

A Science Gateways Community Institute

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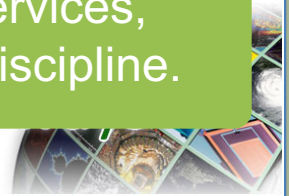
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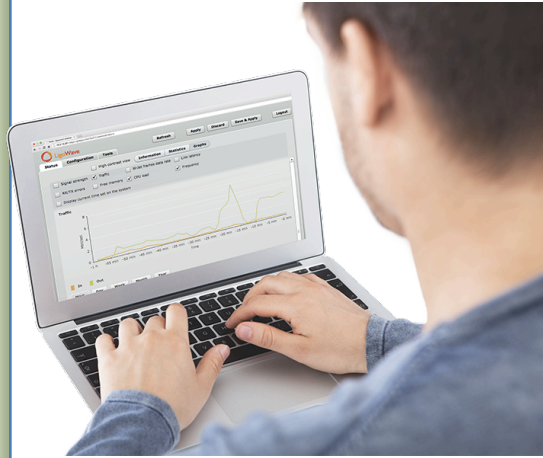
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science gateway /sī' əns gāt' wā/ *n.*

1. an online community space for science and engineering research and education.
2. a Web-based resource for accessing data, software, computing services, and equipment specific to the needs of a science or engineering discipline.



