



*The government seeks individual input; attendees/participants may provide individual advice only.*

**Middleware and Grid Interagency Coordination (MAGIC) Meeting Minutes<sup>1</sup>**  
July 7, 2021, 12-2 pm ET

Virtual

**Participants**

Alan Sussman (NSF)	Lisa Arafune (CASC)
Bryan Shader (U of Wyoming)	Mallory Hinks (NCO)
Chase Cotton (U of Delaware)	Miron Livny (OSG)
Dan Gunter (LBL)	Patrick E. O'Toole (U of Wyoming)
David Brown (LBL)	Rajendra Raj (Rochester Institute of Technology)
Donald Petravick (U of Illinois)	Richard Carlson (DOE-SC)
H Birali Runesha (U of Chicago)	Saswata Hier-Majumder (ASCR)
Ian Cosden (Princeton)	Sharon Broude Geva (U of Michigan)
Jack Wells (NVIDIA)	Suhas Somnath (ORNL)
Kathy Austin (TTU)	Terrill Frantz (Harrisburg Univ)
Keith Beattie (LBL)	Vipin Chaudhary (NSF)
Kristen Davis (NTIA)	William Pentland

**Introductions:** This meeting was chaired by Richard Carlson (DOE/SC)

**Sustainable Software Speaker Series – Workforce Development and Training**

**Research Software Engineers: Establishing Careers**

*Ian Cosden, Director, Research Software Engineering for Computational & Data Science, Princeton University*

**Research Software Use**

- Ian defined research software as:
  - Anything used to generate, process, or analyze results you intend to appear in a publication
  - Anything from a few lines of code written by you to a professionally developed software package
- He showed statistics that 95% of researchers in the US use research software and 66% say it is fundamental to their research

**Some of the problems in research software careers**

- Writing good code requires experience/training
- Writing good code is time consuming

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<sup>1</sup> Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Networking and Information Technology Research and Development Program.

- Typically aren't rewarded for good code
- Transient

#### A Solution: RSE

- Establish a position dedicated to research software
  - A new career path in the research community: Research Software Engineer

#### Princeton RSE group

- Formed in 2016
- Goal: Help researchers create the most efficient, scalable, and sustainable research code possible in order to enable new scientific advances
- Complement traditional academic research groups with embedded, long-term software development, domain specific knowledge, algorithm development and selection, performance tuning and optimization, coding standards and techniques

#### What is a Princeton RSE?

- Part Software Engineer/Developer
- Part Computational Researcher/Scientist
- NOT Traditional Research IT Support

#### Advantages

- Combining research/domain knowledge with software engineering best practices
- Primarily focused (and evaluated) on software contributions not research output
- Institutional knowledge
- Mentor and leads novice developers
- Educate

#### Challenges

- Funding
- Expansion
- Career paths and classification

#### US-RSE Mission

- Community
  - Slack
  - Working Groups
  - Events
- Advocacy/promotion
- Provide resources
  - Website
  - Newsletters
  - Twitter
  - Syndicated blog
  - RSE stories podcast
  - Job board

Link to join: <https://us-rse.org/join>

#### Intersect: Research Software Engineering Training

- Innovative Training Enabled by a Research Software Engineering Community of Trainers
  - 3-year NSF funded CyberTraining project
- Goals
  - Develop an open-source modular training framework conducive to community contribution

- Deliver RSE-led research software engineering training targeting developers
- Deepen the connection within the national community of Research Software Engineers
- 2 annual events
  - Workshops
  - Bootcamp
- <https://intersect-training.github.io/participate>

#### Q&A

- Sash Hier-Majumder commented that this is really incredible work that Ian and his team are doing
- Rajendra Raj asked how much reuse do you think you have been able to do the last few years of software.
  - Ian said he doesn't have a hard answer, but they get feedback saying things like, I can use this now. He gave an example of a postdoc leaving the code in a state of disarray. The RSE chased down the postdoc, rewrote it, refactored it, packaged it up into a simple, easy to use Python package that now the entire lab is using.
- Keith Beattie asked if Ian had anything more about return on investment. He also asked what different types of funding models may be possible for RSE groups.
  - Ian said the return on investment is actually something that seems different institutions and organizations have different views on ROI. The metric that matters on ROI is the feedback that the senior administration is getting from faculty researchers.
  - In terms of funding models, they co-fund most positions with a partner. They have since expanded it to be fully funded.
- Rich asked what the biggest challenge going forward.
  - Ian said figuring out how to grow the group in the capacity that the demand is growing.
  - He said as an RSE he thinks they've made tremendous efforts in awareness in using the terminology and understanding this as a role. He doesn't think they are at a national acceptance of this as a career path that is a first-class citizen in the research ecosystem.

