

# ADVANCED TECHNOLOGY LAB

San Diego Supercomputer Center



*“As the demands of computational science increase along with the ever-accelerating pace of technological change, it is more important than ever to partner with technology providers to plan out the future of our supercomputing infrastructure.”*

– Frank Würthwein, Director, San Diego Supercomputer Center

SDSC’s Advanced Technology Lab (ATL) is embarking on a multi-year program to define and validate the core technologies that will enable the next generation of computational science for NSF and UC San Diego researchers. The ATL, established in 2016, is a division of SDSC, a leader in High Performance Computing for over 35 years.

## OVERVIEW

The mission of SDSC’s Advanced Technology Lab is to identify and evaluate new hardware and software technologies for future

computing and storage systems that will be needed to conduct scientific research at scale. The lab develops research, development and evaluation programs looking at needs over a 3-5 year time horizon. The ATL is funded by industrial sponsors as well as by contracts and grants from Federal and other sponsoring agencies.



The San Diego Supercomputer Center

# RESEARCH CONTEXT

The computational and storage infrastructure (collectively, “cyberinfrastructure”) supporting scientific research is evolving rapidly and ranges from large-scale supercomputer and interconnected cloud computing centers to intermediate facilities to edge devices including sensor networks and scientific instruments. The increasing use of artificial intelligence methods coupled with conventional modeling and simulation presents new technology challenges. R&D projects to address these challenges range from hardware based “data accelerators” (DPUs, smart NICs, computational storage, etc.), to “data preparation for AI,” to software and algorithms that reduce time-to-solution while improving ease of use of end-to-end systems. Cybersecurity is an ancillary topic of increasing concern.



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# RESEARCH PROGRAM

To address these challenges, the ATL is beginning a program to identify, prototype, test, evaluate, and further develop the technologies that will form the future cyberinfrastructure complex at SDSC. It is expected that many of these technologies will be proposed and potentially deployed in future CI systems funded by the National Science Foundation (as well as technology upgrades to existing systems). Our goal is to partner with innovators in industry, academia, and government to address these challenges.



Representative Technology Roadmap

The program will be guided by a technology roadmap based on emerging requirements such as new sensors, instruments, experiments, and methods. The technology roadmap will inform the selection of technologies to be deployed and evaluated during each year of the program. Semiannual reviews will be held to assess the state of the program and make course corrections as necessary. The ATL will publish scholarly

papers, white papers, reports, media articles and other documents on an ongoing basis.

A hallmark of the program is a complex of architectures that facilitates the transition of innovation into practice for both competing and complementary technologies. Our process is unique in that this translation occurs by integrating innovations into facilities we operate for hundreds of educational and research institutions. Use of open source software facilitates community adoption, innovation, and transparency. This diverse community provides for a broad spectrum of evaluators, and a path for rapid community adoption of new technologies.



SDSC's Expanse Supercomputer

## STAFF, FACILITIES, RESOURCES

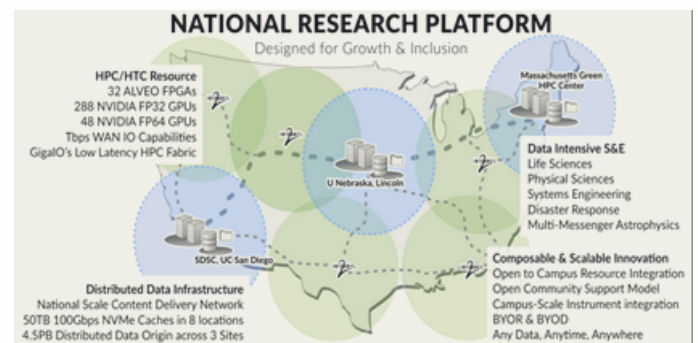
The lab is staffed by a cadre of distinguished and experienced researchers in computational science and other disciplines. We have established a core leadership team to provide a steady hand in guiding the activities of the lab (see team list at back).

The ATL has multiple facilities available for conducting its activities at scale. Key facilities include:

**Expanse Supercomputer** – Expanse is SDSC's flagship computing resource, deployed in 2020. Expanse is a general-purpose supercomputing platform serving a wide range of workloads. Expanse also provides novel features such as cloud bursting, composable systems, and portal-based access.

**Voyager Supercomputer** – The Voyager supercomputer, entering production operations in 2022, is a novel “AI-centric” supercomputing platform. Using a new family of training and inferencing processors, Voyager provides a unique, high performance platform for experimenting with AI workloads in science.

