

Survey on Knowledge and Knowledge Management



This document is a survey of knowledge management practices of scientific software developers. Large-scale scientific software projects are among the most knowledge-intensive undertakings in all of human history, consisting of extremely diverse communities of practice and inquiry. The purpose of this survey is to understand the kinds of knowledge that are created and shared and their relationship to the software project.

This study is being conducted through the Interoperable Design of Extreme-scale Application Software (IDEAS-ECP) project. Only the researchers involved in this study will see your responses. Your participation in this study is voluntary. If you do not want to participate, please return the questionnaire to the researcher. You also do not have to answer any question that makes you uncomfortable. This survey is expected to take about 20 minutes to complete.

WARNING: Not all PDF readers will allow you to fill out this survey, and not all will allow you to save your results. If you are able to fill out the results, it is highly recommended that you use the Print option and print the result to a PDF file. Alternatively, you can print out a paper copy of the attached survey to complete it. In either case, once you have done so, you may scan and/or email the document to rmilewi@sandia.gov. Alternatively, place the survey in a sealed envelope and deliver it to CSRI/253.

Informed Consent Form

1. Participation

Your participation in this survey is voluntary. You may refuse to take part in the research, and you are free to decline to answer any particular question you do not wish to answer for any reason.

2. Benefits

You will receive a report detailing the anonymized results of this survey. The researchers of this study intend on using the data you provide to produce a publication characterizing the work habits of scientific software developers. The aim is to inform better policies and practices for the broader scientific software community.

3. Confidentiality

Your responses will remain anonymous. No one will be able to identify you or your answers, and no one will know whether or not you participated in the study, not even your manager. This form asks your name and Github handle (if you have one). However, any uniquely identifying information we collect will be stored separately from the survey responses, and it will not be present in the data we use for analysis.

4. Risks

The possible risks or discomforts of the study are minimal. You may feel somewhat uncomfortable answering questions about the problems you face in doing your work. We reiterate, however, that none of your responses will be tied to you individually.

5. Contact

If you have any questions or concerns, please contact Reed Milewicz (1426), the PI for this survey. You are welcome to reach out to him by email (rmilewi@sandia.gov) or phone (505-845-0278) if you have any concerns about your participation or the survey process.

6. Consent

Signing your name below indicates that

1. You have read the above information.
2. You voluntarily agree to participate.

Additionally, we ask for two more things. First, we request your Github handle you use to contribute to the Trilinos project (if any); this information is needed to link your survey responses to your contributions in order to better understand the evolution of the software project. Second, to aid in de-identifying your survey responses, please provide a code name below. This self-identification code will take the place of any identifying information collected in this survey. It will only be known to the researchers, and only the researchers will have a key linking your name to your pseudonym.

Your Signature

Your Github handle

Your Code Name

#1: Your Code Name

#2: Your relationship to Sandia

- | | |
|------------------------|--------------------------|
| Student Intern | <input type="checkbox"/> |
| Postdoctoral Appointee | <input type="checkbox"/> |
| Contractor | <input type="checkbox"/> |
| Limited-term Employee | <input type="checkbox"/> |
| Full-time Employee | <input type="checkbox"/> |
| Other (please specify) | <input type="text"/> |

#3: What is the highest level of education which you have completed?

- | | |
|----------------------------------|--------------------------|
| High school degree or equivalent | <input type="checkbox"/> |
| Associate's degree | <input type="checkbox"/> |
| Bachelor's degree | <input type="checkbox"/> |
| Master's degree | <input type="checkbox"/> |
| Doctoral degree | <input type="checkbox"/> |

#4: How many years of experience do you have working in your area of interest?

- | | |
|--------------------|--------------------------|
| Less than 2 years | <input type="checkbox"/> |
| 2-5 years | <input type="checkbox"/> |
| 6-10 years | <input type="checkbox"/> |
| 11-15 years | <input type="checkbox"/> |
| 16-20 years | <input type="checkbox"/> |
| 21-25 years | <input type="checkbox"/> |
| More than 25 years | <input type="checkbox"/> |

#5: How many people do you work with on a regular basis?

- | | |
|--------------|--------------------------|
| 1-2 | <input type="checkbox"/> |
| 3-5 | <input type="checkbox"/> |
| 6-10 | <input type="checkbox"/> |
| 11-15 | <input type="checkbox"/> |
| 16-20 | <input type="checkbox"/> |
| More than 20 | <input type="checkbox"/> |

#6: How many projects do you contribute to in the course of a year? These activities may be funded or unfunded.

- | | |
|-----------|--------------------------|
| 1 | <input type="checkbox"/> |
| 2 | <input type="checkbox"/> |
| 3 | <input type="checkbox"/> |
| 4 or more | <input type="checkbox"/> |

#7: Select one or more topics that encompass your areas of interest.

