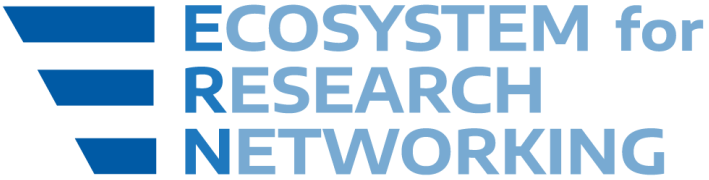

WORKSHOP REPORT

ERN Summit

April 11-12, 2024

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ABSTRACT

This document reports on the Ecosystem for Research Networking Summit that took place April 11-12, 2024 at the Pittsburgh Supercomputing Center in Pittsburgh, Pennsylvania.

1. EXECUTIVE SUMMARY

The Ecosystem for Research Networking (ERN), formerly the Eastern Regional Network) was formed to simplify multi-campus collaborations and partnerships, in order to advance the frontiers of research, pedagogy, and innovation. The ERN is first and foremost a network of people interested in pursuing this goal, and who use and manage the campus and regional research computing and instruments, data, storage and network resources that can make it happen. A major goal of the ERN is to enable partnerships and collaborations that support the democratization of science, research instruments, technical expertise, infrastructure, and services, aimed at lowering the barriers to participation for scientists engaged in research that cross institutional and disciplinary boundaries.

The vision and mission of the ERN reflect the reality that multi-institutional collaborations are on the rise, but the data sets that support them are getting too large to transfer easily, the computing resources that they require often exceed the capacity of a single institution, and the expertise needed to support compute

intensive research is scarce. To address these challenges, the ERN leverages the special relationship between researchers and the people who build and support research cyberinfrastructure in the region that it serves.

In April 2024, the ERN organized the ERN Summit 2024. The Summit focused on understanding the cyberinfrastructure and resource needs at small and/or under-resourced institutions. Advancing the frontiers of research and education through enhanced collaboration, strategic initiatives, and a federated approach to resource sharing, supporting the vision for simplifying multi-campus collaborations to propel innovation and research across diverse scientific domains.

The Summit provided an opportunity for the community to come together to discuss challenges and opportunities in their respective institutions, and highlighted research collaborations, funding opportunities, resource accessibility and innovative workforce development programs. The Summit also featured innovative use of technology to broaden the reach and impact of research tools and resources, emphasizing collaborative efforts, accessibility, and the advancement of research capabilities through state-of-the-art platforms and initiatives.

The overall findings of the Summit highlight the multifaceted challenges and opportunities encountered by both research universities and smaller institutions in providing effective research support and leveraging advanced computing technologies. Despite differences in scale and resources, common themes such as resource management and access, expertise availability, and clear policies emerge. The report underscores the importance of collaboration, capacity building, and strategic initiatives to address these challenges and seize opportunities for improvement.

The ERN Summit highlighted critical needs and recommendations for enhancing education and workforce development, particularly in STEM fields. Key needs include broadening participation in STEM, supporting continuous learning, modernizing educational infrastructure, and fostering interdisciplinary education to keep pace with rapid technological advancements. Recommendations emphasized the importance of structural reforms in higher education, promoting lifelong learning, and strengthening partnerships between academia, industry, and government. Specific actions suggested include advocating for supportive policies, increasing funding for STEM education in underserved communities, democratizing access to research instruments, and developing programs that update skills throughout professional careers. These strategies aim to prepare a diverse and innovative workforce capable of sustaining the U.S.'s competitive edge in the global economy.

Overall recommendations resulting from the summit include access to resources and programs, exploring international models, fostering collaboration through funding incentives, and developing clear policies and agreements. By implementing these strategies, stakeholders can promote research excellence, drive interdisciplinary collaboration, and advance knowledge and innovation within higher education institutions.

2. CONTEXT AND OBJECTIVES

The Ecosystem for Research Networking (ERN) Summit provided the scientific and cyberinfrastructure research community an opportunity to come together and discuss ERN mission and accomplishments, hear from domain researchers and CI professionals at smaller institutions about the successes and challenges related to leveraging local, regional, and national resources for projects, and learn about funding resources and partnership opportunities, as well as regional and national communities. The Summit provided opportunities for open discussion and conversations on focused topics and policies as they pertain to areas of community interest including AI, quantum, Big Data, cybersecurity and protecting data, research instruments, workforce development, applications for ERN, education, and training. Goals of the Summit included:

- **Learning and Collaboration:** Encouraging participants to learn from each other's experiences and expertise. Learn about challenges and opportunities as well as existing solutions, programs and communities.
- **Democratizing Access:** Focusing on making research instruments more accessible across various institutions.
- **Updates on Workgroups:** Sharing progress and developments from various ERN Working Groups.
- **Discussing Future Initiatives:** Planning for future projects, workshops, and collaborations that could benefit from a federated approach to resource sharing.
- **Workforce Development:** Tackling the strategies for developing skilled professionals in emerging technologies.
- **Role of Funding Agencies:** Understanding how funding agencies can support the infrastructure and research goals of the community.

The Summit involved diverse stakeholders, including domain researchers, research computing professionals, network and system administrators, campus Deans, CIOs and other administrators, and regional network leaders. The Summit attracted 60 participants from more than 45 distinct organizations. Most attendees were from academic institutions, including 10 R1's and 23 non-R1's (includes small liberal arts schools, HBCU, MSI, TCU). Other organization types included six consortiums, The National Science Foundation (NSF), three industry participants, and two regional/national networking organizations. A complete list of registrant affiliations and job titles is provided in the Appendix to this report.

3. EDUCATION

One of the major components of the ERN's mission is education. This section highlights the topics related to education and workforce development that were discussed during the workshop.

The needs and recommendations regarding education and workforce development, as highlighted by Dr. James R. Martin's presentation at the ERN Summit and other discussions throughout the summit, focus on several strategic areas to ensure the U.S. remains competitive in the global landscape and effectively addresses both current and future challenges. Here's a summary of the key points:

Needs in Education and Workforce Development:

1. **Broadening STEM Participation:** There is a critical need to increase engagement in STEM fields across diverse populations to close gaps in education and workforce representation. This includes enhancing access to STEM education for underrepresented groups and regions to cultivate a broader base of talent.

2. **Integrating Continuous Learning:** As industries evolve with advancements in technology, there is a need for educational systems to support lifelong learning and continuous professional development. This approach ensures that the workforce can adapt to new technologies and methodologies.

3. **Enhancing Educational Infrastructure:** Modernizing educational facilities and resources to support advanced learning and research is crucial. This includes investing in high-performance computing facilities, laboratories, and collaborative spaces that encourage innovation and practical learning experiences.

4. **Fostering Interdisciplinary Education:** Encouraging educational programs that blend disciplines, such as integrating arts with technical studies or combining biology with computer science, to foster a more versatile and innovative workforce.

Recommendations for Education and Workforce Development:

1. **Government and Institutional Initiatives:**

    - **Support for Policy Changes:** Advocate for policies that promote educational reform and workforce training, focusing on equity and access.

    - **Funding for Educational Programs:** Increase funding for programs that expand STEM education, particularly in underserved communities, to prepare a diverse workforce capable of leading future innovations.

2. **Role of Higher Education:**

    - **Structural Reforms:** Universities and colleges should reevaluate and adjust their curricula and programs to include more inclusive and diverse educational opportunities, integrating DEI efforts into their core strategies.

- **Partnerships for Innovation:** Establish partnerships between educational institutions, industry, and government to create programs that respond dynamically to labor market needs and focus on practical, hands-on learning experiences.

3. **Promoting Lifelong Learning:**

   - **Development of Continuing Education Programs:** Institutions should develop programs that allow professionals to update their skills and knowledge throughout their careers, particularly in emerging fields like AI and quantum computing.

   - **Community-Based Learning Initiatives:** Encourage community engagement and learning beyond traditional classrooms, using technology to reach wider audiences.

4. **Enhancing Global Competitiveness:**

   - **Learning from International Models:** Adopt successful education and workforce development strategies from other countries, especially those leading in STEM and innovation sectors.

   - **Competitive Grants and Incentives:** Implement grant programs that incentivize educational institutions to pioneer new teaching methods, technological integration, and interdisciplinary studies.

By addressing these needs and implementing these recommendations, the U.S. can enhance its educational systems and workforce development strategies to better prepare for the demands of the future economy, ensuring it remains a leader in global innovation and technology. Individual institutions, funding agencies, and communities such as the ERN, play important roles in addressing the needs and implementing recommendations.

4. Presentation and Panel Sessions

Opening Remarks and ERN Overview

The opening remarks at the ERN Summit 2024 were delivered by Barr von Oehsen, chair of the ERN Steering Committee, setting the stage for a collaborative and insightful conference. The primary goals outlined for the meeting included fostering mutual learning, discussing the democratization of access to research instruments, updating attendees on the ERN Working Groups' activities, and exploring future projects and collaborations. Emphasis was also placed on workforce development, the role of funding agencies, and envisioning a national federated ecosystem for research and education. The remarks highlighted the role of the Pittsburgh Supercomputing Center (PSC), a joint computational research facility between Carnegie Mellon University and the University of Pittsburgh, known for its pioneering efforts in AI and research computing. With substantial funding and a history of leadership in networking and security, the PSC exemplifies the type of collaborative research infrastructure the Summit aims to promote across more institutions.

Keynote : Re-imagining American Innovation: Bridging the Gap to Unlock America's Stranded Brilliance

The keynote presentation by James R. Martin, PhD, from the University of Pittsburgh, titled "Re-imagining American Innovation: Bridging the Gap to Unlock America's Stranded Brilliance," emphasized the urgent need for the United States to enhance innovation and broaden participation in STEM fields to leverage economic and technological leadership. It outlined the historical context of innovation following major disruptions and the current challenges posed by rapid technological changes and global competition. The presentation advocated for significant educational reforms and government initiatives like the NSF ENGINES program and the CHIPS Act to foster an inclusive innovation ecosystem. It highlighted the importance of transforming higher education to support continuous learning and community engagement, addressing both historical inequities and future opportunities to maintain competitive advantages in the global landscape.

Research and Research Instrument Use Case Panel

The "Research and Research Instrument Use Cases at LAC/Smaller Institutions/MSIs/HBCUs/TCUs" panel was moderated by Carrie Rampp, CIO of Franklin & Marshall College, and featured distinguished panelists from various academic institutions, including Sunita Kramer from The College of New Jersey, Jason Simms from Swarthmore College, Suxia Cui from Prairie View A&M University, Henry T. Jackson from North Carolina A&T State University, and Almesha Campbell from Jackson State University. The panelists shared their insights and experiences on leveraging research capacities and infrastructure at their respective institutions, highlighting how these facilities and initiatives support the academic and research objectives, particularly in the context of minority-serving institutions and smaller colleges. The panel participants collectively illustrated the unique challenges faced by smaller and minority-serving institutions in expanding and managing research capabilities. However, they also highlighted significant opportunities for growth and leadership in higher education and research through strategic investments in infrastructure and programs. Some of the highlights from the panel are listed below.

- As a primarily undergraduate institution, small liberal arts schools face the challenge of integrating high-level research within an undergraduate-focused academic environment.
- Managing and expanding research capabilities while maintaining teaching excellence requires careful balance. For example, The College of New Jersey has leveraged its High-Performance Computing (HPC) cluster to enhance research capabilities across various scientific disciplines. This infrastructure supports a wide range of research and educational activities, benefiting both faculty and students and positioning TCNJ as a leader in undergraduate research.
- Challenge of managing and coordinating research across various colleges and domains with limited central oversight effects the efficiency and effectiveness of research initiatives.
- Challenges related to funding, resource allocation, and expertise are common among small institutions, MSI's, and HBCU's.
- All the institutions represented on the panel have been able to leverage various funding opportunities (e.g. NSF CC*, MRI) to enhance research and education capabilities.
- Institutions are exploring options for access to resources and resource sharing. For example, leveraging a recent CC* award, Swarthmore college is teaming up with another small liberal arts college to share HPC resources.

- Opportunities to increase collaborations among researchers across types of institutions were an important part of the discussion. Individuals from non-R's including smaller institutions, and specifically those from MSI's, HBCU's, and TCU's expressed concerns that many times they are contacted to participate or write Letters of Commitment/Support (LoC/LoS) for broader impacts only. While broader impacts is an important aspect for projects, the interest is to be included as part of the core or critical part of the project in collaborative proposals, they do not only want to be included as a "5th PI" as a token of diversity for the broader impacts.

- HBCU's represented provided information about how several of researchers have been able to leverage resources through the Princeton-HBCU Alliance for Collaborative Research and Innovation (PACRI), a program at Princeton University that is designed to enable research collaborations between Princeton faculty and their peers at HBCUs.

Access to funding sources and robust research programs position universities well for leading innovative research and contributing significantly to regional and national economic development.

Role of Funding Agency Panel

The panel titled "The Role of Funding Agencies" which discussed the pivotal roles these organizations play in supporting research and development across various scientific fields. Moderated by Wendy Huntoon from the American Indian Higher Education Consortium, the panel featured insights from the NSF's Office of Advanced Cyberinfrastructure (OAC) and the Technology Innovation and Partnerships (TIP) Directorate. Panelists including Plato Smith, Sharon Geva, James L. Moore III (participated virtually), and Chaitanya Baru provided insights into the roles these directorates play in fostering scientific and technological advancement.

1. **Office of Advanced Cyberinfrastructure (OAC):** The OAC focuses on providing comprehensive support for research involving computing, data management, and networking, aiming to enhance scientific discovery and innovation.

    - **NSF OAC Funding Programs:**

        1. *Campus Cyberinfrastructure (CC):** This initiative emphasizes the development of network infrastructure to support science-driven projects, with significant funding opportunities for campuses and regions.

        2. **Major Research Instrumentation (MRI):** This program increases access to scientific and engineering instrumentation, supporting both the acquisition and development of multi-user research equipment.

    - **Learning and Workforce Development:** The NSF is committed to fostering a national research workforce adept at utilizing and supporting advanced cyberinfrastructure, which is critical for modern scientific research.

    - **Public Access and Open Science:** The NSF promotes open access to research outputs and data through various funding mechanisms, ensuring that the benefits of federally-funded research are broadly accessible.

    - **National AI Research Resource (NAIRR):** The NAIRR initiative aims to build a comprehensive AI research infrastructure to enhance the U.S.'s capabilities in AI research and development, focusing on accessibility, diversity, and innovation.

2. **Technology Innovation and Partnerships (TIP) Directorate:** TIP Directorate focuses on harnessing the nation's diverse talent pool to advance critical and emerging technologies, address significant societal and economic challenges, and accelerate the translation of research results from the laboratory to market and society.

    - **Mission:** Harnesses the nation's diverse talent pool to advance critical and emerging technologies, address significant societal and economic challenges, and accelerate the translation of research results to societal applications.

    - **Focus Areas:**

        1. **Strengthening Translational Research:** Engaging communities throughout the country, particularly those that have been historically underserved in the nation's research and innovation enterprise.

        2. **Innovative Programs:** Includes NSF Engines to create inclusive pathways for innovation ecosystems, fostering collaboration among academia, industry, government, and community practice.

The panel emphasized the significant role of strategic investments in advanced infrastructure and collaborative platforms to spur scientific progress and innovation. Both the OAC and TIP directorates play crucial roles in the NSF's efforts to foster a competitive, inclusive, and technologically advanced research landscape, addressing both foundational scientific inquiries and applied, market-driven research challenges.

Preparing the Workforce for Advanced Technologies – AI and Quantum

Panel 3 of the ERN Summit 2024, titled "Preparing the Workforce for Advanced Technologies - AI and Quantum," moderated by Florence D. Hudson, focused on the challenges and opportunities in workforce development as it relates to AI and quantum technologies. Detailed contributions of the panelists were as follows:

Andrew Begel, Ph.D. - Focused on creating inclusive work environments for neurodivergent individuals within the tech sector, specifically within AI development. He discussed his research on developing communication and support tools, such as the "Facilitating Inclusion through Technology (FIT)" initiative and "INTENT," an Interactive Tool for Empathy for NeuroTypicals. These tools are designed to help autistic workers with social communication and to educate their coworkers on better integration practices.

John Zappa - Represented the Advanced Robotics for Manufacturing (ARM) Institute, detailing the significant role of RoboticsCareer.org in bolstering the U.S. manufacturing workforce. This platform has been instrumental in connecting over 77,000 users to training programs and job opportunities, helping to solve workforce issues in manufacturing. He emphasized the platform's new features like personalized job matching and student/job seeker profiles, which enhance the job searching experience and match capabilities to industry needs.

Hanna Terletska, Ph.D. - Presented on the initiatives at Middle Tennessee State University to integrate quantum education in the curriculum through the QISE initiative. She highlighted the partnership between MTSU and Fisk University, which aims to broaden participation in quantum sciences. The collaboration has led to the development of courses in Quantum Computing

Fundamentals and Professional Certificates in Quantum Information Science, alongside workshops and summer camps to further engage and prepare students.

Shuangbao (Paul) Wang, Ph.D. - Discussed the implications of quantum computing on cybersecurity, highlighting the potential vulnerabilities introduced by quantum technologies. He explored how quantum computing could compromise current cryptographic methods, such as RSA encryption, and discussed the need for quantum-resistant cryptography to secure data against future quantum attacks.

Each panelist provided insights into different aspects of workforce preparation for advanced technologies, emphasizing both the educational needs and the inclusive practices necessary to utilize the full potential of the workforce in the rapidly evolving landscapes of AI and quantum technology. The discussions underscored the need for innovative educational programs, supportive workplace tools, and robust security measures to prepare for the technological advancements shaping the future.

Resources and Communities

The "Building Awareness - Resources and Communities," provided an in-depth look at various initiatives aimed at enhancing cyberinfrastructure and community engagement within the realm of research computing. The discussions revolved around improving resource accessibility and fostering professional development across diverse institutional landscapes. Here's a more detailed overview of the contributions from each panelist:

Jennifer Kim, from Internet2, spoke about the Minority Serving - Cyberinfrastructure Consortium (MS-CC). The MS-CC initiative is focused on advancing cyberinfrastructure capabilities across minority-serving institutions such as HBCUs, HSIs, TCUs, and MSIs. The consortium works on promoting a transformational partnership that not only enhances cyberinfrastructure but also supports curriculum development, professional development, and capacity-building tailored to the unique needs and voices of these communities. Key efforts include facilitating greater access to advanced cyberinfrastructure, enhancing communication across various campus stakeholders, and fostering collective advocacy and partnerships.

