Community of Communities: A Working Group Enhancing Interactions Between Organizations and Projects Supporting RC Professionals

Sandra Gesing
Discovery Partners Institute
University of Illinois System
Chicago, IL, USA
sgesing@uillinois.edu

Julie Ma
Massachusetts Green
High Performance Computing
Holyoke, MA, USA
jma@mghpcc.org

Henry Neeman
University of Oklahoma
Norman, OK, USA
hneeman@ou.edu

Laura Christopherson
University of North Carolina at Chapel Hill
USA
laura@renci.org

Dirk Colbry
Michigan State University
USA
colbrydi@msu.edu

Maureen Dougherty
Ecosystem for Research Networking
USA
maureen.dougherty@ernrp.org

James Griffioen
University of Kentucky
USA
griff@netlab.uky.edu

Susan Tussy
The University of Chicago
USA
stussy@uchicago.edu

Alycia Crall
The Carpentries
Oakland, CA, USA
community@carpentries.org

John Goodhue
Massachusetts Green
High Performance Computing
Holyoke, MA, USA
jtgoodhue@mghpcc.org

Rafael Ferreira da Silva
Oakridge National Laboratory
USA
silvarf@ornl.gov

Kyle Chard
The University of Chicago
USA
chard@uchicago.edu

Marisa Brazil
Arizona State University
USA
Marisa.Brazil@asu.edu

Thomas Cheatham
University of Utah
USA
tec3@utah.edu

***Abstract*—Currently, there are many Research Computing (RC) communities that support RC professionals by providing opportunities for connecting and collaborating with peers, sharing information, and developing professional skills. However, the RC landscape is vast, and a newcomer to the RC profession can easily become lost trying to understand where s/he best fits. The Community of Communities (CoCo)[1] is a working group whose purpose is to act as a bridge connecting these RC communities, and to provide RC professionals with a map for navigating the RC landscape. CoCo includes representatives from across the RC landscape, including individuals that participate in the Science Gateways Community Institute (SGCI), the National Science Foundation (NSF) Center of Excellence for Science Gateways (SGX3), the NSF Advanced Cyberinfrastructure Coordination Ecosystem: Services and Support (ACCESS) program, the US Research Software Engineer Association (US-RSE), Campus Research Computing Consortium (CaRCC), Virtual Residency, Campus Champions, The Carpentries, the Workflows Community Initiative and more. This paper introduces CoCo and provides a brief overview of its history, goals, and activities, and extends an invitation to other RC communities and RC professionals to participate in CoCo and take advantage of CoCo services.**

***Index Terms*—communities, RC professionals, working group, education, training, collaboration**

I. Introduction

Novel hardware, software and advanced cyberinfrastructure is enabling researchers to answer questions that could not even have been asked 20 years ago, without the methods, data, and computational resources available today in Research Computing (RC). RC professionals and their knowledge are crucial for accelerating research that relies on such computational methods - from complex research infrastructures to science gateways to lab instruments. The Campus Champions [1], for example, were founded in 2008 with the goal to provide support for researchers using Teragrid[2] high performance computing (HPC) resources. Teragrid evolved into XSEDE[3] which in turn evolved into ACCESS[4] and the Campus Champion community of experts has grown to over 800 members, with collective expertise extending far beyond HPC. The US Research Software Engineers Association (US-RSE) [2] has grown from 20 members in 2018 to over 1800 in 2023.

[1]CoCo Community of Communities website - https://coco.cyberinfrastructure.org/

[2]https://www.teragrid.org/

[3]https://www.xsede.org/

[4]https://www.access-ci.org/

While the need for RC professionals is becoming increasingly important, appreciation of these professionals is not growing commensurately, and the RC landscape often lacks incentives and valuable career paths for RC professionals.

