Who Cares About Science Gateways?

A Large-Scale Survey of Community Use and Needs

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Abstract

With the rise of science gateway use in recent years, we anticipate there are additional opportunities for growth, but the field is currently fragmented. We describe our efforts to measure the extent and characteristics of the gateway community through a large-scale survey. Our goal was to understand what type of support services might be provided to the gateway community.

75+ Gateways & More

We believe there is much room for additional growth for science gateways in research and development. To investigate this hypothesis and to measure, for the first time, the full extent and characteristics of the gateway community, we have undertaken a community survey. Our goal was to understand what type of support services might be provided to the gateway community by a center of gateway expertise.

The survey was developed inductively, through expert interviews, focus groups, and pilot testing of the resulting questions. The result was 36 questions that branched in different ways depending on whether a recipient was an administrator, researcher or faculty member, or technology developer.

Nearly 5000 Cared

The survey sample was collected from three primary sources: National Science Foundation–funded principal investigators (PIs) (90% of sample), senior administrative members of EDUCAUSE and CASC (6%), and individuals who have previously expressed interest in gateway initiatives (4%). The NSF PIs were limited to those who had received funding within the last 18 months for at least $100,000. The total sample size was nearly 29,000, and the 4,957 participants in our online survey (by email invitation) represent a response rate of approximately 17%, exceeding our 10% target.

Respondents represent a broad range of disciplines (Figure 1). Respondents were primarily faculty and research scientists, but also included members of higher education leadership, graduate students, and technology developers. Some 57% of respondents (n=2821) report having participated in some capacity in the creation of desktop, mobile, or web applications.

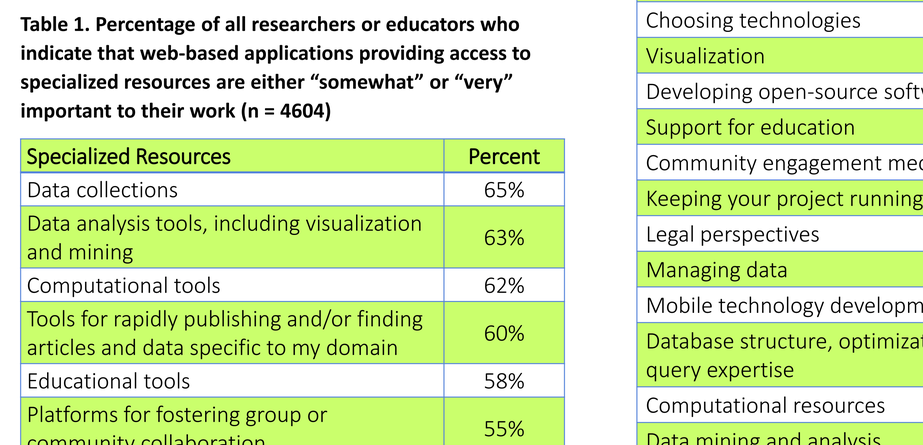

Figure 1. Primary areas of current domain expertise. Respondents could select all that apply; 86% (4278 of 4957) responded, generating 9702 total responses (mean=1.96 domains/respondent).

Not Just Techies — Senior Personnel Participate, Too

Projects employ many different types of people. The respondents who have participated in development projects have served in multiple roles, weighed heavily toward Principal Investigator (Figure 2).