Tom Cheatham, from University of Utah, highlighted the activities of the Campus Research Computing Consortium (CaRCC) People Network. This network aims to support the professional development of individuals involved in research computing and data (RCD) roles. Cheatham detailed the structure of CaRCC, which includes several focus tracks or "Facings" that address different aspects of the RCD profession—ranging from direct researcher support to policy and strategy. The network provides a platform for RCD professionals to connect, share resources, and engage in continuous learning through organized tracks, discussions, and community-led initiatives.

Bob Freeman, from Harvard University Business School, discussed the strategic implementation of research technology operations. His presentation focused on the integration of high-performance computing resources to support research initiatives, emphasizing the importance of aligning these resources with the broader academic and research goals. Freeman stressed the significance of community collaboration in enhancing research outcomes and the role of centralized technology operations in supporting diverse research needs.

Each presentation underlined the critical role of cyberinfrastructure in supporting research and education, particularly in institutions serving minority groups. The discussions aimed to foster a greater understanding of how technological resources and community networks can be leveraged to enhance

institutional capabilities, support professional development, and ultimately lead to more inclusive and effective research environments.

ACCESS/NAIRR and other Resources

The panel "ACCESS/NAIRR and Other Resources," provided in-depth insights into the latest advancements and offerings in computational resources, laboratory innovations, and heritage science. A description of each panelist's presentation is included here.

Stephen Deems focused on the NAIRR and ACCESS programs. Additional details were provided about the NAIRR program in this session. ACCESS serves as a critical resource for the U.S. academic community by providing advanced computing resources. He explained how ACCESS simplifies the process for researchers to obtain computing power, with over 30 types of resources available, including CPUs, GPUs, and various storage options. A significant highlight was the program's efficiency, where a typical researcher could start using resources within ten days of request. In 2023 alone, ACCESS created over 12,000 new accounts and awarded resources to 2,400 projects with a 95% success rate, emphasizing its pivotal role in facilitating scientific research across the nation.

Ed Dunlea, Ph.D., elaborated on the Carnegie Mellon Cloud Lab, a remotely controlled laboratory environment that represents a significant leap in research methodology. The lab features a central code-based platform managing automated instrumentation and operations, which ensures that every experimental action is traceable. With approximately 130 different types of instruments available, the lab supports a wide range of scientific activities from synthesis and purification to experimentation and characterization. This facility is an evolution of the existing ECL (Electronic Classroom Lab) and aims to make laboratory research more accessible and efficient.

Hugo Reyes-Centeno, Ph.D., discussed EduceLab's integration of heritage science with cutting-edge technology. He outlined the lab's focus on extracting valuable insights from heritage data to preserve and understand cultural and biological inheritances. The EduceLab, situated at the William S. Webb Museum of Anthropology, employs sophisticated imaging and computational techniques to explore and reconstruct historical artifacts digitally. This approach not only supports academic research but also enhances public engagement and educational programs by making heritage science more accessible and interactive.

Maureen Dougherty introduced the ERN CryoEM Federated Instrument Access Pilot Project, which aims to streamline access to Cryo-Electron Microscopy (CryoEM) instruments across different institutions. This project creates a secure environment that integrates federated authorization, authentication, and access, making it easier for researchers to conduct reproducible and reliable experiments. The initiative is part of a broader effort to federate instrument access through the ERN OpenCI Cloudlet, which uses open-source tools like Open OnDemand to facilitate remote scientific experimentation.

Together, these presentations showcased how technological innovations and collaborative efforts are significantly enhancing the capabilities and accessibility of scientific research tools. Each project not only advances the specific scientific fields they cater to but also sets new standards for how modern research infrastructures can be developed and utilized effectively.

5. Workshops

ERN CryoEM Remote Instrument Access - Cloudlet Installation Workshop

The "ERN CryoEM Remote Instrument Access - Cloudlet Installation," was led by Maureen Dougherty from ERN and Morgan Ludwig from TechSquare. Participants were introduced to the ERN CryoEM Remote Instrument Access Project and the ERN Instrument Cloudlet (Cloudlet) for facilitating remote access to Cryo-Electron Microscopy (CryoEM) instruments, including analytical workflows leveraging edge-computing for real-time parameter adjustments in combination with advanced computing resources for sophisticated data analysis and modeling. The goal of this project is to facilitate multi-institutional collaboration at the interface of computing and scientific instrumentation, by removing many barriers, leveraging real-time result monitoring and edge computing, with emphasis on under-represented and under-resourced institutions.

The workshop presented a brief review of the inception of the CryoEM project, the initial ERN Instrument Cloudlet design, and the connective tissue concept:

1. Connect remote scientific instruments to researchers - providing new multi-institutional collaborations opportunities, bridging research resources to researchers and students to advance scientific discovery and pedagogy. Enable sharing of research resources with the potential for an institutional core service, and funding agency resource sharing requirements.
2. Provide an open-source, secure web-based user platform (Instrument Cloudlet) to access research resources, including scientific instruments, compute resources, and storage by connecting existing tools and and resources developed through NSF funded projects like Open OnDemand (OOD), CILogon, FABRIC, and ACCESS (national compute centers, data management, workflow management).
3. Connect workforce and resource training for on boarding researchers and support personnel for optimal utilization of scientific instruments.

An overview of the Instrument Cloudlet components was presented, discussing the use of containers, Open OnDemand, parameterized scripts, authentication via CILogon and Globus, FABRIC implementation, cluster resources including the ACCESS resource Pittsburgh Supercomputing Center's Bridges2 cluster, and the scientific application CryoSPARC's role for analysis as well as data and workflow management.

The participants then were guided through the technical aspects of the Cloudlet installation and configuration. A detailed review of implementation covered system prerequisites, host and security limitations, the GitHub repository resources covering OOD customization, CILogon and user mapping for authentication, container configuration scripts, Flask application, security, reverse proxying with OOD for VNC communications. Troubleshooting and common issues that might arise during setup or use were discussed. A demonstration video of an active workflow with real-time adjustments was presented concluding with an open question and answer session.

The workshop demonstrated how Cloudlets can be integrated to enable researchers to remotely control CryoEM instruments, and any scientific instrument leveraging VNC for communications. This capability is particularly vital for researchers who are unable to physically access these sophisticated tools due to geographical or logistical constraints, thus enabling multi-institutional collaborations that might not normally be available particularly to researchers and students from under-represented and under-resourced research institutions. The session was designed to be interactive, offering attendees the

opportunity to engage with the technology, ask questions, and discuss potential applications and benefits of remote instrument access in their own research contexts.

Thought Leader Workshop - Resource Sharing

The "Thought Leader – Resource Sharing" workshop, moderated by Forough Ghahramani, EdD, NJ Edge, and facilitated by Sunita Kramer, Ph.D., The College of New Jersey (TCNJ), focused on the critical theme of resource sharing among higher education institutions. This ideation session brought together thought leaders from diverse educational backgrounds, including small schools, liberal arts colleges, HBCUs, MSIs, and research-intensive R1 universities. Utilizing a design thinking methodology, the workshop aimed to tackle the challenges and explore opportunities related to advanced computing and robust research support systems. This workshop was part of a broader conversation about enhancing the research capabilities of both small and large institutions through innovative resource allocation and collaborative efforts.

The workshop participants were divided into two groups: Large Research Universities (R1's) and non-R1's (small schools and MSI's, HBCU'). Each group worked together to answer the following set of questions: What are the challenges, strengths, opportunities, and wish list items for respective institution.

> Based on the responses, non-R1 group of school challenges include infrastructure limitations, lack of expertise, and cultural barriers to collaboration. They seek professional development, easier collaboration pathways, and access to shared resources. Their strengths lie in nimbleness and personal connections. Opportunities include increased funding focus on under-resourced institutions, national resources, and collaborations like regional conferences and industry connections for resources.
>
> Research universities face challenges in effectively managing distributed resources and fostering communication between research and IT teams. Data management issues, such as risk, size, and sharing, create silos and hinder collaboration. Asset inventorying proves challenging, leading to redundancy and underutilization of resources. Faculty often lack awareness of available resources and expertise, exacerbating the problem. Accessing expertise across multiple domains and ensuring long-term sustainability pose additional hurdles. Political barriers impede collaboration with other institutions, while inflation affects hardware and salary costs. However, research universities boast stable central funding, multi-disciplinary facilitation teams, and strong community relationships. Opportunities lie in sharing successes through workshops, collaborative grant writing, and leveraging environmental sustainability initiatives. Strengthening relationships at local, regional, and national levels fosters collaboration. Wishlist items include vision projects, increased funding sources for expertise development, and workforce development for the next generation of experts, along with exploring regional funding opportunities.

The next part of the workshop asked each group to provide specific challenges that they want insights from the other group on how they might be addressed.

> The non-R1's sought insights on the following: **"How might we create connective tissue that simplifies sharing and collaboration**?" Research universities proposed various strategies to enhance collaboration and resource sharing. They suggested exploring international models and capacity building within institutions. Recommendations included submitting proposals to the NSF, establishing student exchange programs, and mandating contributions to centralized databases. Leveraging RENs, incentivizing collaboration through funding requirements, and engaging community colleges were also emphasized. Legal expertise, dedicated management, and

industry partnerships were highlighted for effective governance. Starting with pilot programs was recommended to minimize risks.

