The Engagement and Performance Operations Center: EPOC

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Overview:
Over the last decade, the scientific community has experienced an unprecedented shift in the way research is performed and how discoveries are made. Highly sophisticated experimental instruments create massive datasets for diverse scientific communities and hold the potential for new insights that will have long-lasting impacts. However, scientists cannot make effective use of this data if they are unable to move, store, and analyze it.

The **Engagement and Performance Operations Center** is a collaborative focal point for operational expertise and analysis jointly led by Indiana University (IU) and the Energy Sciences Network (ESnet). EPOC provides researchers with a holistic set of tools and services needed to debug performance issues and enable reliable and robust data transfers. By considering the full end-to-end data movement pipeline, EPOC is uniquely able to support collaborative science, allowing researchers to make the most effective use of shared data, computing, and storage resources to accelerate the discovery process.

Main Project Activities
Supporting the process of scientific innovation must be done in a systematic fashion. It is not feasible to address a single component without understanding how it interacts or works with others. Network infrastructure forms a "circulatory system" for science and links the facilities that produce, process, store, and serve research products and address issues of data mobility across the entire system.

EPOC supports five main activities:
- *Roadside Assistance* via a coordinated Operations Center to resolve network performance problems with end-to-end data transfers reactively;
- *Application Deep Dives* to work more closely with application communities to understand full workflows for diverse research teams in order to evaluate bottlenecks and potential capacity issues;
- *Network analysis* enabled by the NetSage monitoring suite to proactively discover and resolve performance issues;
- *Encapsulated Network Services* (aka Services in a Box)that provide managed data services via support through the IU GlobalNOC and our Regional Network Partners;
- *Coordinated training* to ensure effective use of network tools and science support.

A Community for Community Support
EPOC can not only deliver appropriate end-to-end user support and engineering solutions but is a central community hub that provides personal expertise and assistance on an ongoing basis. Through our targeted partnerships, this Center has the potential to benefit nearly all of US science, research, and education on a far broader scale than any one organization can accomplish alone.
Many researchers at larger educational institutions, or part of large-scale collaborations, already have access to significant in-house resources, so we focus on small or medium-sized

institutions and collaborations that may lack the financial and human resource capacity for more advanced services. By working with the regional networks to develop, teach, and making available additional instructive material to these institutions, we not only increase the abilities of the teams we are in direct contact with but we also provide a broad set of materials to the general public.

Our initial collaborators include Regional Network Partners, with whom we will develop a sustainable approach to support services. The initial Regional Network Partners include:
- The Indiana State Network (I-Light);
- The Ohio State R&E Network (OARnet);
- The Keystone Initiative for Network Based Education and Research (KINBER);
- The Great Plains Network (GPN);
- The Texas State R&E Network (LEARN); and
- The Front Range Gigapop (FRGP).

We have also identified a set of Infrastructure Partners who themselves provide services to end user scientists to expand the set of services available to the community, including:
- The Campus Research Computing Consortium (CaRC), a consortium of over 30 campuses that facilitate access to cyberinfrastructure;
- The NSF Cybersecurity Center of Excellence (CCOE), which supports cybersecurity for NSF funded projects;
- Internet2, which supports solving common technology challenges for their over 200 educational, research and community members;
- The Quilt, which provides a central organization for networks to share the best practices to support end user science;
- The Science Gateway Community Institute (SGCI), which provides best practice recommendations and support for scientists building and using data portals; and
- The Extreme Science and Engineering Discovery Environment (XSEDE), which supports a single virtual system and expertise through the Campus Champions.

In addition, our Science Community partners, each of which comprises a collaboration of scientists, allow us to scale our reach to entire community groups. These partners include:
- The Earth Science Information Partners (ESIP), a consortium of over 180 members that provides a forum for the Earth science data and technology community;
- The World Climate Research Programme's International Climate Network Working Group (ICNWG), which supports thousands of scientists through using the Earth System Grid Federation's (EGSF) globally distributed climate data repository sites;
- The IU Grand Challenge Precision Health Initiative, which works with a broad set of precision health applications;
- The University of Hawai'i System Astronomy Community, which supports 15 facilities with hundreds of researchers and experiments every year;
- The Midwest Big Data Hub (MBDH), which supports the use of data for a variety of applications and end users across twelve states; and
- The Open Storage Network (OSN), which will support dozens of applications across a broad set of application domains.

The Engagement and Performance Operations Center will be transformational to science and education by providing not only a depth understanding to achieve better data transfers but also the human expertise needed to make the most of research collaborations.

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