- | | |
|---|--------------------------|
| Scalable solvers | <input type="checkbox"/> |
| Optimization | <input type="checkbox"/> |
| Adaptivity and mesh refinement | <input type="checkbox"/> |
| Graph-based, discrete, and combinatorial algorithms | <input type="checkbox"/> |
| Uncertainty estimation | <input type="checkbox"/> |
| Mesh generation | <input type="checkbox"/> |
| Dynamic load balancing | <input type="checkbox"/> |
| Visualization | <input type="checkbox"/> |
| Scalable heterogeneous computing | <input type="checkbox"/> |
| Parallel I/O | <input type="checkbox"/> |
| Theoretical computer science | <input type="checkbox"/> |
| Multiscale methods | <input type="checkbox"/> |
| Nonlinear systems | <input type="checkbox"/> |
| Distributed systems | <input type="checkbox"/> |
| Software engineering | <input type="checkbox"/> |

Other (please specify)

#8: Scientific software developers often find themselves taking on many different responsibilities. How important are the following activities to your career currently? Answer on a scale ranging from unimportant to very important.

| Q. | Activity | Unimportant | | Somewhat Impor- tant | | Very Impor- tant |
|------|---|--------------------------|--------------------------|----------------------------|--------------------------|--------------------------|
| 8.0 | Conducting research | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.1 | Producing academic publications | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.2 | Writing software for your own use | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.3 | Using or modifying software written by others | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.4 | Writing software for the benefit of others | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.5 | Maintaining software for which you are responsible | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.6 | Mentoring less experienced employees | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.7 | Receiving mentoring from others | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.8 | Providing consultation or support to others | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.9 | Leveraging the talents of others | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.10 | Communicating directly with clients | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.11 | Working with people in other areas of expertise | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.12 | Working with people within your own area of expertise | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.13 | Building relationships with other teams | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.14 | Attending professional conferences | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

#9: What means do you use to receive and share information with colleagues? How often do you use them? Answer on a scale ranging from never or not in the last year to daily.

| Q. | Statement | Never or not in the last year | Less than once a month | Monthly | Weekly | Daily |
|------|---|---|---------------------------------|--------------------------|--------------------------|--------------------------|
| | Face-to-face interpersonal communication | | | | | |
| 9.0 | Private, unrecorded one-on-one conversations | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.1 | Unstructured impromptu meetings with multiple people | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.2 | Regular planned meetings | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.3 | Large meetings with multiple teams or stakeholders | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | Digital interpersonal communication | | | | | |
| 9.4 | Private email exchanges | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.5 | Public mailing lists | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.6 | One-on-one phone calls | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.7 | Conference phone calls | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.8 | SMS text messages | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.9 | Videoconferencing software (e.g. Skype, BlueJeans) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.10 | Personal instant messaging services | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | External sources of information | | | | | |
| 9.11 | Social media (e.g. social networking sites, forums, blogs) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.12 | Team collaboration software (e.g. Confluence, Slack, Wiki) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.13 | Issue tracking and task management software (e.g. Github, Bugzilla) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9.14 | Documentation, code comments, or tutorials | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

#10: Scientific software development demands many different kinds of expertise, oftentimes more than any one individual can possess. For each of the following topics, answer how knowledgeable or comfortable you are with that subject, on a scale from not very knowledgeable to very knowledgeable. Additionally, check the box on the far right if you work with someone else that you could turn to for help on that topic.

| Q. | Topic | Not very knowledgeable | | Somewhat knowledgeable | | Very knowledgeable | | Know someone else |
|------|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 10.0 | Knowledge of the real-world phenomena that the software is used to study | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10.1 | The selection of mathematical techniques to attack a problem | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10.2 | Software design | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10.3 | Software construction (e.g. use of C++, Fortran) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10.4 | Compilers and compiler optimizations | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10.5 | The effects of the hardware architecture on algorithm performance | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10.6 | Using a version control system | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10.7 | How the software is integrated with client codes | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

#11: Are any of the following problems for software development that you encounter in your work? If so, to what extent? For each, select whether it is not a problem, a (moderately difficult) problem, or a difficult problem.

| Q. | | Not a problem | A problem | A difficult problem |
|-------|---|--------------------------|--------------------------|--------------------------|
| 11.0 | Understanding the rationale behind a piece of code | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.1 | Understanding code that someone else wrote | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.2 | Finding the right person to talk to about a piece of code | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.3 | Understanding the history of a piece of code | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.4 | Understanding code that I wrote a while ago | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.5 | Having to switch tasks often because of requests from my teammates or manager | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.6 | Having to switch tasks because my current task gets blocked | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.7 | Having to divide my attention between many different projects | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.8 | Being aware of changes to code elsewhere that impact my code | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.9 | Understanding the impact of changes I make on code elsewhere | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.10 | Finding the right person to review a change before a check-in | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.11 | Finding all the places code has been duplicated | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.12 | Understanding who "owns" a piece of code | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.13 | Finding the bugs related to a piece of code | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.14 | Finding code related to a bug | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.15 | Finding the right person to talk to about a bug | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.16 | Finding out who is currently modifying a piece of code | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| | | | | |
|-------|---|--------------------------|--------------------------|--------------------------|
| 11.17 | Convincing managers that I should spend time rearchitecting, refactoring, or rewriting code | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11.18 | Convincing developers to make changes to code I depend on | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |