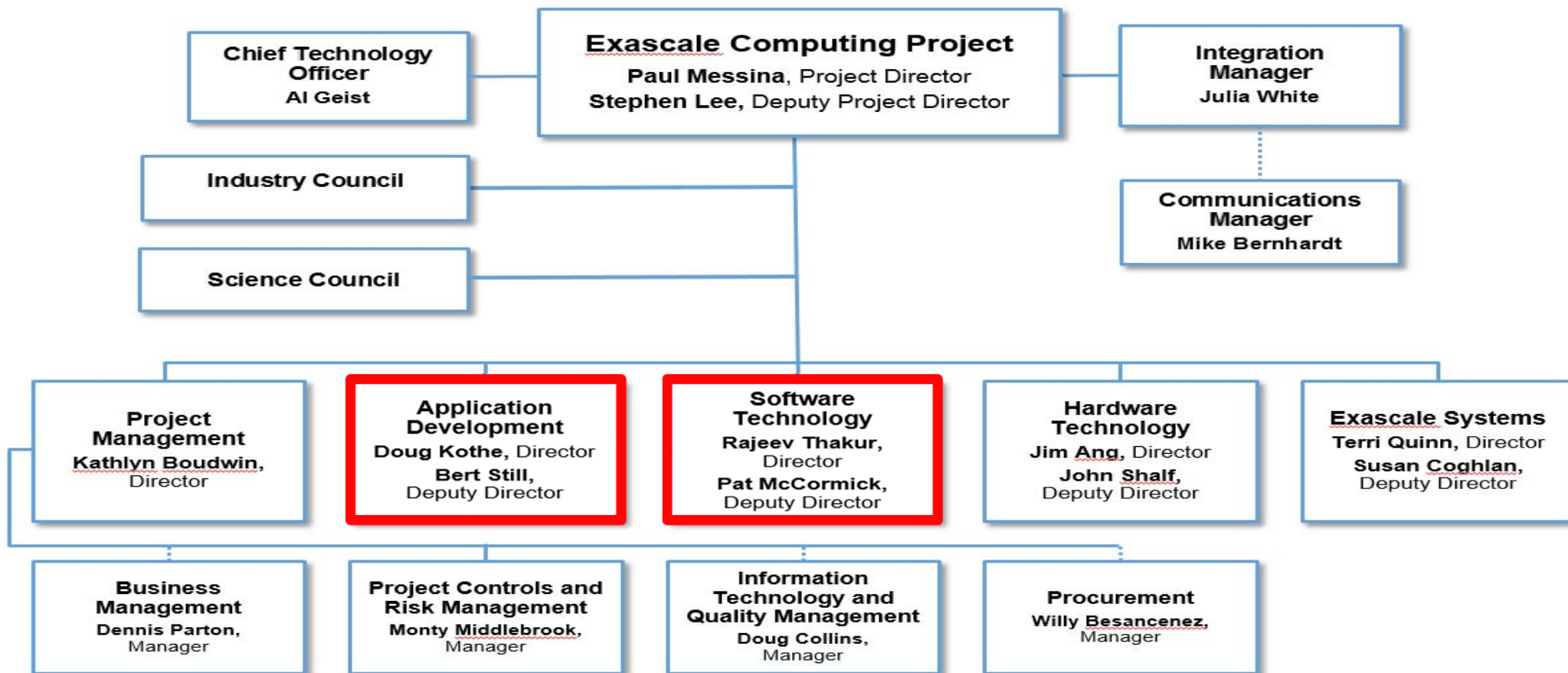
  ECP is chartered with <u>accelerating delivery</u> of a <u>capable exascale</u> computing ecosystem to provide breakthrough modeling and simulation solutions to address the most critical challenges in scientific discovery, energy assurance, economic competitiveness, and national security.

  This role goes far beyond the limited scope of a physical computing system. ECP's work encompasses the development of an <u>entire exascale ecosystem</u>: applications, system software, hardware technologies and architectures, along with critical workforce development.