Science requires complex, interconnected cyberinfrastructure






Scientific
Instruments



Computational
Resources



Data



Software



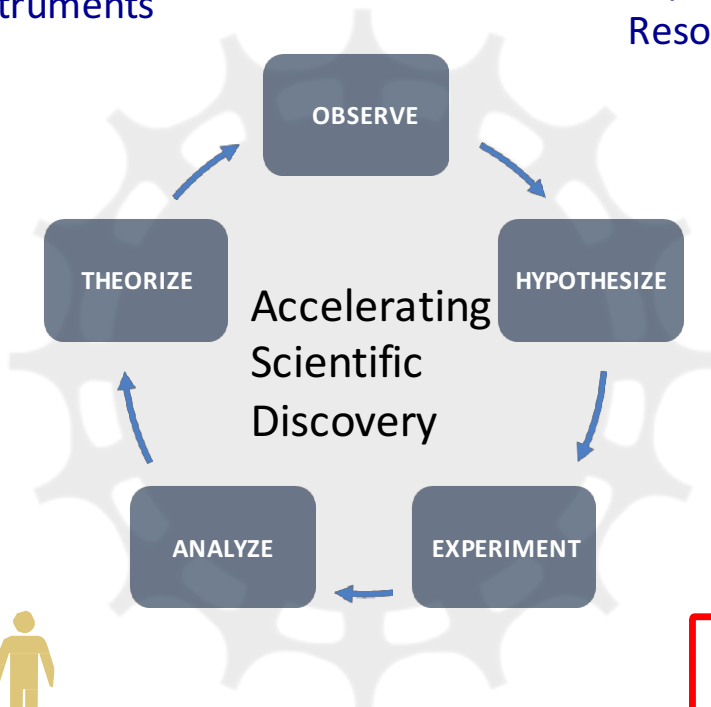
People, organizations,
& communities



Networking &
Cybersecurity

Science gateways connect these

**Science
Gateways**



Hallmarks of digital research

Science gateways play an important role in all of these

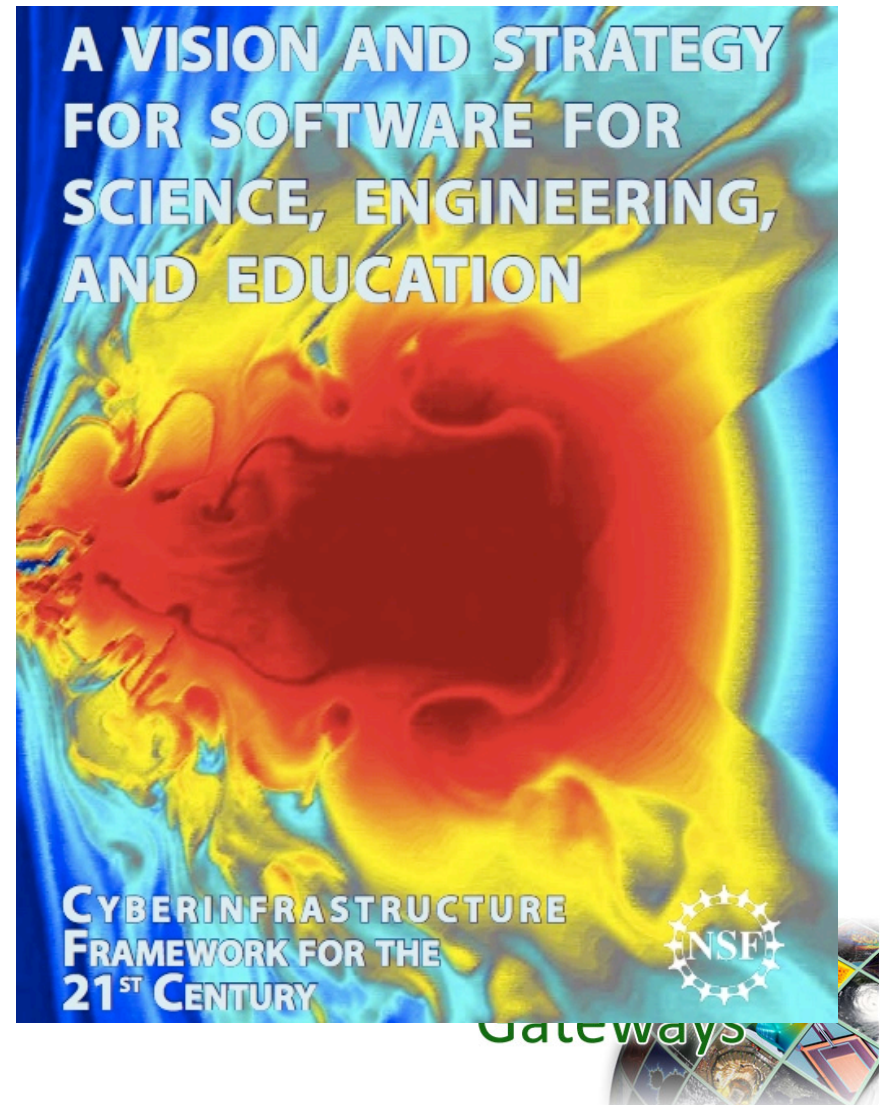
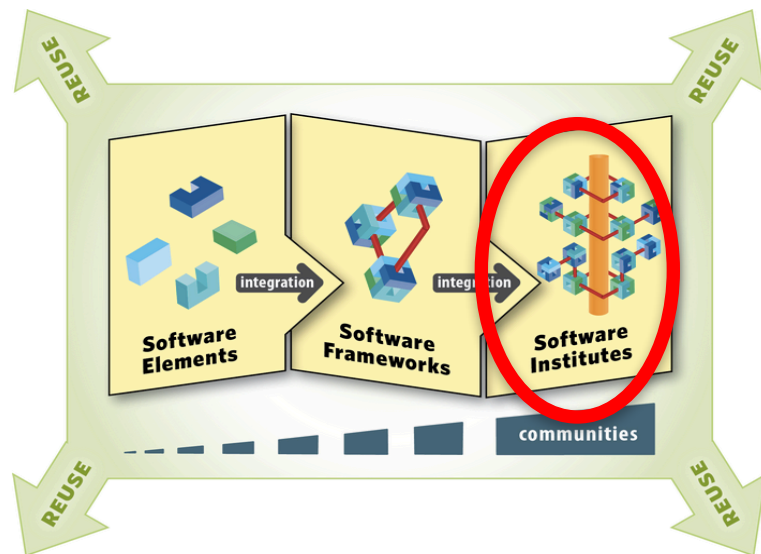
- Increased complexity of
 - today's research questions
 - hardware and software
 - skills required
- Greater need for openness and reproducibility
 - Science increasingly driving policy questions
- Opportunity to integrate research with teaching
 - Better workforce preparation

*We need interfaces
that provide
broad access to
advanced resources
and
allow **all** to tackle
today's challenging
science questions.*

**Science
Gateways**



Software Institutes are the pinnacle of NSF's software investment strategy



NSF call for a Science Gateway Software Institute

\$3M/year, 5 yr + 5 optional renewal

Software Infrastructure for Sustained Innovation - S2I2 (SI2-S2I2)

PROGRAM SOLICITATION

NSF 15-553

IMPORTANT INFORMATION AND REVISION NOTES

This revision primarily adds details about Implementation Awards. This solicitation describes the S²I² component of the SI² program. Implementation awards in area of topics **1) Chemical and Materials Research** and **2) Science Gateways** may be proposed in response to this solicitation. Future versions of this solicitation focused on additional areas will be published in response to S²I² Conceptualization awards and other community activities. The overarching description, vision, and goals of the S²I² element of the SI² program and the high-level description of S²I² Implementation awards is intended to remain unchanged over these solicitations.