Research institutions identified key areas of "how might we?" for improvement, including **communication of value and availability of specialized tools**, **building repositories for training and policy documentation**, and **addressing limited expertise and retention**. The non-R1 representative responses to "how might we ? for the three areas, proposed leveraging community workshops, establishing one-stop-shop centers, and implementing designated support individuals at the regional level. They also suggested collaborating with community colleges, developing institutional research support models, and emphasizing lifelong learning and career pathways.

The workshop concluded with a commitment to enhancing collaboration across institutions to democratize access to vital research tools and foster a more inclusive environment for innovation. By sharing resources more effectively and acknowledging the distinct needs and constraints of various educational settings, stakeholders can facilitate a more robust ecosystem for research and academic achievement. In summary, while research universities and smaller institutions face unique challenges, there are common themes such as resource management, expertise availability, and the need for clear policies that impact both types of institutions in their pursuit of advanced computing and research excellence.

6. FINDINGS

The two-day Summit was a successful engagement of key ERN stakeholders from across the nation, leveraging presentations and workshop sessions to stimulate open discussions. In addition to exchanges surrounding the initial areas of interest, observations were presented that extended beyond this scope. Evaluation of these findings and subsequent recommendations will be incorporated into the future strategic direction of the ERN, with the focus of long-term transformative impact on research collaborations beyond the ERN community.

This section summarizes the key findings from the ERN Summit 2024, with justification drawn from participant exchanges during the workshop.

The findings of the Summit underscore the intricate landscape of challenges and opportunities that both research R1 universities and smaller institutions encounter in their pursuit of effective research support and utilization of advanced computing technologies. Despite their differing sizes and resources, both types of institutions grapple with similar overarching themes. These include the efficient management and allocation of resources, the availability of specialized expertise, and the establishment of clear and conducive policies and procedures. Technological innovations and collaborative efforts are significantly enhancing the capabilities and accessibility of scientific research tools. The technologies and collaborations not only advance the specific scientific fields they cater to but also set new standards for how modern research infrastructures can be developed and utilized effectively.

Resource management emerges as a critical concern, with institutions striving to optimize the utilization of personnel, infrastructure, and funding to support research endeavors. Additionally, the availability of expertise, particularly in areas such as advanced computing, data management, and data storage is identified as essential for facilitating research and innovation across disciplines. Clear policies and procedures are deemed necessary to create a conducive environment for collaboration and to ensure responsible research practices.

Collaboration emerges as a key strategy for overcoming these challenges and capitalizing on opportunities for improvement. By fostering collaboration both within and across institutions, stakeholders can pool resources, share expertise, and leverage collective strengths to address common challenges effectively. Furthermore, capacity building initiatives are highlighted as essential for empowering institutions to develop the necessary infrastructure, skills, and culture to support collaborative research efforts.

Education and inclusive practices are necessary to utilize the full potential of the workforce in the rapidly evolving landscapes of AI and quantum technology. There is a need for innovative educational programs, supportive workplace tools, and robust security measures to prepare for the technological advancements shaping the future.

NSF is committed to fostering a national research workforce adept at utilizing and supporting advanced cyberinfrastructure, which is critical for modern scientific research. In addition to the funding opportunities for workforce development and professional development, Summit participants are encouraged to participate on NSF review panels.

Community networks can be leveraged to enhance institutional capabilities, support professional development, and ultimately lead to more inclusive and effective research environments.

The Summit also identified several strategic recommendations to address these challenges and capitalize on opportunities. These include exploring international models for collaboration, leveraging funding incentives to promote collaboration, and developing clear policies and agreements to govern collaborative research efforts. Additionally, the importance of starting with smaller-scale pilot programs to test and refine collaboration models is emphasized to mitigate risks and optimize outcomes.

Overall, the findings underscore the importance of collaboration, capacity building, and strategic initiatives in addressing the complex challenges faced by research universities and smaller institutions. By embracing these strategies, stakeholders can foster a culture of innovation, drive interdisciplinary collaboration, and ultimately advance knowledge and discovery within the higher education landscape.

7. RECOMMENDATIONS

Based on the Summit, suggestions and recommendations have been developed for individual institutions, the ERN, and Funding agencies:

Suggestions for Funding Agencies:

1. **Invest in Capacity Building**: Allocate funding for capacity-building initiatives aimed at enhancing research support, advanced computing capabilities, and interdisciplinary collaboration within smaller institutions. Support training programs, workshops, and professional development opportunities to empower faculty members and researchers with the skills and knowledge needed to leverage advanced computing technologies effectively.

2. **Promote Collaborative Partnerships**: Encourage collaborative partnerships and consortia among institutions by providing grant opportunities that incentivize resource sharing, infrastructure development, and interdisciplinary research initiatives. Support initiatives that facilitate networking and collaboration among research institutions of varying sizes and specialties to promote knowledge exchange and innovation. Encourage collaborations among researchers from Research intensive institutions and non-R1's especially those representing small

institutions, HBCU's, MSI's, and TCU's where they are playing core and critical roles in proposals.

3. **Facilitate Access to Resources:** Provide funding and resources to establish and publicize centralized repositories, shared facilities, and research networks that enable smaller institutions to access advanced computing infrastructure, specialized equipment, and research support services. Foster collaboration between funding agencies, industry partners, and academic institutions to enhance resource accessibility and promote research excellence.

4. **Funding for Educational Programs:** Increase funding for programs that expand STEM education, particularly in underserved communities, to prepare a diverse workforce capable of leading future innovations.

5. **Solicitation Response Support:** Additional efforts are needed to help level the playing field for smaller non-R1m HBCU's, MSI's, and TCU's institutions when responding to solicitations, particularly for major solicitations. These groups have fewer institutional and human resources, including central sponsored research projects offices, with the knowledge, expertise and time to support and develop competitive proposals. Institutional size based response examples with emphasis on auxiliary required components for some of these solicitations would benefit these institutions.

Recommendations for Small and other non-R1 Institutions:

1. **Strengthen Institutional Capacity:** Invest in building institutional capacity by prioritizing professional development, training, and mentorship programs for faculty members, researchers, and staff. Leverage external funding opportunities, such as NSF CC*, MRI, SCIPE, and collaborative partnerships to enhance expertise, infrastructure, and research support services within the institution.

2. **Foster Collaboration:** Cultivate a culture of collaboration and knowledge sharing among faculty members, researchers, and students by establishing interdisciplinary research teams, joint projects, and community engagement initiatives. Explore opportunities for collaboration with other institutions, industry partners, and government agencies to access resources and expertise.

3. **Promote Grant Writing and Management:** Provide support and resources for grant writing, management, and compliance to streamline the funding acquisition process and maximize external funding opportunities. Establish dedicated offices or personnel to assist faculty members with grant proposal development, budgeting, and reporting requirements.

Recommendations for R1 Universities:

1. **Support Small Institutions:** Extend support and resources to smaller institutions through collaborative partnerships, joint research initiatives, and capacity-building programs. Offer mentorship, training, and technical assistance to help smaller institutions enhance their research capabilities and leverage advanced computing technologies effectively.

2. **Facilitate Resource Sharing**: Establish mechanisms for resource sharing, collaboration, and knowledge exchange among research universities and smaller institutions. Promote initiatives that facilitate access to shared facilities, research networks, and specialized expertise to foster innovation and interdisciplinary research collaboration.

3. **Promote Diversity and Inclusion:** Prioritize diversity, equity, and inclusion initiatives within research universities by fostering a welcoming and inclusive environment for faculty members, researchers, and students from diverse backgrounds. Promote collaboration with minority-serving institutions, HBCUs, and other underrepresented groups (e.g. the Princeton University PACRE program) to promote diversity in research and innovation.

Recommendations for the Ecosystem for Research Networking (ERN):

1. **Expand Networking Opportunities:** Facilitate networking opportunities, collaborative forums, and knowledge-sharing platforms to connect researchers, institutions, funding agencies, and industry partners within the research ecosystem. Promote interdisciplinary collaboration, resource sharing, and best practices across diverse domains and specialties.

2. **Support Interoperability and Integration:** Promote interoperability and integration of research networking tools, platforms, and services to streamline collaboration, data sharing, and communication within the research community. Foster the development of standardized protocols, data formats, and interoperable systems to facilitate seamless integration and information exchange.

3. **Advocate for Policy and Funding Support:** Advocate for policy initiatives and funding support that prioritize research networking, infrastructure development, and collaborative research initiatives. Engage with policymakers, funding agencies, and industry stakeholders to highlight the importance of investing in research networking infrastructure and fostering collaboration across institutional boundaries.

4. **ERN CryoEM Remote Instrument Access Project**: Continue the development of the ERN Instrument Cloudlet enabling remote access to scientific instruments to the research community fostering multi-institutional collaborations through partnerships and collaborations targeting smaller, under-resourced and under-represented institutions. Obtain funding to advance ERN's connective tissue concept and develop robust identity management, data management and workflow management services leveraging existing open source and NSF funded solutions.

By implementing these recommendations, funding agencies, non-R1 institutions, R1 universities, and the Ecosystem for Research Networking (ERN) can collectively contribute to enhancing research support, advancing computing capabilities, and fostering collaboration and innovation within the academic research community.