This gap has been recognized, and many organizations and initiatives have started to form and be funded in support of RC professionals. As mentioned above, the Campus Champions and US-RSE are part of this ecosystem. Another early RC project, the Advanced Cyberinfrastructure - Research and Educational Facilitation (ACI-REF)[5] project was funded in 2014 with the goal of analyzing the gaps in the RC ecosystem and the steps needed to improve the situation for RC professionals. In 2015, the Virtual Residency Program [3] started to offer a week-long training for RC professionals with topics ranging from communication between researchers and RC professionals to an overview of the RC ecosystem. The Science Gateways Community Institute (SGCI) [4] was funded in 2016 and its services have been extended and partially taken over by the NSF Center of Excellence for Science Gateways (SGX3) since 2022. Services include a week-long Focus Week that provide training on sustainability of projects [5], workforce development with hackathons, internships and a coding institute for science gateway creators.

The community of RC professionals continues to grow steadily, as does the companion community of supporters and allies. With this growth, the ecosystem is becoming increasingly complex and difficult to understand and navigate. Thus, there is a demand for initiatives to maximize the positive impact on the community and to avoid redundant efforts. While each project has its own focus and strengths, collaborations can lead to synergistic effects and activities that can complement one another.

To address this need, the *Community of Communities (CoCo)* working group[6] was formed as an outcome of the 2020 NSF Cyberinfrastructure Workforce Development Workshop[7]. We will present CoCo's goals and sample member communities in the next two sections and we will conclude with next steps planned for the near future.

II. How CoCo Works

CoCo's goal is to better understand the array of RC communities available to RC professionals, and to provide a map of these organizations to help newcomers to better acclimate to what is a very rich and vast landscape. The CoCo $website$[6] serves as this map, and any RC community is welcome and encouraged to create a listing on the site. A community's listing may contain their website URL, a brief description of the group, the community's logo, and a means to contact community representatives. This information is not automatically harvested from the community's website, but instead is owned and managed by the community itself, thus giving each community complete control over the message it chooses to send to the broader community.

[5]https://aci-ref.github.io/

[6]https://coco.cyberinfrastructure.org/

[7]https://www.rcac.purdue.edu/ciworkforce2020/

The backbone of the CoCo website is the Connect.Cyberinfrastructure.org (ConnectCI) community management platform[8]. Communities utilize the ConnectCI Tag Taxonomy to classify and describe their organization to CoCo website visitors [6]. This enables site visitors to understand the specializations of each community and what is unique about each community, which in turn helps visitors to better assess where they fit and how they can contribute.

The CoCo team also curates a list of training opportunities and community events that RC professionals may wish to participate in. The CoCo website will soon include this event information thereby providing a central location for these opportunities that spans multiple community websites. Currently, this information is collected by ACCESS Support and the Campus Champions, which also utilize the ConnectCI platform, and can be found on respective events pages of these websites.

By listing RC communities and aggregated community events, the CoCo website acts as a central hub for community-wide information, serving as a welcome mat at the door to the RC landscape. The goal is not to duplicate the efforts of other groups but instead to direct individuals to the communities and events that best match their interests.

Currently, the CoCo team meets biweekly and business includes discussion of outreach activities designed to engage other communities; how best to promote member RC communities and connect professionals to them; and plans for broadening CoCo services and resources. Representatives from all member communities are welcome to participate.

III. The Different Faces of CoCo

As stated previously, the CoCo team includes representatives from a growing list of RC communities. Each representative brings their community's voice to the table and advocates for their community's needs which then determines the initiatives CoCo pursues. Key contributors currently include ACCESS[9], Ask.CI[10], Campus Champions, Campus Research Computing Consortium (CaRCC)[11], the Carpentries[12], CyberAmbassadors[13], the Ecosystem for Research Networking (ERN) [7], [8], Massachusetts Green High Performance Computing Center (MGHPCC)[14],SGX3/SGCI[15], US-RSE[16], Virtual Residency[17], Workflows Community Initiative[18]. A sampling of these communities appears below.