This is a tremendous vote of confidence for all gateways!



A successful gateway institute will provide leadership to

- 1) *bring science gateway developers together with each other and with the developers and operators of existing and potential cyberinfrastructure elements that science gateways integrate and enable the use of*
 - *in order to promote the efficient, effective, and sustainable development of scientific web and mobile interfaces*
- 2) *educate developers and the next generation of investigators to effectively use the gateway software ecosystem to solve real research problems; and*
- 3) *educate the next generation of researchers to enable them to create the software cyberinfrastructure required to both advance fundamental understanding of science gateways and enable researchers to address the grand challenge problems of the future*

**Science
Gateways**



Some NSF calls even specify the use of gateways

This is the right direction to go! Gateways as cost-effective infrastructure



National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

NSF 14-044

Dear Colleague Letter: BRAIN EAGERs to Enable Innovative Neurotechnologies to Reveal the Functional and Emergent Properties of Neural Circuits Underlying Behavior and Cognition

Date: March 7, 2014

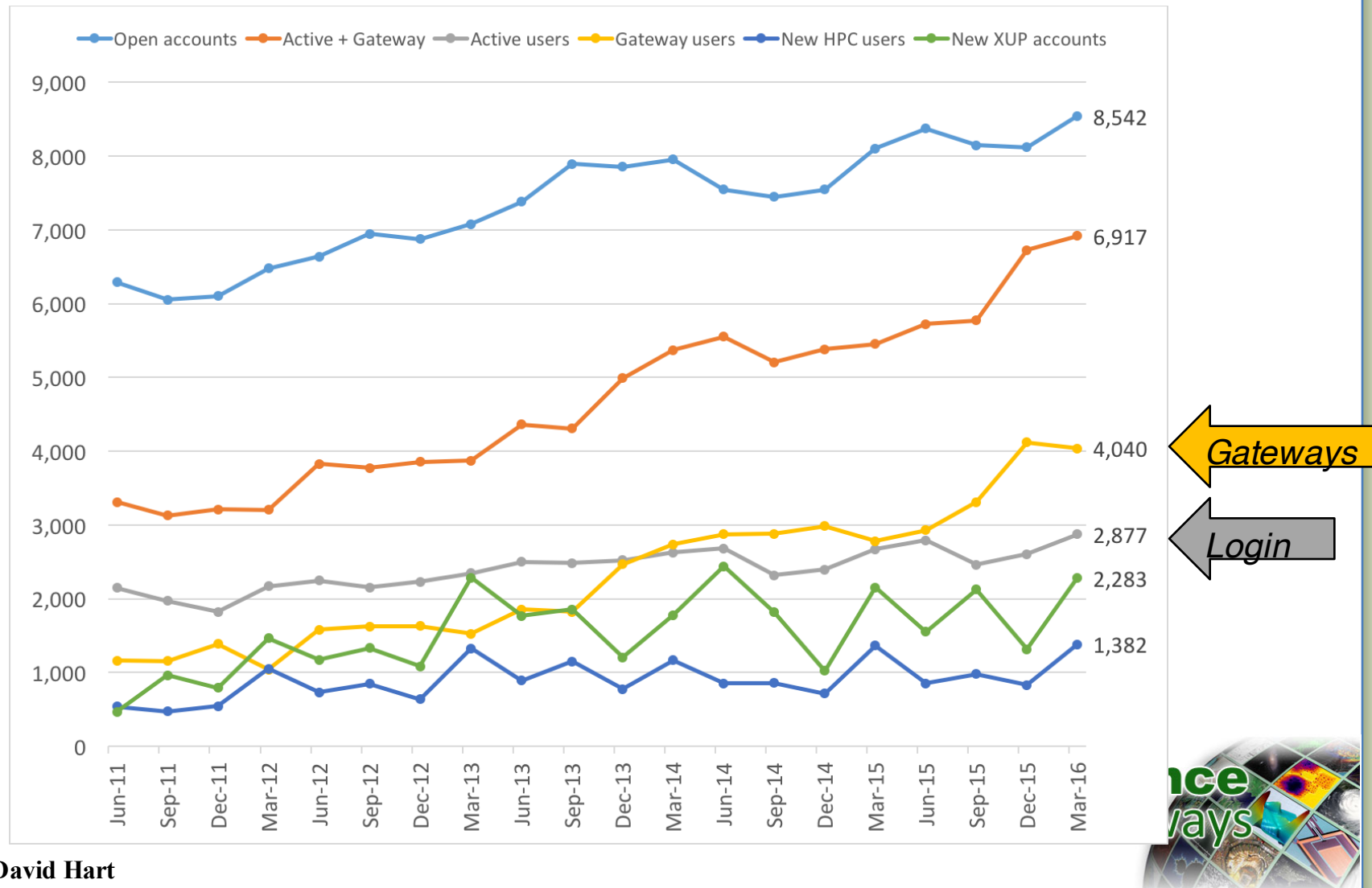
This Dear Colleague Letter is aimed at identifying opportunities to leverage and synthesize technological and conceptual innovation across disciplines and scales to accelerate progress toward an integrated understanding of neural circuits in behavior and cognition, or more simply “catching circuits in action”. The neuroscience research community and specialists in other areas including, but not limited to genetics, physiology, synthetic biology, engineering, physics, mathematics, statistics, behavior and cognition are encouraged to work across disciplines to develop new approaches and neurotechnology focused at understanding the properties of circuits that underlie behavior and/or cognition in any organism. Projects that take advantage of existing DBI investments in informatics, computing and other infrastructure, such as the **Neuroscience Gateway**, in novel ways are also eligible.