8. ACKNOWLEDGEMENT

This Workshop was supported in part by the NSF CC* CRIA: The Eastern Regional Network Award (OAC-2018927). Special acknowledgement to the ERN Working Group Members for program development and execution, the ERN Steering Committee for guidance and support, and the Pittsburgh Supercomputing Center and Carnegie Mellon University staff for assistance for event management support.

9. APPENDICES

9.1 ERN Working Group Overviews

9.1.1 Materials Discovery Working Group

Materials Discovery is one of the research areas where gaining a deeper understanding of the workflows, research computing and data requirements, collaborations, and challenges will enable the ERN to have the broadest impact across multiple research disciplines, pedagogical approaches, senior level college and university administrators, and other organizations within the region and beyond. Researchers in materials discovery are realizing that their traditional data-intensive HPC workflows are reaching the limits of spatial and temporal scales required to make deeper insights and predictions. For this reason, they are looking to new paradigms that include convergence of HPC and Machine Learning (ML) methodologies, algorithm development, and novel ways to access the data distributed across multiple institutions used in training systems as promising approaches to overcome the major computational performance limitations. As a science design driver, the ERN materials discovery working group will work with OpenCI Labs to develop an instrument abstraction layer for four widely used instruments within the materials discovery community. By offering federated access to these instruments through OpenCI Labs, we anticipate usage from a broader research and education community as well as lay the groundwork for a national materials database for the materials discovery community, similar to the PDB for the structural biology community.

ERN Materials Discovery Data Driven Vision:

- Develop materials-centric structured database that can be accessed through a secure interface from all member institutions - organization, architecture, HPC, storage, etc.
- Develop materials data-sharing policies and language for umbrella institution agreements - IP, Publication, Thesis, etc.
- Involve shared facilities at each institution to participate in development of structured database. Software and hardware updates needed to make this process as automated as possible.
- Develop web-based training protocols for young researchers at partnering institutions to access and utilize the database.

Program Tasks:

- Data Sharing Protocols - data differs for each instrumentation.
    - Form a Materials Data Sharing Policy team, lead by shared facilities, that develops the data organization and sharing standards for each type of characterization technique
- User interfaces required to upload data from commonly used software on large instrumentations to cloud-based structured database
- Develop network of users across participating institutions
- Enhancement in the computational science - modeling and simulations facilitated through the experimental data and HPCs
- Broader impact activities - connection to colleges and MSIs

The goal of our remote instrumentation program would be over the course of three/four years, many of

these machines, initially Scanning Electron Microscopy (SEM)and diffraction, would be available on-line for all the world to utilize. Data collected and compiled would be placed into the database developed through this program, and launch the next generation of materials science from this.

9.1.2 Structural Biology Working Group

Structural biologists are now generating huge datasets as they develop new tools and instruments to gain better understanding of the molecular structure of biological macromolecules and how these structures are formed or affected if altered. For this reason, biologists are faced with having to overcome many challenges that occur when developing research workflows that couple their instruments with research computing and machine learning. An added challenge occurs when collaborating with researchers outside of their respective organizations. Firewalls, bandwidth, and campus authentication services are just a few of the roadblocks they typically encounter. As an example, Cryo-electron Microscopy (Cryo-EM), and more recently Electron Cryotomography (Cryo-ET), have revolutionized structural biology through advances in microscope optics and detectors, but rely heavily on image processing pipelines that are both compute and data intensive. Exploratory conversations with structural biology leadership at Rutgers, Yale, the University of Massachusetts, Penn State, and others suggest that a stronger partnership between providers of structural biology and research computing services can both improve the efficiency with which well-resourced labs can obtain scientific results, and make these resources and techniques more readily available to underserved institutions that have fewer resources and less access to technical expertise. As a science design driver, the ERN structural biology working group will work closely with the OpenCI Labs development teams to ensure that the system software, instrument abstraction layers, user interfaces, workflow designs, and containerized data focused micro-services meet the needs of the structural biology community, especially those using CryoEM/ET instrumentation.

9.1.3 Architecture and Federation Working Group

The vision of the federated collaboratories requires the development of many layers of abstractions ranging from hardware, networking, federation architecture, scientific workflows, and domain-specific models and tools to enable collaborative discovery. The ERN Architecture and Federation working group concentrates on gathering information and developing what the “federated collaboratory” might look like from both a hardware and software perspective, and what federation should look like as ERN strives for a seamless collaborative sharing experience.

These developing solutions focused on supporting the vision and mission of the ERN, many of the challenges the ERN will face will lead to questions that ultimately become interesting Computer Science (CS) research projects on topics such as ontologies and knowledge representation, workflow analysis, federated AI/ML, domain-specific programming languages, to architecture, networks, systems, and security. The ERN will also provide a testbed for CS experiments (Measurement Monitoring,

Self-Optimizing Systems) and will leverage existing NSF funded projects (FABRIC, Open Cloud, CC*) leading the way to become an instrument to connect other research instruments or platforms.

9.1.4 Policy Working Group

The vision of the ERN is to simplify multi-campus collaborations and partnerships that advance the frontiers of research and innovation. In order to do this successfully the ERN needs to consider current university policies as well as engage with university administrations (VPRs, CIOs, General Counsel, and IRB directors) in developing a policy strategy to help us bring the vision to reality. Community topics of concern include university policies and what considerations need to be taken into account as we create new policies and procedures for the ERN as a whole and its participants; what needs to be in place that allows ease of sharing knowledge, data, infrastructure, and people; compliance requirements and security concerns; and sustainability. The Policy Working Group has worked toward these goals focused on CI sharing policies, organizational aspects, and anticipation of possible collision between local policy and overall policy.

9.1.5 Broadening the Reach Working Group

Many smaller, mid-sized and under-resourced campuses, including MSIs, HSIs, HBCUs and EPSCoR institutions have compelling science research and education activities along with an awareness of the benefits associated with better access to cyberinfrastructure resources. These schools can benefit greatly from resources and expertise to augment their in-house efforts. This could include identifying, understanding, and quantifying the science drivers; understanding the cyberinfrastructure needed to support the applications; and provide both the technical and application support associated with matching the applications to the infrastructure, particularly when the required resources are outside of their campus environment. The ERN Broadening the Reach working group is focused on learning directly from this community on how best to support under-resourced academic institutions in the region, which happens to be a majority of the academic institutions within the Northeast. Because of the trusted relationship between smaller academic institutions and the regional network providers, the role of regionals as facilitator and user support for these smaller institutions within the ERN will be explored.

Goals:

- Focus on engaging/supporting small/medium under- resourced campuses: MSIs, HSIs, HBCUs, EPSCoR
- Identify compelling science research and education activities
- Explore the role of regionals as facilitator and user support for these smaller institutions within the ERN

- Identify potential collaboration opportunities for proposals
- Building & leveraging a highly skilled, diverse workforce to support advanced CI

9.2 SUMMIT Program Details

9.2.1 Presentation Materials

The workshop event website for registration and participant information was hosted by ERN through the ERN website (https://www.ernrp.ci/) and located here: https://www.ern.ci/event/the-ecosystem-for-research-networking-Summit/.

Presentation materials are posted here

9.2.2 Program Agenda

Ecosystem for Research Networking (ERN) Summit 2024 Agenda

April 11-12, 2024
Pittsburgh Supercomputing Center
300 S. Craig St.
Pittsburgh, PA 15213

The Ecosystem for Research Networking (ERN) Summit provides the scientific and cyberinfrastructure research community an opportunity to come together and discuss ERN mission and accomplishments, hear from domain researchers and CI professionals at smaller institutions about the the successes and challenges related to leveraging local, regional, and national resources for projects, and learn about funding resources and partnership opportunities, as well as regional and national communities. There will be open discussions and conversations on focus areas and policies as they pertain to areas of community interest including AI, quantum, Big Data, cybersecurity and protecting data, research instruments, workforce development, applications for ERN, education and training.

Day 1 Morning Session (9:00AM - 12:00PM EDT)

8:00 - 9:00 Continental Breakfast and Registration

9:00 - 9:30 Opening remarks and Introduction to the ERN
Barr von Oehsen, Ph.D., Director Pittsburgh Supercomputing Center

9:30 - 10:15 Keynote *"Re-imagining American Innovation: Bridging the Gap to Unlock America's Stranded Brilliance"*

James Martin, Ph.D., Vice Chancellor of Stem research and Innovation , University of Pittsburgh

10:15 - 10:30 Morning Break

10:30 - 11:15 Panel 1 : Research and Research Instrument use cases LAC/smaller institutions/MSIs/HBCU's/TCU's

Moderator: **Carrie Rampp**, CIO, Franklin and Marshall College

Panelists:

- **Sunita Kramer**, Ph.D., Dean of the School of Science, The College of New Jersey
- **Jason Simms**, Ph.D., Research Computing Manager, Swarthmore College
- **Suxia Cui**, Ph.D., Professor and Graduate Program Coordinator Electrical & Computer Engineering Department, Prairie View A&M University
- **Henry T. Jackson**, Vice Chancellor of Information Technology Services & CIO, North Carolina Agricultural & Technical State University
- **Almesha Campbell**, Ph.D., Assistant Vice President for Research and Economic Development, Jackson State University (Virtual)

11:15 - 11:45 Morning Discussion Breakouts

11:45 - 12:00 Morning Discussion Report outs

12:00 - 1:00 Lunch

<u>Day 1 Afternoon Session (1:00PM-5:00PM EDT)</u>

1:00 - 2:00 Panel 2: The Role of Funding Agencies

Moderator: **Wendy Huntoon** , CI Team Lead, American Indian Higher Education Consortium (AIHEC) Lead PI, NSF funded Tribal College and University Cyberinfrastructure Facilitation project

Panelists:

- **Plato Smith**, Ph.D., Program Director NSF OAC
- **Sharon Geva**, Ph.D., Program Director NSF OAC
- **James L. Moore III**, Ph.D., Assistant Director for the Directorate for STEM Education NSF (Virtual)
- **Chaitanya Baru**, Ph.D., Senior Advisor, Technology, Innovation, and Partnerships Directorate, NSF

2:00 - 3:00 Panel 3: Preparing the workforce for Advanced Technologies - AI and Quantum

Moderator: **Florence D. Hudson**, Executive Director and co-PI, Northeast Big Data Innovation Hub, and Proto-OKN PI

Panelists:

- **Andrew Begel**, Ph.D., Associate Professor in Software and Societal Systems, Carnegie Mellon University
- **John Zappa**, Director of Project Management, Advanced Robotics for Manufacturing(ARM) Institute
- **Hanna Terletska**, Ph.D., Associate Professor, Department of Physics and Astronomy, Middle Tennessee State University (MTSU)
- **Shuangbao (Paul) Wang**, Ph.D. Professor and Chair of Computer Science, Director, Morgan Quantum Computing Group, Technical Director, Equitable AI Center, Morgan State
- **Daniel Justice**, Quantum Computing Instructor and software developer, Software Engineering institute, Carnegie Mellon University

3:00 - 3:15 Afternoon Break

3:15 - 4:00 Panel 4: Building Awareness - Resources, Communities

Moderator: **John Hicks**, Research Network Engineer, Internet2
Panelists:

- **Jennifer Kim**, MS-CC Cyberinfrastructure Engineer, Internet2
- **Tom Cheatham**, Ph.D., Professor of Medicinal Chemistry and Director of High Performance Computing, University of Utah
- **Bob Freeman**, Ph.D., Harvard University, Director Research Technology Operations, Harvard Business School

4:00 - 4:30 Day 1 Session 2 Discussion Breakouts

4:30 - 4:45 Day 1 Summary Discussion Report outs

4:45 - 5:00 Day 1 Summary Remarks

5:30 - 7:00 ERN Summit Reception

<u>Day 2 Morning Workshop Sessions (9:00AM - 12:00PM EDT)</u>

8:00 - 9:00 Continental Breakfast

9:00 - 12:00 Track 1 ERN CryoEM Remote Instrument Access - Cloudlet Installation workshop

Learn about the ERN CryoEM Remote Instrument Access project and how to install, configure and customize an ERN Cloudlet on a FABRIC node slice to access a simulated scientific instrument and a demonstration of access to a production Transmission Electron Microscope. Workshop reviews the Cloudlet's the use of containers, Open OnDemand, parameterized scripts, CILogon, FABRIC, GitHub repositories, and cluster resources including Pittsburgh Supercomputing Center

Moderator/Presenter: **Maureen Dougherty**, ERN
Presenter: **Morgan Ludwig,** Techsquare

9:00 - 12:00 Track 2 Thought leader workshop - Sharing Resources

Moderated thought leader workshop around the needs of the community and how to address them, focusing on the challenges with remote resources awareness, sharing and accessing.

Moderator/Presenter: **Forough Ghahramani**, EdD, Assistant Vice President for Research & Innovation, NJ Edge
Presenter/Facilitator: **Sunita Kramer**, PhD, Dean of the School of Science, The College of New Jersey

12:00 - 1:00 Lunch

Day 2 Afternoon Session (1:00PM-2:15PM EDT)

1:00 - 2:00 Panel 5: Access and Resources

Moderator: **Bala Deninghu**, Senior Scientist, Office of Advanced Research Computing (OARC), Rutgers University
Panelists:

- **Stephen Deems**, Pittsburgh Supercomputing Center, ACCESS and National AI Research Resource(NAIRR)
- **Ed Dunlea**, Ph.D., MCS Senior Director of Corporate and Government Relations, Carnegie Mellon Cloud Lab
- **Hugo Reyes-Centeno**, Ph.D., University of Kentucky, Educelab
- **Maureen Dougherty** - ERN, ERN CryoEM Federated Instrument Access Pilot Project

2:00 - 2:15 ERN Summit Closing Remarks

2:15 - 4:00 Concurrent Tours - prior registration required

- University of Pittsburgh's Cathedral of Learning National and Heritage Rooms
- Carnegie Mellon University Cloud Lab

9.2.3 Summit Registrants/Participants

Affiliation	Role
Advanced Robotics for Manufacturing Institute	Director Project Management
Alcorn State University	Professor, Graduate Business Director
American Indian Higher Education Consortium	CI Team Lead
Brown University	Engineer
Carnegie Mellon University	MCS Senior Director of Corporate and Government Relations

Carnegie Mellon University	Associate Professor
Coalition for Networked Information	DIrector
Columbia University	Executive Director, Northeast Big Data Innovation Hub, and ERN Steering Committee
Davidson College	Deputy CIO
Denison University	Instructional Technologist
Ecosystem for Research Networking	Project Coordinator
Franklin & Marshall College	Vice President & CIO
Franklin & Marshall College	Research Computing Systems and Project Manager
Grambling State University (HBCU)	Cybersecurity Instructor
Harvard Business School	Director, Research Technology Operations
Internet2	Research support engineer
Jarvis Christian University	Associate Professor of Mathematics
Keystone REN	Executive Director
Lafayette College	Director, Learning and Research Technologies
Macalester College	Academic Technologist
Massachusetts Green High Performance Computing Center	Executive Director
Meharry Medical College	Associate Professor
Middle Tennessee State University, Fisk University	Associate professor, Head of Quantum@MTSU
Minority Serving Cyberinfrastructure Consortium (MS-CC), Internet2	Cyberinfrastructure Engineer
Morgan State University	Professor, chair, director
National Science Foundation	Program Director
NJ Edge	Assistant Vice President for Research & Innovation
North Carolina A&T State University	Chief Information Officer
NSF Office of Advanced Cyberinfrastructure	Senior Advisor, TIP Directorate
NSF Office of Advanced Cyberinfrastructure (OAC)	Program Director
Omnibond	CEO
Penn State University	Sysadmin
Penn State University	Assistant Director
Pennsylvania State University	Research Computing Manager
Pennsylvania State University	ICDS Director for Technology-based Research Projects and Partnerships

Pittsburgh Supercomputing Center	Director
Pittsburgh Supercomputing Center	Assistant Director for Project Management
Prairie View A&M University	Professor
Rice University	AVP for Research Computing
Rutgers University	Senior Scientist
St. Olaf College	Director of Enterprise Infrastructure
Staff in the Center for Research Computing at Rice	Infrastructure Specialist
Swarthmore College	Research Computing Manager
Swarthmore College	Director of Academic Technology
TechSquare	Exhibitor
Texas A&M, San Antonio	Professor
The College of New Jersey	Dean, School of Science
Trinity College	Head of Digital Learning & Scholarship
Trinity College	Assistant Vice President and Chief Technology Officer
University of Kentucky	Assistant Professor; Co-PI, NSF EduceLab Mid-scale
University of Maine System	Federation and Architecture Working Group
University of Massachusetts Amherst	Associate Director of Research Computing and Data
University of Massachusetts Amherst	Director IT Architecture
University of Pittsburgh	Co-Director, Center for Research Computing
University of Pittsburgh	Vice Chancellor of Stem research and Innovation
University of Pittsburgh	Instructor / Researcher- AI and cybersecurity
University of Utah / CaRCC	Professor / Director / CaRCC Chair
Vassar College	Infrastructure Architect

9.3 ERN Steering Committee Members:

John Barden, Yale University

Maureen Dougherty, Ecosystem for Research Networking

Forough Ghahramani, Edge

John Goodhue, MGHPCC

Jim Griffioen, University of Kentucky

Vasant Honavar, Pennsylvania State University

Florence Hudson, Northeast Big Data Innovation Hub

Ron Hutchins, University of Virginia

James Kyriannis, NYSERNet

David Marble, OSHEAN

John Moore, Consultant

Carrie Rampp, Franklin & Marshall College

Bruce Segee, University of Maine-Orono

Barr von Oehsen, Pittsburgh Supercomputing Center

Yifeng Zhu, University of Maine

9.4 Summit Registration Statistics and Post-Summit Survey Results

This section highlights information about participant affiliations and results of the post-summit survey. 38% of attendees participated in the survey.