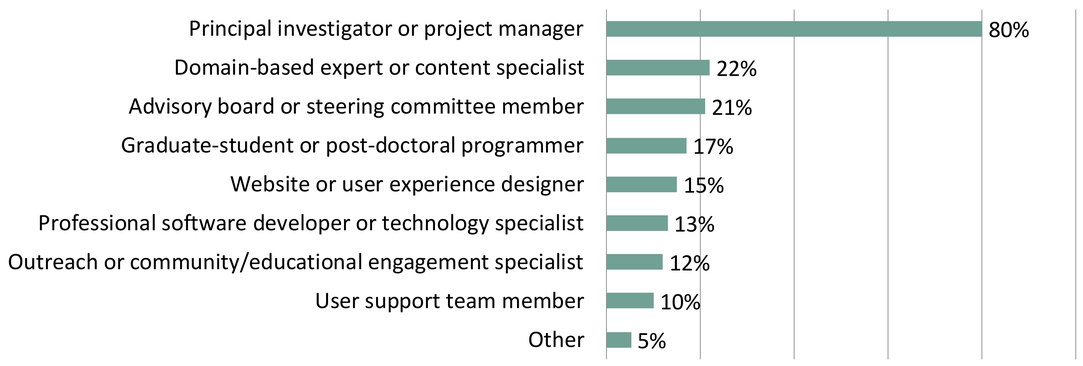

Figure 2. Roles on software development projects. Respondents could select all that apply; 2737 respondents in the developer group selected 5366 roles (mean=2 roles/respondent).

We also provided a list of eight common types of staff members on software development projects and asked participants to indicate whether, on their projects they (a) had this type of staff, (b) wished they had this type of staff, or (c) did not need this type of staff (Figure 3).

In addition to these eight types, we asked respondents to indicate any other roles. The more common roles included content or domain experts, instructional designers, technical writers, librarians, computer scientists, software or system architects, and IT support.

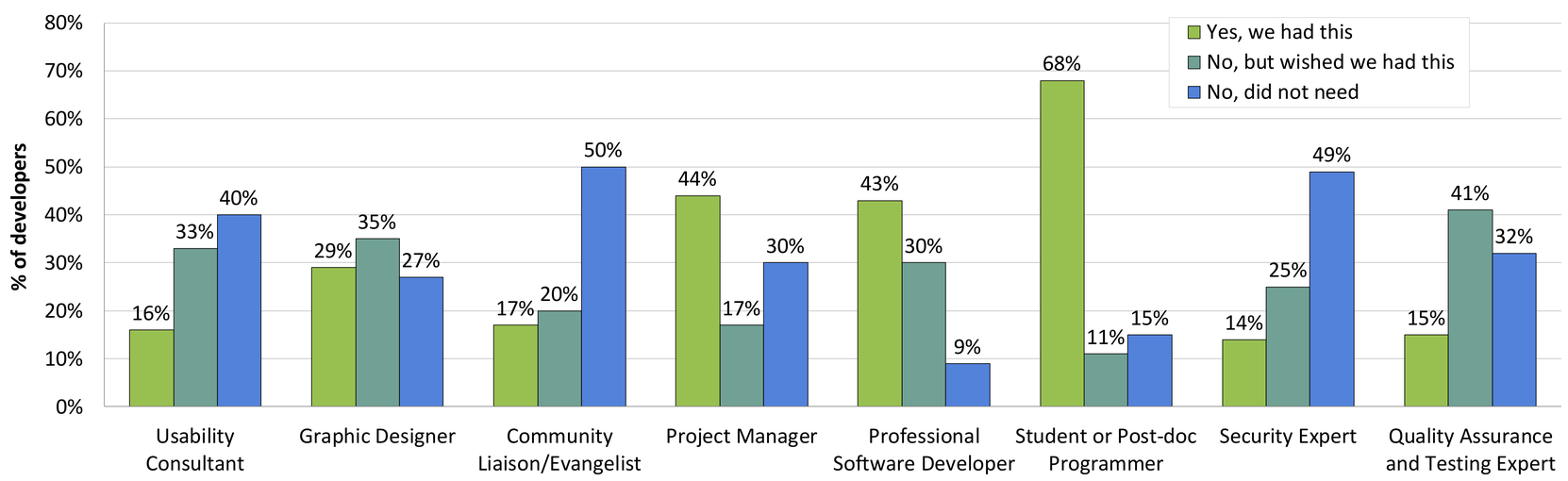

Figure 3. Types and desirability of staff members who have worked on projects (n=2821, 88-94% response rate across types).

> 50% of Developers Want Support

We asked the respondents who had participated in creating web- or mobile-based applications how they would anticipate needing help with their development projects. Many indicated a high interest in help with many of the functions associated with building a gateway (Table 2).

When technology developers were asked what they use to build their web- or mobile-based applications, Drupal, Ruby on Rails, and WordPress were most commonly cited, but nearly 200 other development platforms, frameworks, and applications were cited at least once, including DreamWeaver, Java/ JavaScript, Python, and php/MySQL, as well as "home-grown" codes. This suggests that providing a one-size-fits-all solution is not feasible; instead, a technical community forum should be fostered to share and extend these solutions in a collaborative way.

