NIST - National Standards Strategy for Critical and Emerging Technology - Listening session

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Sandra Gesing: “Science Gateways: Accelerating Research and Education via Collaboration Platforms”

Many thanks for everyone organizing these listening sessions on the national standards strategy for critical and emerging technologies. I am a Co-PI in the Center of Excellence on Science Gateways, a senior researcher at the San Diego Supercomputer Center and the Executive Director of the US Research Software Engineer Association.
I am honored to be here today to discuss science gateways as a standard concept. In the ever-changing landscape of critical and emerging technologies, science gateways play a crucial role in accelerating research, fostering collaboration, and democratizing access to advanced computational resources.
Science gateways are a concept that describes collaboration platforms that allow researchers and educators to access shared data, software, computing services, instruments, and educational resources. You might have heard about them as virtual research environments, research portals or virtual labs. The overarching goal is to accelerate science and make the life of researchers and educators easier by letting them focus on their core topics instead of the nitty-gritty details of complex research infrastructures. By providing a centralized platform for data sharing, collaborative analysis, and resources, gateways enable cross-disciplinary partnerships. This collaborative approach is essential for tackling complex challenges that span multiple domains. I’m citing NSF here: “The grand challenges of today -- protecting human health; understanding the food, energy, water nexus; exploring the universe at all scales -- will not be solved by one discipline alone.” Science gateways ensure that researchers, regardless of their geographical location or institutional affiliation, can use advanced technologies. This allows for inclusion and diversity in research and innovation.
Science gateways are designed to allow seamless integration with different research infrastructures and novel technologies. Thus, they allow for a fast adoption of cutting-edge solutions and emerging technologies. Researchers and educators can continue to stay in the computational work environment they are used to while being enabled to access such solutions.

Hubzero, Tapis and Galaxy are examples of science gateway frameworks that are mature and serve together millions of users. There are many instances tailored to the needs of different communities such as nanoHUB for the nanotechnology community or MyGeoHub for the geospatial research community. QubitHub is a prototype of a science gateway for quantum computing. It includes the QInterpreter that can translate algorithms for five different quantum architectures automatically so that users do not have to adapt the algorithm for each architecture. The user can use the platforms IBM Qiskit, Amazon Braket, Cirq, PyQuil and PennyLane.

Research in the area of science gateways includes research areas for critical and emerging technologies in their own right: cybersecurity, privacy, usability, UX - user experience, workflows,

resource allocation, reproducibility, to name a few. Science gateway research addresses the full stack of collaboration platforms from backend services accessing computational resources to middle layers for managing simulations to frontend services and user interfaces.

Critical and emerging technologies are unthinkable without AI nowadays. The combination of AI and science gateways has many beneficial aspects. Science gateways can act as enablers, providing researchers with seamless access to AI tools and resources such as machine learning algorithms and deep neural networks. Science gateways can simplify the complexity of AI applications, making them more accessible to a broader scientific community.
On the other hand, AI technologies can enhance the functionality of science gateways. Intelligent algorithms can optimize resource allocation, predict user needs, and automate repetitive tasks. While the combination of science gateways and AI is promising, we need to address challenges such as ethical considerations, data privacy, avoiding bias and the interpretability of AI models.

In conclusion, science gateways are invaluable for the strategy for critical and emerging technologies with their features of simplifying access to advanced research infrastructures, fostering collaboration, and democratizing technology.

Thank you for your attention.