9.4.1 Summit Registration Statistics

Registration Statistics

ERN Summit 2024 Registration Statistics	
Attendees	60
Institutions	43
R1	10
Non-R1, MSIs, HBCUs, TCUs	21
Consortiums	6
RENs	2
Industry	3
Funding Agency	1

Affiliation/Institution
Advanced Robotics for Manufacturing Institute
Alcorn State University

American Indian Higher Education Consortium
Brown University
Carnegie Mellon University
Coalition for Networked Information
Columbia University
Davidson College
Denison University
Ecosystem for Research Networking
Franklin & Marshall College
Grambling State University (HBCU)
Harvard Business School
Internet2
Jarvis Christian University
Keystone REN
Lafayette College
Macalester College
Massachusetts Green High Performance Computing Center
Middle Tennessee State University, Fisk University
Minority Serving Cyberinfrastructure Consortium (MS-CC), Internet2
Morgan State University
National Science Foundation
NJ Edge
North Carolina A&T State University
Omnibond
Pennsylvania State University
Pittsburgh Supercomputing Center
Prairie View A&M University
Rice University
Rutgers University
St. Olaf College
Swarthmore College
TechSquare
Texas A&M, San Antonio
The College of New Jersey
Trinity College

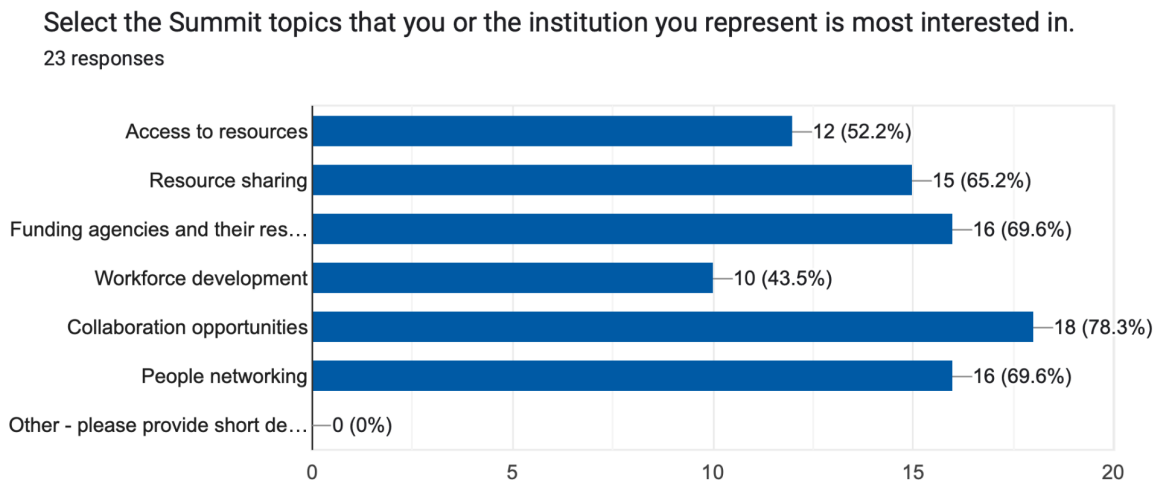
University of Kentucky
University of Maine System
University of Massachusetts Amherst
University of Pittsburgh
University of Utah / CaRCC
Vassar College

9.4.2 Post-Summit Survey Results

This section highlights the results of the post-summit survey. 23 respondents, 38.3% of Summit participants completed the survey.

Post-Summit Survey Results

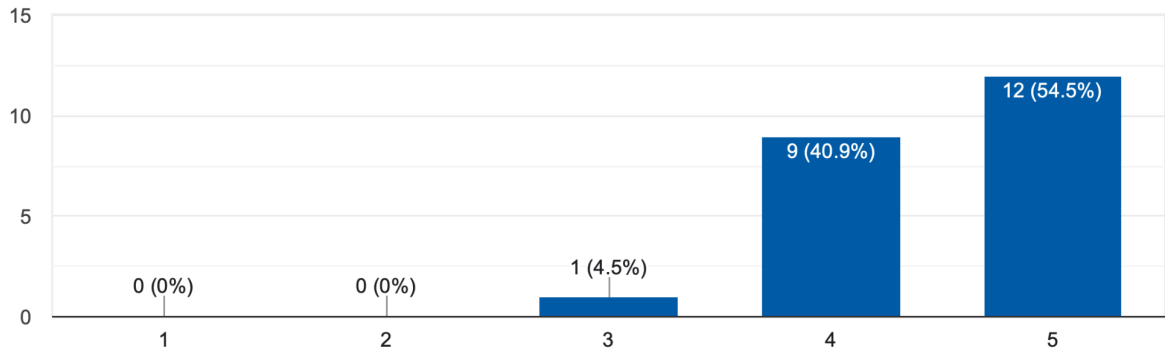
Question 1:



Question 2:

On a scale of 1-5, how useful did you find the information presented?

22 responses



Question 3:

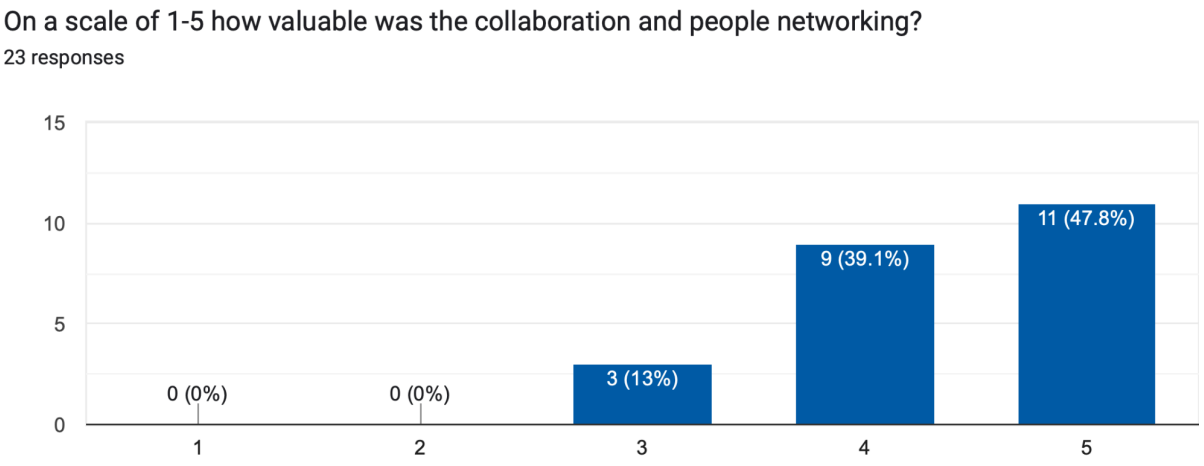
What are the primary reasons for your rate?

17 responses

Now have a better idea of resource and potential partnerships.
I wasn't present for the majority of the meeting due to a conflict, but was a presenter during a session.
I like learning about the work currently being done and also about opportunities to collaborate. Some of the presentations could have been more relatable for small colleges.
I learned of several resources that can help our researchers of which I was unaware.
In my current role, I haven't had a lot of exposure to the research-focused side of the department. The inf presented helped to provide context and fill in knowledge gaps.
I found the information on resources very useful as a smaller school that where I was uneducated about those resources. Some of the session contained information that either doesn't apply to my work at the institution or doesn't yet apply.
I mostly benefit from the people networking, rather than most of the actual presentations or panels, though conversations with individuals are, of course, influenced and informed by such presentations to a great degree.
It was pretty good, but I always like to leave room for improvement! :)
It was an excellent combination of hearing about how to apply for NSF grants, hearing what other institutions are doing with HPC, hearing about what some researchers are doing with HPC, and hearing about the cloudlet remote instrument access.

In addition to R1 institutions, there was good representation from smaller institutions, where access to resources are more constrained. This balance provides multiple perspectives to the RCD enterprise. Liked the panel question where it was asked what smaller institutions do that is more effective than the larger institutions. It was useful to have the representation from the program officers to highlight new opportunities and emerging federal funding trends.
Good content, good discussions.
Good information sharing.
Interesting and relevant.
The people who were there had a wide range of experience and were from widely varied types of institutions. It was great to hear all of these perspectives, and to talk with such a varied group.
Information discussed and shared were relevant, concise and demonstrated.
I felt like these things were accomplished.
I learned a lot about a whole range of topics.

Question 4:



Question 5:

What are the primary reasons for your rating?

18 responses

Small group made for easy networking.
I was able to attend some networking sessions and it was a great convening.
Everyone seemed to be interested and eager to get to know about others.

Diverse group of thinkers.
Again, in my current role, the collaborative and networking aspects provided weren't useful. I would imagine this will change for me in the future and I know the opportunity is very valuable.
It was great to put faces to programs so I can follow up about resources. I also found a few other attendees that were also from smaller institutions like mine and look forward to developing relationships with them.
This is the "true" benefit of the event, at least for me. The opportunity to connect with others against the backdrop of the event is invaluable.
Met new colleagues to develop new collaborations
It was pretty good, but I always like to leave room for improvement! :)
I'm relatively new to my position (one year), and the small size enabled me to get to know folks and chat with them. I was able to have some excellent in-depth conversations at the reception and to also meet some folks when we grouped up on Friday.
The breakout session where R1 and smaller institutions brainstorm about strengths, challenges and opportunities was enlightening. Learned that what makes smaller institutions from R1s is not simply about scaling. There's also the ecosystem of the community interacting with RCD.
Good to talk to and share with folks.
The arrangement of the workshop is very professional.
I made several excellent contacts that made the time and trip worthwhile.
Same as the previous answer: much variation.
Many attendees were not friendly and welcoming.
Met quite a few people for potential future projects.
Good networking opportunities. Met a wide range of folks.

Question 6:

What do you think is the most important piece of information that the funding agencies should take away from the Summit, and how this would impact you and/or your constituents?