A. ACCESS

The NSF-funded Advanced Cyberinfrastructure Coordination Ecosystem of Services and Support (ACCESS) program

[8]https://connect.cyberinfrastructure.org/

[9]https://access-ci.org/

[10]https://ask.cyberinfrastructure.org/

[11]https://carcc.org/

[12]https://carpentries.org/

[13]https://sites.google.com/msu.edu/cyberambassadors/?pli=1

[14]https://www.mghpcc.org/

[15]https://sciencegateways.org/

[16]https://us-rse.org/

[17]http://www.oscer.ou.edu/virtualresidency.php

[18]https://workflows.community/

encompasses a large and broadly-defined research computing community. The community is supported by the ACCESS Support [9] group which functions as the researcher-facing arm of ACCESS. ACCESS Support (1) leverages modern information delivery systems to simplify user interfaces; (2) leverages experts from the community to develop training materials that can dramatically reduce the researcher learning curve; and (3) employs a matchmaking service that strives to maintain a database of specialist consultants, mentors and student-facilitators that can be matched with projects to provide the domain-specific expertise needed to effectively use ACCESS resources.

B. Ask.CI

Ask.CI [10] seeks to streamline knowledge sharing and encourage self-service learning through centralized aggregation of experience, lessons learned and best practices, by encouraging respectful discussion on research computing topics. Through frequent updates to relevant topics, the goals for this site are to have answers to most "of the moment" research computing questions asked by the community and that these answers will show first in search engine results.

C. Campus Champions

The Campus Champions are a group of 800+ RC professionals at 300+ US colleges, universities, and other research-focused institutions, whose role is to help researchers at their institutions to use research computing, especially (but not exclusively) large scale and high-end computing. Champions peer-mentor each other by exchanging ideas and helping each other solve problems.

D. Campus Research Computing Consortium

The Campus Research Computing Consortium is an organization of dedicated professionals developing, advocating for, and advancing campus research computing and data* and associated professions. Current focus areas include building community among research computing and data professionals, connecting the broader research computing and data ecosystem, professionalization and workforce development, and defining stakeholders and shared value propositions for the community at a time of accelerating change.

E. The Carpentries

The Carpentries is an international community that builds capacity for training in foundational computational and data science skills. Instructors, certified through the organization, create welcoming learning environments and deliver training on a range of topics across multiple domains.

F. CyberAmbassadors

The National Science Foundation (NSF)-funded CyberAmbassadors program is focussed on building the professional skills necessary for success in interdisciplinary research teams. The CyberAmbassadors curriculum offers more than 20 hours of training in communications, teamwork, and leadership skills, with a focus on training STEM (science, technology, engineering, math) students and professionals. Participants who complete the full training program are recognized as Certified CyberAmbassadors, prepared to mentor and educate their peers and colleagues, and help build collaborative teams to promote the adoption of advanced infrastructure for scientific research.

G. Ecosystem for Research Networks (ERN)

The Ecosystem for Research Networking (ERN[19] is a consortium of universities and regional network providers with a vision to simplify, support, catalyze, and foster multi-campus collaborations and partnerships between academic institutions that advance the frontiers of research, pedagogy, and innovation. The ERN strives to provide standards, blueprints, policies, and training associated with the design and implementation of a democratized cyberinfrastructure within a distributed federated environment. Working groups engage with the research community through various outreach activities, and share pilot project developments through a Github repository.

H. Massachusetts Green High Performance Computing Center (MGHPCC)

An intercollegiate high-performance computing facility, the MGHPCC[20] is a joint venture of Boston University, Harvard, MIT, Northeastern, and the University of Massachusetts system with three principal objectives: fostering collaborative computationally intensive research, operation of a data center dedicated to research computing, and positive impact in the underserved community where the data center is located. The MGHPCC user community spans more than 20,000 faculty and students, more than a dozen small and mid-sized institutions, and numerous cross-institutional research collaborations. The MGHPCC also hosts the ConnectCI community management platform and leads the ConnectCI Alliance and Ask.CI.