Significant developments in XSEDE as well

Gateway users surpass login users in 2013

Automated user-counting in 2015

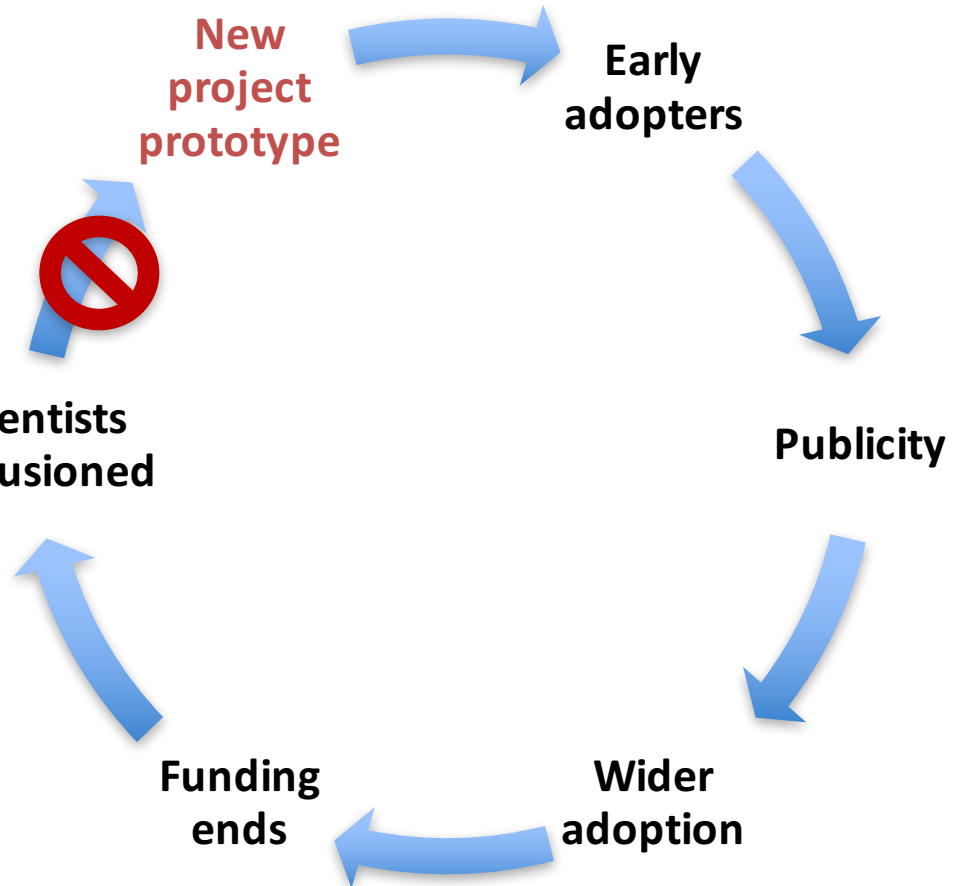


Source: David Hart

But we've observed challenges

Isolated development limits both research and cost effectiveness

- Studies show that gateway developers typically
 - work in isolation
 - must bridge to variety of resources
 - need building blocks in order to focus on higher-level functionality
 - struggle to secure sustainable funding



**Science
Gateways**



5000-respondent survey of NSF PIs and Academic CIO/CTOs

88% indicate Web-based applications are important to their work

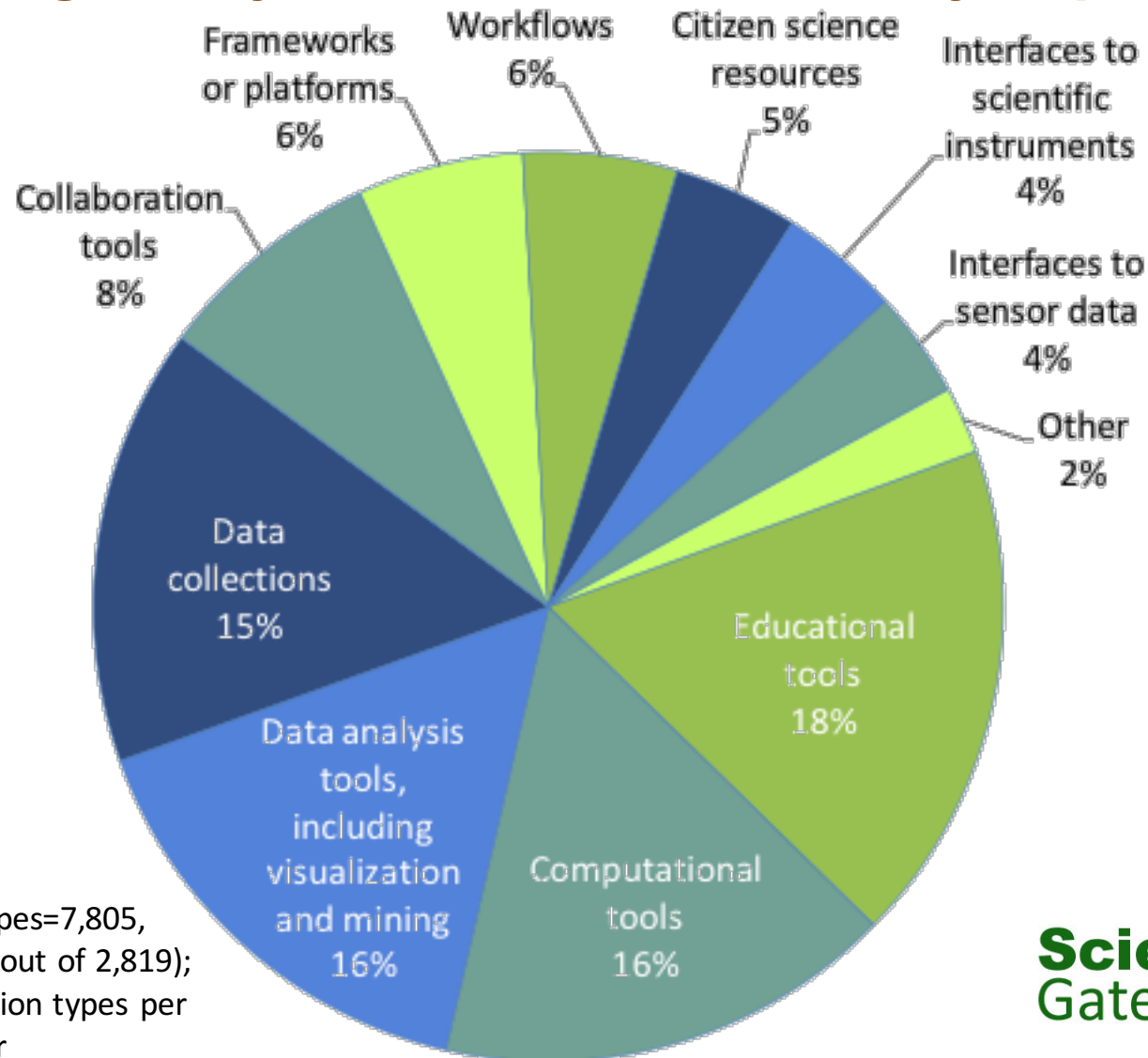
Specialized Resources	Percent
Data collections	75%
Data analysis tools, including visualization and mining	72%
Computational tools	72%
Tools for rapidly publishing and/or finding articles and data specific to my domain	69%
Educational tools	67%
Platforms for fostering group or community collaboration	63%
Simplified interfaces that eliminate the need to learn coding	62%
Citizen science and other public engagement resources	47%
Workflows that automate or capture tasks or processes	42%
Scientific instruments, such as telescopes, microscopes, or sensors	39%

n=4,004, or 88% of 4,538 researcher/educators. Percentage indicates these resources are “somewhat” or “very” important to their work.