16 responses

The challenges faculty from R1 grad schools face when taking a job at a small college.
I believe the funding agency recognizes the importance of Supporting initiatives from colleges that are "outliers". Non-R1 & R2 universities could become implementing and outreach partners for larger fund recipients.
Consider the variations in the different situations and institutions.

Funding agencies should recognize that the grant process is unintentionally biased towards larger institutions where there is more institutional support for writing proposals. Need to either have a lighter-overhead process for smaller institutions, or offer resources to help researchers from smaller institutions with the proposal process.
There is still a lack of understanding of what programs are out there and who is eligible for what kind of support. Continuing to find growing ways of education institutions about what is available is an important message.
There needs to be...something, such as greater resources, trainings, or just recognition that smaller institutions (non-R1s) face different challenges than R1s when seeking funding. Boutique science drivers, insufficient FTEs or experience, and so on make for a difficult landscape that must be navigated differently, and the solicitation and review processes should somehow reflect that.
Some grants are "inaccessible" to smaller institutions because of the person-time involved in applying for them, as well as the skills and background needed to do so.
I think the varied ways in which smaller institutions use research computing and the various levels of resources. I'm not sure how this knowledge would affect my constituents.
The democratizing of RCD goes beyond just access to hardware and software resources. There is also the people support component, including the domain facilitators who can speak the language of the science as well as the technology. Democratizing access to expert help will be the next "frontier". However, these expert help are in short supply while the demand is high. The funding agencies should invest more towards workforce development to bridge this gap.
There is a lot of work still to be done from this community.
NSF PD’s presentation.
The funding agencies should simplify their process and promote their opportunities better.
The hardest thing for us to get funding for is a FTE. We are relatively small and so the SCIPE program might be too big for us. We would benefit greatly with a smaller dollar amount per award, but with more awards.
Networking.
I feel like it was the resources available to small institutions. Without the knowledge of them small schools don't stand a chance.
The effort for a small institution to apply for a major federal award, like CC* is herculean and is usually undertaken entirely by just a couple of individuals. There is no team of grant writers or sponsored research office to aid you. Having examples, particularly of the auxiliary components required from grant seekers would be really helpful. Similar to esnet for CI plans.

Question 7:

What would you recommend as the next focus area or project for the ERN and why?

16 responses

n/a
A workforce development grant development in AI, with member universities as partners.
I'm relatively new to ERN so will have to give it some thought. I mostly work with computer science, computer engineering, and electrical engineering researchers. Access to environments that can be used for cloud-scale modeling, cloud security research, hardware optimization, etc. is of great interest.
Not sure that I have a solid recommendation on that at this time.
Dimensions of "AAA" (access, authorization, and authentication) and how that can be deployed in an almost "cookbook" like manner so that (especially smaller) institutions can share and access CI resources and scientific equipment much more smoothly than is now possible, again cognizant of the more limited resources.
Quantum education and leverage,
Economies of scale by resource sharing (HPC, training, and otherwise) across institutions.
In particular, we have quite a number of undergrads who do research computing for their major and/or for summer research. It would be interesting to hear how other institutions use it in their undergrad programs.
Need to go beyond "proof of concept" into production environment examples. Real-world production scenarios will force the question about identity and access management, cost models, data policies, governance surrounding shared infrastructure, workforce training, and sustainability.
Small institution support. Because they need help.
Partnering with regionals for collaboration or working to enable technology and resource needs.
Invite moreR1 institutions with active grants for small institutions to join.
Research in population health management and cybersecurity.
More of the same.
Getting more faculty members involved.
I'd like to see some clearer ways for R1s and others to collaborate or find possible partnerships. Like speed dating?

Question 8:

Please identify what aspects of the Summit were most valuable to you and why.

19 responses

n/a
Networking - direct engagements with individuals and groups at networking events spurs collaboration, enriches our "soft" interpersonal skills, and also helps to point others in the directions to capabilities that may enhance their work or the work of their constituents.
The visit to the Cloud lab.
Keynote was excellent. Topics were important and well handled.
The CryoEM workshop was excellent for me, despite not being able to walk through the installation. I was very much looking forward to the Cloud Lab tour, but could not make it due to scheduling conflicts with my return flight.
The presentation about programs that are out there and a solid summary of what they can do and who they are for. Also appreciated the demonstration of the ERN CryoEM Remote Instrument Access. Would have been better if we had been able to do a true live demo obviously.
Again, the people networking.
The keynote and all the panels, the collaboration exercise and the cloud lab tour were all very valuable.
Networking with people, getting an idea of the challenges others are facing (similar to ours!), skill-sharing! The casual conversations in between events were actually the most valuable parts of the conference for me.
The reception for networking, the sessions (all of them, really), Friday session where we brainstormed and worked in groups.
I enjoyed the CloudLab tour: spurred discussions about the future of work, automation, and workforce training.
Discussion around smaller institutions.
Exposure to a variety of resources and entities and being able to have some additional deeper dives into some of the specific resources.
Networking.
The session on AI and Quantum Computing. It aligned with my research interest.
Meeting with NSF officers in formal and informal environments was extremely helpful. Talking with people from MSIs and HPCs was great too. We have some similarities, despite one of our Universities now being an R1. It is helpful to hear how obstacles are being worked on.
Q&A
Access and resource sharing as well as information on what the panels were doing.
Interacting with funding agency personnel in a small group setting.

Question 9:

Please add final comments you wish to share with the ERN Steering Committee.

14 responses

The question asked repeatedly was "where can I go to get access to resources for a small college". Good discussion but no actual answer, since this is no, one place. What we need is a repository of resources, details, cost, contact info, etc. We heard from many, but we need something structured. I imagine this as a place where everyone, including small colleges that might have special resources they're willing to share, could add an entry. I'd be interested in helping think about how to put something like this together. cdr@stolaf.edu.
Thank you for having me.
Thank you, overall it was a very delightful experience. Please keep doing these!
Looking forward to future opportunities to participate.
A suggestion for a future event would to get approval from everyone beforehand to share the attendee list and contact information. The networking part of ERN would be well served if we could know all who attended and from where instead of just the subset that there was time to meet during the conference.
Many presenters were long-winded or delivered content that felt "off the mark" for the given focus of the panel or overall event. I appreciate the more casual feel of the Summit, but there should be better enforcement of time limits and topical content.
Excellent session! Looking forward to the follow up!
Great conference! Order better weather next time, OK? :-) Thanks for all of your work. Nice to meet all of you.
To some extent, it felt like many folks knew each other. I knew a couple of people from having met with them virtually, but did not know any others. I might have missed morning introductions, but it might have been nice to have some sort of simple icebreaker for folks to get to know each other (maybe even the first day at lunch for people who couldn't get there by 9). I loved that it was an easy walk from the hotel (I stayed at the Hilton). The one downside was being in a building all day with zero windows (all the blinds were drawn and many rooms were windowless), which made me a bit nuts, and few places to have a call or online meeting. One of the PSC folks allowed me to use their office (which was so generous!) for one of my online meetings.
Y'all did a great job putting this all together, congratulations!
Very good workshop for small institutions.
Great job and thank you for your hard work in putting this together.
I really appreciated the effort that was put into the organization of the event. I especially appreciated that there was vegan food available at each break/meal/event. It is rare that I don't have to go elsewhere to get a meal/snack to supplement.
Hats off to the organizers. The event was well managed and delivered.

9.4.2 Post-Summit Feedback by Email

This section highlights the feedback received by email from attendees.

Post-Summit Feedback by Email

Thanks so much for reaching out and for inviting me to speak at ERN. I enjoyed connecting with everyone there. Glad to hear the message was well received. Hopefully, it will serve as stimulus for us to think about how we can work together to accelerate progress during this critical time for our nation.
Congratulations again on a successful Summit. So thrilled to have been invited. I enjoyed connecting with everyone.
Thanks for inviting me! It was fun to meet everyone and talk about some very cool work to democratize our workforce!
It has been nice meeting you in person. and congratulations on a very successful meeting. I really enjoyed the program and found discussions and talks very helpful. Great also for networking. Having opportunity to talk to NSF program directors was also very great. Also, sincerely gratitude for including us and the opportunity to present. Very grateful!
Thank you for organizing this large and interesting panel. I'm sure there will be collaborations and engagements come out from this panel/meeting.
Thank you so much for inviting me and I had a good time attending ERN. Sorry of not being able to send you my appreciation email earlier
Thank you for the opportunity to speak and interact with this very important group of schools.
It was a great opportunity to listen to valuable perspectives we don’t always hear in other venues. Looking forward to the meeting report!
Thanks for inviting us to the meeting. I enjoyed being at the meeting and learning about this community.
Thank you for inviting us to the meeting that resulted in new networking contacts and potential future opportunities. It was truly a professional honor and privilege to engage and interact with faculty from various organizations and MSIs. The tour of the CMU Cloud Lab was a perfect ending to a successful meeting.”
The Cathedral of Learning tour was awesome! I’m so glad you included it in the agenda!
I'd really like to thank you and the others at ERN for putting this meet-up on. I have a lot of information to go over and I know that there will be a lot of productive discussions moving forward. I appreciate all the hard work that you put into this.
Thank you for all your great leadership and operational support to make a great ERN summit come true! And thank you for including me. I look forward to following up on several potential collaboration opportunities.

What made the summit unique was the balance between sessions and networking, mix of types of institutions, and the different roles that were represented by research, research computing, academic administrators, CIO's, NSF program directors.