I. SGX3/SGCI

Launched in 2022, SGX3 is a 5-year NSF Center for Excellence on Science Gateways. SGCI is the NSF Science Gateways Community Institute, funded from 2016-2023, that will continue to offer client-funded services such as UX evaluation and design engagements to the community. SGX3 services include i) technology design and selection to help researchers building science gateways to do so leveraging existing technologies where possible; ii) user experience design to ensure that science gateways offer the lowest possible barrier to their users; iii) educational services to train science gateway professionals on sustainability and good practices for software engineering; iv) workforce development to train faculty about science gateways and their students to become science gateway developers; v) outreach activities and a conference series to catalyze the science gateway community; and vi) forward looking activities to develop roadmaps that address the next

[19]Ecosystem for Research Networking - https://www.ernrp.org/

[20]Massachusetts Green High Performance Computing Center - http://www.mghpcc.org/

generation science gateway technology advances necessary to support new areas of science and engineering.

J. US Research Software Engineers (US-RSE)

US-RSE is a community-driven effort focused on the increasingly important role of the Research Software Engineer. It focuses efforts on four overarching goals: Community, Advocacy, Resources, and Diversity, Equity, and Inclusion (DEI). The US-RSE Association is committed to providing an inclusive environment with equitable treatment for all and to promoting and encouraging diversity throughout the RSE community in the US.

K. The Virtual Residency Program (VRP)

The VRP trains pre-service and in-service Research Computing and Data Facilitators, focusing primarily on professional/interpersonal skills and only secondarily on technical skills. Founded in 2015, the VRP hosts an annual weeklong summer workshop as well as several apprenticeships on Grant Proposal Writing, Paper Writing and Grant Running, because many RC Facilitators come from non-research-intensive background, including enterprise IT and RC professionals who haven't engaged in the full spectrum of research tasks.

L. Workflows Community Initiative

The Workflows Community Initiative is a collaborative effort aimed at advancing the state-of-the-art in workflow systems and related technologies. The initiative brings together researchers, developers, and practitioners to foster communication and collaboration on important issues related to workflow management, including workflow design, execution, monitoring, optimization, and interoperability. One of the key activities of the initiative is the Workflows Community Summits, which are international workshops that provide a forum for participants to share their experiences, discuss emerging trends and challenges, and develop new collaborations [11].

IV. Outlook

CoCo continues to identify ways to provide linkages across RC communities and leverage existing RC community resources. Besides extending the list of communities on the website, we will share a calendar of events organized by the different communities. Future plans also include providing a knowledge base (drawing from ConnectCI) of research computing resources on the CoCo website. CoCo also intends to make the job boards from ConnectCI and US-RSE available on the website. In this way, the CoCo website will provide a central place for accessing RC ecosystem knowledge. The different communities vary in their interconnection and CoCo can contribute to a closer collaboration. Currently, we are relying on volunteer work and we will aim at applying for seed funding to support some of the effort of the working group.

Acknowledgment

We acknowledge MGHPCC for providing the CoCo website. https://coco.cyberinfrastructure.org/. The Ecosystem for Research Networking is supported by the National Science Foundation CC* CRIA Eastern Regional Network planning grant (OAC-2018927).

References

[1] M. Brazil, D. Brunson, A. Culich, L. DeStefano, D. Jennewein, T. Jolley, T. Middelkoop, H. Neeman, L. Rivera, J. Smith, and J. Wernert, "Campus champions: Building and sustaining a thriving community of practice around research computing and data," in *Proceedings of the Practice and Experience in Advanced Research Computing on Rise of the Machines (Learning)*, ser. PEARC '19. New York, NY, USA: Association for Computing Machinery, 2019. [Online]. Available: https://doi.org/10.1145/3332186.3332200

[2] J. C. Carver, I. A. Cosden, C. Hill, S. Gesing, and D. S. Katz, "Sustaining research software via research software engineers and professional associations," in *2021 IEEE/ACM International Workshop on Body of Knowledge for Software Sustainability (BoKSS)*. IEEE, jun 2021.

[3] H. Neeman, A. Bergstrom, D. Brunson, C. Ganote, Z. Gray, B. Guilfoos, R. Kalescky, E. Lemley, B. G. Moore, S. K. Ramadugu, A. Romanella, J. Rush, A. H. Sherman, B. Stengel, , and D. Voss., "The advanced cyberinfrastructure research and education facilitators virtual residency: Toward a national cyberinfrastructure workforce." in *Proceedings of the XSEDE16 Conference on Diversity, Big Data, and Science at Scale - XSEDE16*. New York, NY: ACM Press, 2016. [Online]. Available: https://doi.org/10.1145/2949550.2949584

[4] S. Gesing, N. Wilkins-Diehr, M. Dahan, K. Lawrence, M. Zentner, M. Pierce, L. Hayden, and S. Marru, "Science gateways: The long road to the birth of an institute," in *Proceedings of HICSS 2017*, 01 2017.