**Science
Gateways**



57% played some role in gateway creation and these gateways were used for a variety of purposes

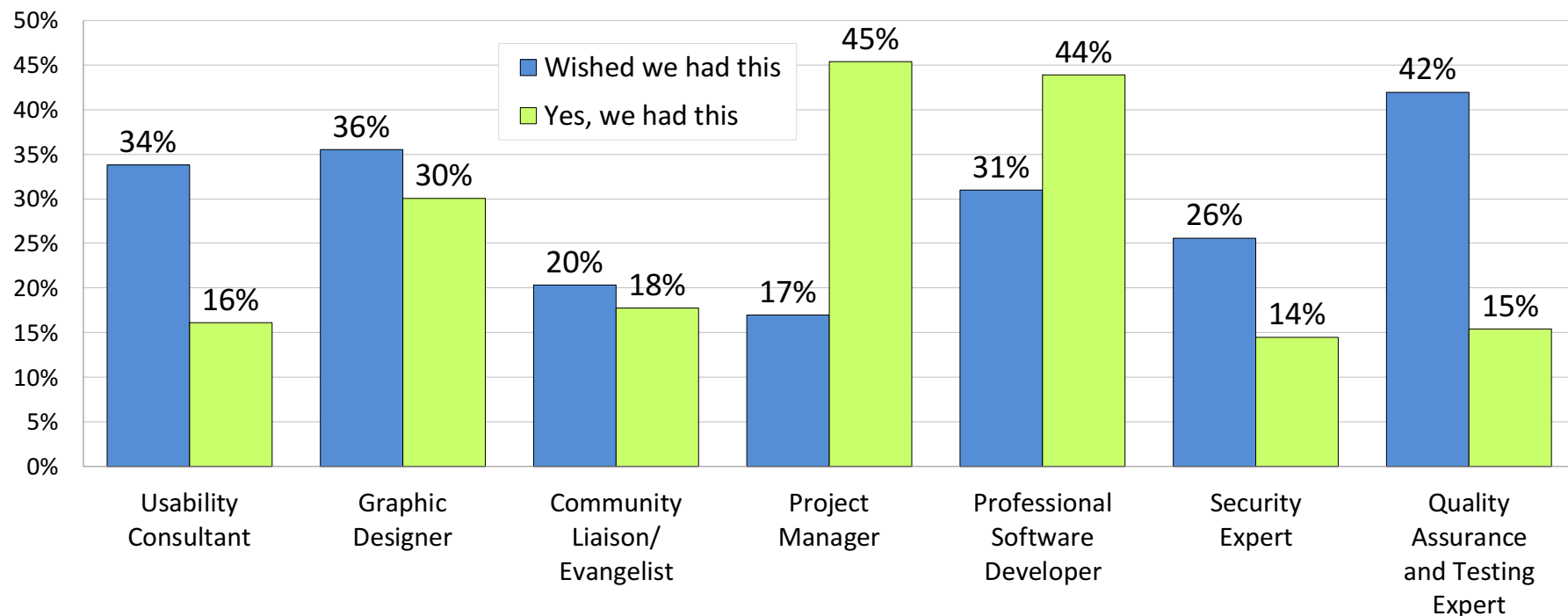


n of application types=7,805,
by 2,756 creators (out of 2,819);
mean=2.8 application types per
application creator