#### **Toward Competent Computer Science Graduates**

*Rajendra Raj, Professor, Computer Science, Rochester Institute of Technology*

#### Gave a brief bio

- Described ACM/IEEE-CS/AAAI CS202X Task Force of which he is co-chair

#### Motivators for Ongoing Work

- There have been societal changes in the world of higher ed
  - Moved from knowledge-based curricular guidelines to competency-based guidelines
  - Stackable credentials
- Competence of CS graduates
  - Changes in computing education
  - CS202X Curricular Guidelines Task Force
- Employer needs
  - NSF IUSE grant
    - Support a much more diverse student body

#### To build sustainable software you need competent programmers. What is competence?

- Possession of sufficient knowledge or skill
- Quality of being adequately or well qualified physically and intellectually

#### Stackable Credentials

- BYU pathways example
  - Certificate

- Associate
- Bachelor's

#### Competence needs to be a transferable currency

#### ACM/IEEE-CS CS2013 Curricular Guidelines

- Compared knowledge areas in 2001, 2008, and 2013
- Previously curriculum focused on knowledge

#### Toward Competence

- Knowledge – “know-what”
- Skills – “know-how”
- Dispositions – “know-why”

#### Compared CS to Healthcare Professional Competence – Amended Miller's Pyramid

- Lower levels reflect competencies
- Upper levels reflect behaviors

#### Assessing Computing Competencies

- Assessment of professional dispositions challenging
- Assessment of workplace competencies – ultimate context for skills and disposition

#### Q&A

- Patrick O'Toole asked if Raj had examples of how to test for a conscientiousness or any of these slightly more ethereal characteristics amongst students?
  - Raj compared it to doctor or teacher training (bedside manner). Some instructors have been assessing collaboration by looking at the feedback that they get from different teammates on group projects.
- Sash asked if Raj or anyone else could comment on how the computer science curriculum is adapting itself to training students who can write codes that take advantage of these new architectures.
  - Raj compared HPC to the Curricular Guidelines he went over on slide 13. He said you can apply HPC to these areas as well as use some of these areas to improve HPC. He noted that that's one of the challenges that CS202x task force is currently trying to decide. He said he may have a better answer to the question in a few months.
- Miron said that he is concerned that computer science curriculum is too performance focused. He asked if Raj had any comments about how qualified are the teachers in teaching and things like that, given the fact that most of them don't have much experience in actually developing and maintaining software.
  - Raj said it's definitely a challenge. The approach they have taken at RIT, since their faculty generally do not have a software development background, they really highlight that extra year that they have their students spend with them. A couple of semesters and then a summer where they are actually being supervised by actual software developers. The needs of the employers are fed back into the curriculum.
- Miron wondered how much can be leverage from a project or effort that happens on the campus in terms of software development to enrich the educational process.
  - Raj said that when he started teaching after coming back from working in industry as a software developer and manager, he was teaching introductory computer science (CS1) and upper division data management. He found a striking difference between the two groups of students. The CS1 students didn't really question the faculty. The upper division students had been to one or two cooperative education gigs in industry and they challenged the faculty a lot more.
  - Raj asked Ian how many undergraduate students he had involved in his RSE efforts?

- Ian said they don't work much with undergrads. The RSEs work more with grad students and postdocs. Opportunity to involve undergrads in internships.
- Patrick asked about students being poached before they graduate.
  - Raj said that it is something that constantly comes up at faculty meetings because students were able to get good jobs and lost the incentive to finish their degrees. He said that's why he mentioned stackable credentials. Sometimes they have had students that lose their jobs and then they find out that their skills have aged inappropriately for them to get jobs. But because at many institutions you have to finish a degree in a certain number of years, so they can't finish their degrees. Stackable credentials address that problem.
- Patrick asked if anyone has looked at changing some of the metrics that high demand fields are being looked at by administration and academia?
  - Raj said that they are still in the stages of this transition, just looking at the retention numbers and graduation rates may not be the right thing to do. How many students graduated with certain credentials would be a better measure. He commented that not all jobs really need 4-year degrees and not all people require that.
  - Sash commented that in the UK they have a national satisfaction survey for undergraduates finishing degrees. An important metric is not just how many students graduated, but the fraction of students that graduated that got a successful placement.

**Next Meeting**

August 4 (12 pm ET)