- Funded by DOE Office of Science and NNSA

- Deliver "capable" exascale system by 2023
  - Capable: 50x performance for apps, 20-30 MW, MTTAI ~1 week, general software stack

- Initial advanced architecture exascale system by 2021

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ECP Organization

ECP Extended Project Leadership Team

Exascale Computing Project
Paul Messina, Project Director
Stephen Lee, Deputy Project Director

Chief Technology Officer
Al Geist

Integration Manager
Julia White

Industry Council

Communications Manager
Mike Bernhardt

Science Council

Project Management
Kathlyn Boudwin, Director

Application Development
Doug Kothe, Director
Bert Still, Deputy Director

Software Technology
Rajeev Thakur, Director
Pat McCormick, Deputy Director

Hardware Technology
Jim Ang, Director
John Shalf, Deputy Director

Exascale Systems
Terri Quinn, Director
Susan Coghlan, Deputy Director

Business Management
Dennis Parton, Manager

Project Controls and Risk Management
Monty Middlebrook, Manager

Information Technology and Quality Management
Doug Collins, Manager

Procurement
Willy Besancenez, Manager

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AD and ST Breakdowns and Project Counts

Application Development

- 15+3 applications

- 7+0 "seed" applications

- 4+0? co-design centers

- *Initially funded for 4 years*

Note: project counts are shown as "*e*+*a*" where *e* are the Office of Science funded projects and *a* are the NNSA ATDM projects.

Software Technology

- 35+31 projects in total

  - Programming models and runtimes (10+2)

  - Tools (5+7)

  - Mathematical and Scientific Libraries (8+7)

  - Data Management and Workflows (7+4)

  - Data Analytics and Visualization (2+2)

  - System Software (3+7)

  - Resilience and Integrity (0+1)

  - Co-design and Integration (0+1)

- *Initially funded for 3 years*

Open MPI Developer's Meeting

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OMPI-X Team

OAK RIDGE National Laboratory · Los Alamos NATIONAL LABORATORY · Lawrence Livermore National Laboratory · Sandia National Laboratories · THE UNIVERSITY OF TENNESSEE KNOXVILLE

- **ORNL**
  - <u>**David Bernholdt**</u> (Lead PI)
  - Manju Gorentla Venkata
  - Terry R. Jones
  - Thomas J. Naughton III
  - Geoffroy R. Vallee

- **LANL**
  - Nathan Graham
  - Evan Harvey
  - <u>Nathan Hjelm</u>
  - <u>**Howard Pritchard**</u>

- **LLNL**
  - <u>Chris Chambreau</u>
  - Murali Emani
  - **Martin Schulz**

- **SNL**
  - **Ron Brightwell**
  - Ryan Grant

- **UTK**
  - <u>**George Bosilca**</u>
  - Aurelian Bouteiller

Officially started Oct 2016
Funds arrived ~mid-January 2017

Key:
Institutional PI
<u>Attending this meeting</u>

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OMPI-X Focus Areas

- **Runtime Interoperability for MPI+X and Beyond** [Vallee]
  - APIs for better sharing of threads between MPI and other thread-based runtimes
  - Intend collaboration with ExaMPI [MPICH] and SOLLVE [OpenMP]

- **Extending the MPI Standard to Better Support Exascale Architectures** [Grant]
  - Endpoints, Finepoints, Sessions

- **Open MPI Scalability and Performance** [Gorentla]
  - Memory footprint, collectives, message matching, one-sided, PMIx

- **Supporting More Dynamic Execution Environments** [Jones]
  - Intelligent process placement and contention management

- **Resilience in MPI and Open MPI** [Bosilca]
  - ULFM, ReInit, resilience in PMIx

- **MPI Tool Interfaces** [Schulz]
  - MPI_T, PMPI replacement

- **Quality Assurance for Open MPI and New Developments** [Pritchard]
  - Test infrastructure deployed to ECP-relevant systems
  - Regular testing of Open MPI and OMPI-X developments