Finally, we asked web- and mobile-application developers what mechanisms they prefer for training their staff. They could indicate up to 3 preferences. Self-paced, online learning was by far the most popular (41%), followed by workshops or short courses (34%). Webinars (27%) and on-site custom training (24%) are also reasonably popular options.

Up to 65% Say Gateway Resources Are Important

Gateways offer a wide variety of capabilities, as indicated by our application-creator respondents (Figure 4).

We asked respondents who identified as researchers and/or educators how important to their work were the web-based applications providing access to specialized resources (Table 1). For accessing most types, at least 50% indicated that web-based applications were "somewhat" or "very" important.

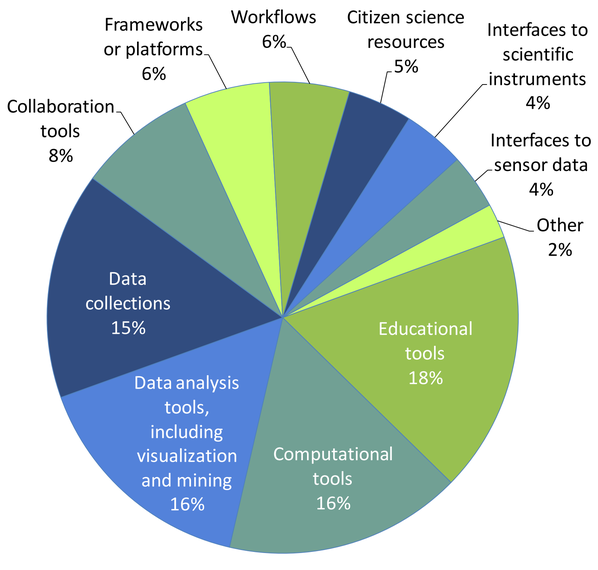

Figure 4. Types of applications created by respondents (n of application types=7805, by 2821 developers; mean=2.8 types/developer).

Table 1. Percentage of all researchers or educators who indicate that web-based applications providing access to specialized resources are either "somewhat" or "very" important to their work (n = 4604)

Specialized Resources	Percent
Data collections	65%
Data analysis tools, including visualization and mining	63%
Computational tools	62%
Tools for rapidly publishing and/or finding articles and data specific to my domain	60%
Educational tools	58%
Platforms for fostering group or community collaboration	55%
Simplified interfaces that eliminate the need to learn coding	54%
Citizen science and other public engagement resources	41%
Workflows that automate or capture tasks or processes	36%
Scientific instruments, such as telescopes, microscopes, or sensors	34%

Table 2. Percentage of mobile- or web-based application developers who would seek at least *some* help from a service provider (n=2542)

Proposed Service	% Interest
Evaluation, impact analysis, website analytics	61%
Adapting technologies	57%
Usability services	56%
Web/visual/graphic design	56%
Choosing technologies	56%
Visualization	55%
Developing open-source software	55%
Support for education	54%
Community engagement mechanisms	53%
Keeping your project running	52%
Legal perspectives	52%
Managing data	51%
Mobile technology development	50%
Database structure, optimization, and query expertise	50%
Computational resources	50%
Data mining and analysis	49%
Cybersecurity consultation	48%
Website construction	41%
Software engineering process consultation	45%
Source code review and/or audit	43%
High-bandwidth networks	38%
Scientific instruments or data streams	37%
Management aspects of a project	32%

Be Part of the Solution

We have additional analysis planned to answer other, more complex questions:

- What types of gateway resources are most popular in specific fields?
- What fields are good candidates for large-scale gateways?
- Who builds the resources used in particular domains (e.g., commercial suppliers, academic institutions, or researchers)? Do certain resources tend to be provided by certain types of sources?
- What "generic" technologies are most needed?
- What are the prevalence and relevant capabilities of mobile devices for accessing gateway-type resources?
- What development roles are most commonly staffed together? Which have been needed but not employed?
- Where do people learn about new technologies and how do they decide to adopt them?
- What are the biggest challenges to hiring and maintaining gateway development staff?

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