[5] S. Gesing, M. Zentner, J. Casavan, B. Hillery, M. Vorvoreanu, R. Heiland, S. Marru, M. Pierce, N. Mullinix, and N. Maron, "Science gateways incubator: Software sustainability meets community needs," in *2017 IEEE 13th International Conference on e-Science (e-Science)*, 2017, pp. 477–485.

[6] J. Ma, S. Akbar, T. Battelle, K. Brandt, E. Brown, D. Brunson, D. Chakravorty, T. Cheatham, B. Chitre, A. D. Maestro, A. Elledge, V. Gazula, J. Goodhue, J. Griffioen, A. Hyde, D. Jennewein, S. Knuth, B. Lougee, T. Middelkoop, S. Mohapatra, S. Najafi, K. Nelson, L. Perez, B. Segee, J. Sheats, A. Sherman, C. Simmons, E. Toto, S. Valcourt, L. Varella, and R. Zottola, "The connect.cyberinfrastructure portal: Creating opportunities for collaboration and cohesion in the research computing ecosystem," in *Proceedings for Practice and Experience in Advanced Research Computing (PEARC)*. New York, NY: ACM Press, 2021. [Online]. Available: https://doi.org/10.1145/3437359.3465606

[7] F. Ghahramani, J. Hicks, and J. B. von Oehsen, "Broadening the reach for access to advanced computing: Leveraging the cloud for research," in *Proceedings of the Practice and Experience in Advanced Research Computing (PEARC'22)*. New York, NY: ACM, 2022. [Online]. Available: https://doi.org/10.1145/3491418.3535143

[8] M. Dougherty, M. Zink, J. B. von Oehsen, K. Dalenberg, D. Balamurugan, J. Kaelber, J. Schafer, J. Goodhue, W. Hey, M. Ludwig, B. Wilson, and C. McKnight, "The ERN Cryo-EM Federated Instrument Pilot Project," in *Proceedings of the Practice and Experience in Advanced Research Computing (PEARC'22)*. New York, NY: ACM, 2022. [Online]. Available: https://doi.org/10.1145/3491418.3535141

[9] S. L. Knuth, J. Ma, J. C. Adams, A. Chalker, E. Deelman, L. Freeborn, V. Gazula, J. Goodhue, J. Griffioen, D. Hudak, A. Pasquale, D. Perkins, A. Romanella, , and M. Rynge, "The Multi-Tier Assistance, Training, and Computational Help (MATCH) Project, a Track 2 NSF ACCESS Initiative," *Journal of Computational Science Education*, vol. 13, no. 2, pp. 17–20, December 2022. [Online]. Available: https://doi.org/10.22369/issn.2153-4136/13/2/4

[10] J. Ma, T. Battelle, K. Bulekova, A. Culich, J. Goodhue, J. Pessin, V. Sochat, D. Brunson, T. Cheatham, S. Najafi, C. Hill, A. D. Maestro, B. Segee, R. Zottola, S. Valcourt, Z. Braiterman, R. Singh, R. Thoelen, and J. Smith, "Ask.cyberinfrastructure.org: Creating a platform for self-service learning and collaboration in the rapidly changing environment of research computing," *The Journal of Computational Science Education*, vol. 12, pp. 37–40, Feb. 2021.

[11] R. F. da Silva, R. M. Badia, V. Bala, D. Bard, P.-T. Bremer, I. Buckley, S. Caino-Lores, K. Chard, C. Goble, S. Jha, and et al., "Workflows Community Summit 2022: A Roadmap Revolution," Mar. 2023. [Online]. Available: https://doi.org/10.5281/zenodo.7750670