**Science
Gateways**



Well-designed gateways require a variety of expertise



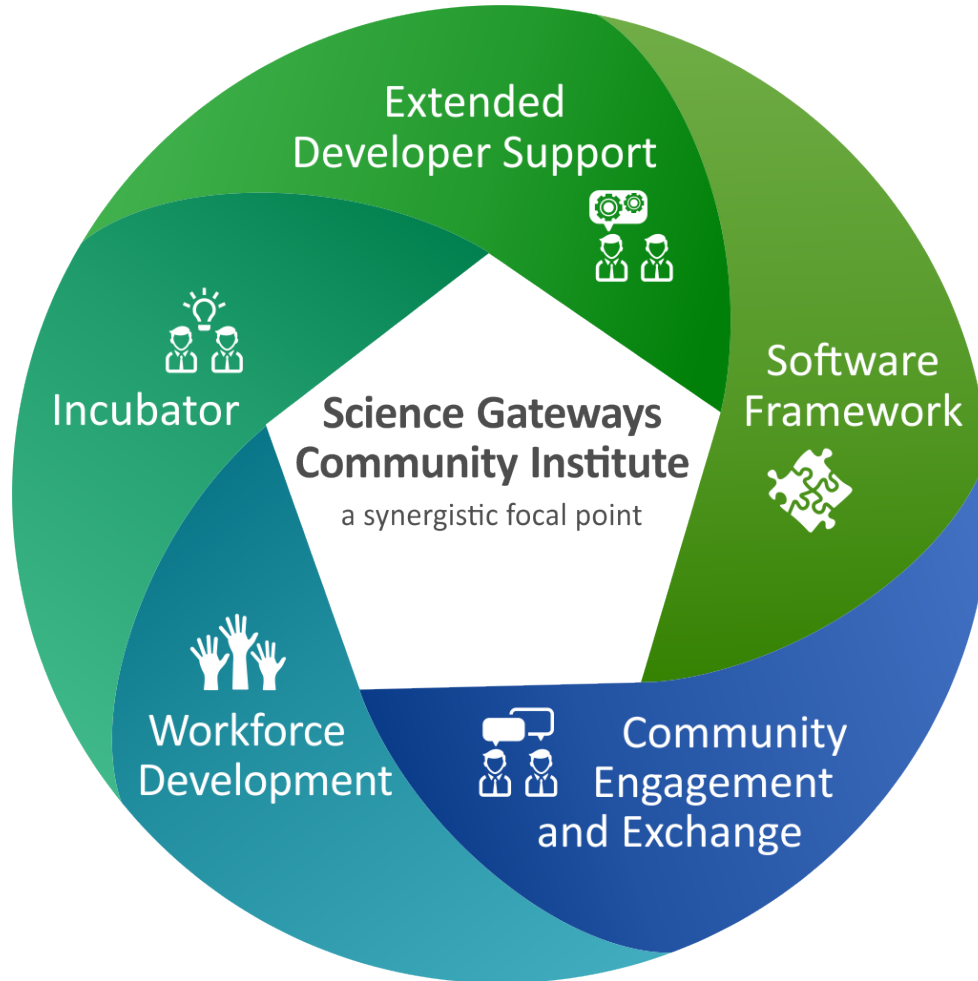
n=2,756 respondents or 98% of application creators

**Science
Gateways**



As a result, we have proposed the **Science Gateways Community Institute**

Launching any day now



- Diverse expertise on demand
- Longer term support engagements
- Software and visibility for gateways
- Information exchange in a community environment
- Student opportunities and more stable career paths

Science Gateways



- What does this mean for me?
 - FREE services
- How is this different from the XSEDE gateway program
 - Support for front end as well as back end development
 - Support building a gateway from the ground up
 - Support for gateways that do not need HPC
 - SGCI likely will be an XSEDE level two Service Provider



Incubator Service

Expertise for the gateway lifecycle

A Framework for Decision Making

Technology Planning

- Choosing technologies
- Cybersecurity
- Software engineering
- Interfaces to compute and data

Business Planning

- Business model development
- Financial planning
- Project management
- Software licensing
- Staff and sustainability planning

Client Interaction Planning

- Usability studies
- Web/visual/graphic design
- Impact measurement
- Community engagement
- Support for education

Specialized Expertise

Security

- Center for Trustworthy Scientific Cyberinfrastructure

Sustainability

- Nancy Maron, creator of the ITHAKA S+R course on Sustaining Digital Resources

Evaluation & Impact Measurement

- Ann Zimmerman Consulting

Campus Resource Development

Network / Cohort Formation

Common Experiences

- Training sessions
- Group interactions

Continuing Engagement

- Customized structure, content, goals
- Mentoring
- Pay It Forward

An Ongoing
Dispassionate Ear

**Science
Gateways**



Extended Developer Support

Dedicated SGCI staff work directly with clients to build and enhance gateways

Focus

- Front-end development
- Gateways using all types of CI
- Both sides give 2-month to 1-year commitment
- Well-defined engagements with work plans
- Technology agnostic