**National Research Platform (NRP)** – The NRP is an open, national, distributed high performance computing and storage infrastructure integrating state-of-the-art processors with a national content delivery network and Terabit/sec networking. The NRP provides a unique, at-scale testbed for distributed AI and machine learning.



NRP Architecture



# BENEFITS FOR SPONSORS

The ATL relies on funding from industry as well as grants and contracts to support its work. Sponsorship of the lab confers multiple potential benefits, including:

- Gaining unique insights into the process of translating innovation into practice that is the core competency of the San Diego Supercomputer Center. This includes:
  - Science drivers for AI, Data, HPC, I/O technologies, edge and IoT, products, and services.
  - Software and systems integration & platform approaches for distributed AI cyberinfrastructure.
- Engagement with leading faculty and researchers at the forefront of research in AI, computational science, and cyberinfrastructure.
- Engagement with postdoctoral scholars and students for internship and recruiting opportunities.
- Exposure to B2B partnering amongst participating companies.
  - We encounter a steady stream of software and hardware start-ups whose innovations we transition to practice.

# SPONSORSHIP AND FUNDING

We are actively seeking new partners and sponsors for ATL, so whether you're a startup or a Fortune 500 company developing innovative technology, we welcome the opportunity to talk with you about joining us in this exciting venture

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# ATL CORE LEADERSHIP TEAM



**Ilkay Altintas, Ph.D.**

Chief Data Science  
Officer, SDSC

Dr. İlkey Altıntaş, a research scientist at the University of California, San Diego, is the Chief Data Science Officer of the San Diego Supercomputer Center and a Founding Fellow of the Halicioğlu Data Science Institute. She is also the Division Director for Cyberinfrastructure and Convergence Research and Education, as well as Founding Director of the WIFIRE wildfire science program at SDSC.



**Thomas DeFanti, Ph.D.**

Research Scientist, QI

Thomas A. DeFanti, PhD, is a research scientist at the Qualcomm Institute, part of the California Institute for Telecommunications and Information Technology, University of California, San Diego, and a distinguished professor emeritus of Computer Science at the University of Illinois at Chicago. He is recipient of the 1988 ACM Outstanding Contribution Award and was appointed an ACM Fellow in 1994. He shares recognition along with Dan Sandin for conceiving the CAVE virtual reality theater in 1991.



**Javier Duarte, Ph.D.**

Assistant Professor of  
Physics, UC San Diego

Javier Duarte is an Assistant Professor of Physics at the University of California San Diego and a member of the CMS Collaboration at the CERN Large Hadron Collider (LHC). Javier is engaged in a variety of AI projects across NSF and DOE. Before joining UCSD, he was a Lederman postdoctoral fellow at Fermilab. He received his Ph.D. in Physics at Caltech and his B.S. in Physics and Mathematics at MIT.



**Ron Hawkins**

Director of Industry  
Partnerships, SDSC

Ron Hawkins is the director of industry partnerships at the University of California's San Diego Supercomputer Center, where he is responsible for developing industry partnerships and research collaborations in high performance computing and big data. Mr. Hawkins is a technology industry veteran, having held VP-level and general management, engineering, and product development positions.



**Arun Kumar, Ph.D.**

Associate Professor,  
Computer Science &  
Engineering and HDSI

Arun Kumar is an Associate Professor in Computer Science and Engineering and the Halicioglu Data Science Institute and an HDSI Faculty Fellow at University of California, San Diego. His primary research interests are in data management and systems for machine learning/artificial intelligence-based data analytics.



**Mahidhar Tatineni, Ph.D.**

Director, User Services,  
SDSC

Mahidhar Tatineni received his M.S. & Ph.D. in Aerospace Engineering from UCLA. He currently leads the User Services group at the University of California's San Diego Supercomputer Center. He has led the support of high-performance computing and data applications software on several NSF and UC resources including Expanse, Comet, and Gordon at SDSC. He has worked on many NSF funded research projects and is co-PI on the Expanse HPC system and the National Research Platform projects at SDSC.



**Frank Würthwein, Ph.D.**

Director, SDSC  
Professor, HDSI and  
Physics, UC San Diego

Frank Würthwein is Director of the San Diego Supercomputer Center at the University of California, San Diego. He is an expert on globally distributed data and computing systems, a professor of physics, and a founding faculty of the Halicioglu Data Science Institute at UC San Diego. Frank received his Ph.D. from Cornell in 1995.