Data

Education

Analysis Tools

Instruments

Computation

Collaboration

Workflows

Sensors

Mission

- Bring new gateways into existence
- Adapt existing gateways to new resources and technologies
- Provide “burst” support to help gateways with smaller issues

Benefits

- Reinforce Incubator lessons
- Develop deep understanding of community needs that feed into other Institute areas
- Capture and document support efforts for scalability
- Hands-on opportunities for student participants

Airavata

HUBzero

AGAVE

Galaxy

Jupyter

And more...

Scientific Software Collaborative

Leveraging existing investments in gateway technologies

Give developers a *single destination for gateway software*, services and resources to easily build, maintain and manage science gateways.

- Create **more gateways** to advance scientific discovery, by making them easier to build
- Create **more researchers using gateways** by increasing awareness and number of gateways
- Enable NSF projects to **integrate** into the software institute and promote their products

End-to-End Solutions

- Serve a diverse set of scientific domains
- Out-of-the-box gateway solution that can be customized
- Based on Docker – executable images that are the skeleton for a secure and functioning gateway
- Portable and reproducible
- Community-contributed

Software Integration & Community Contribution

- Docking mechanisms for community-contributed software, including NSF SI2
- Incorporate community standards

Software Marketplace for Science Gateways

“Use-what-you-need”

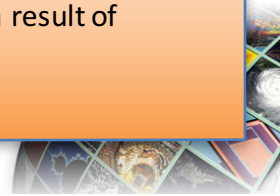
- API integration
- Variety of services
 - Information
 - Security
 - Execution
 - Data
 - Event
 - Accounting
- Hosting opportunity

Gateway Discovery

- Open registry
- Promotes use of existing science gateways
- Community-contributed
- Admin approval
- Automated cleanup

Engage Other Areas of Institute

- Support projects leverage Collaborative components
- Framework evolves as a result of gateway engagements
- Community outreach



Community Engagement and Exchange

Key to a successful institute

Gathering place for scientific web developers across NSF directorates, federal agencies, and international boundaries

- Community members are eager to connect

Website Activities

- Discussion forums
- Gateway showcase with case studies
- Symposium series
- News: media coverage, related happenings, academic publications, job openings, events calendar
- Curated blog with guest authors,
- Professional development: synchronous and asynchronous training
- Capture client/user feedback on web and through other areas

Annual Conference

- Tutorials and workshops
- Paper presentations
- Invited keynotes and panels
- Interactive elements: Open Space, poster session
- Travel support for students and campus IT staff

Builds on 10 years of experience with GCE and IWSG series

Outreach to Complementary NSF Initiatives

- NSF SI2 projects
- Large NSF projects
- Science and Technology Centers
- Engineering Research Centers
- MolSSI software institute collaboration

Campus Gateway Groups

- Task force builds campus-based expertise
- Channel for scaling institute services

**Science
Gateways**



Workforce Development: Keep the best and the brightest in the sciences

4 Focal Areas

Promoting Gateway-Related Career Paths

- Student-related conference programs
- Campus opportunities
- Job boards

Establishing Center for Training and Education at ECSU

- Vigorous schedule of on-site and virtual training
- Development of training and course curricula about science gateways technologies

Providing Financial Support

- Enabling students learning gateway skills

Integrating Gateways into Course Content

Google Summer of Code (GSoC)

SGCI Institute Areas

National Organization for the Professional
Advancement of Black Chemists and
Chemical Engineers (NOBCChE)

Molecular Science
Software Institute

Association of Computer/ Information
Sciences and Engineering Departments at
Minority Institutions (ADMI)

Partners

Vision for success

- Science gateways form a vibrant community
 - Inter-agency, international, collegial
- Creating gateways is easier
 - Created with more thoughtfulness, so they are more sustainable
- Gateway developers have stable career paths
 - More efficient environments on campuses
- Students are excited to stay in the sciences
- All of this benefits research



Upcoming events

- SGCI BOF at XSEDE16
 - Tuesday July 19, 5:15pm, Chopin Ballroom
- Gateways 2016 conference Nov 2-3
 - San Diego
- Services rolling out through the fall
- Mailing list to keep abreast of developments
 - <http://sciencegateways.org/connect-with-us/>

