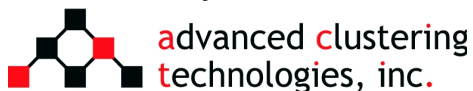# Best Practices for Writing a Successful NSF MRI Grant Proposal

Eight steps to winning HPC cluster funding.

The Major Research Instrumentation Program (MRI), administered by the National Science Foundation's Office of Integrative Activities, is a game-changer for universities and researchers who want to secure funding for the high performance computing solutions that will accelerate research.

As a provider of high performance computing solutions, Advanced Clustering is often called upon to provide recommendations and support that will help grant applicants win funding. Through our work with customers who have won grant money, and our own experiences as HPC consultants, we have developed this white paper to share best practices for writing an NSF MRI proposal for HPC equipment.

The demand for HPC continues to grow. A recent study from Clemson University found that the availability of TOP500-level computing power equates to an efficiency edge in research output. This growing demand will make MRI grants more competitive and difficult to obtain.

To offer some perspective, in fiscal year 2015, the NSF received 811 MRI proposals and awarded 205 grants. That means last year, an MRI grant proposal had a 1 in 4 chance of success. One eighth of the proposals requested budgets of greater than $1 million.

Breakdown: Success Rate by Field of Study

Biological Sciences	20%
Computer & Information Science	45%
Engineering	20%
Geosciences	32%
Mathematical and Physical Sciences	25%
Social Behavioral and Economic Sciences	37%

Source: NSF.gov

Eight Steps to Winning a Grant

1. Get to Know the National Science Foundation First

You can't expect to win thousands of dollars in grant money without first getting to know about the organization that awards it. Start with a visit to NSF.gov. Search recent awards at www.nsf.gov/awardsearch to examine the kinds of HPC proposals that are getting funded. Talk to the NSF program officer where your proposal best fits in order to talk about your proposal. Review The NSF Grant Proposal Guide and solicitation. Learn the guidelines and follow the rules. For example, your proposal may not include any requests that involve infrastructure improvements. Those will have to come from another source.

2. Form a Support Team from Day One

You are going to need to recruit a team of academic partners and an HPC vendor. Having a vendor such as Advanced Clustering will give you the benefit of technical advisers who have experience building HPC systems. Your HPC vendor will be able to tell you about current and upcoming technologies and, given your proposal timeline, will help you select the technology that best fits the need. Your team should include grant winners who can give you pointers such as this: keep your request total at under $1 million to avoid competing against very expensive lab equipment.

3. Make a Strong Case for the Need

Do your homework. Talk to all data center and HPC managers in your area to find out if they won grant funding and, if so, how. Ask these contacts to serve on the external advisory panel for your grant. After these discussions, be able to explain what is different about your HPC request and why you could not get what you need from existing resources and (most importantly) how you'll share your cluster locally and state-wide.

4. Demonstrate That You Understand Your Cluster Users

Another way to demonstrate the need is to identify those who will use your cluster. Solicit their support and feedback in order to write compelling user stories. Do not just talk about your strongest researchers; include others who are just getting started. For major research projects, provide all of the pertinent details. For minor projects, condense the text. This boils down to how well you understand your user community and its goals.

Eight Steps to Winning a Grant

5. Let Your HPC Vendor Map Out a Cluster Plan

Your HPC vendor will you determine which cluster architecture will work best for your need. For example, you'll need to determine what kind of HPC cluster you need – workgroup-level, department-level or campus-wide? You will need to talk to your cluster users and get a comprehensive list of the software they'll need to run their jobs. Your HPC vendor will use that list to develop an HPC system configuration that includes all of the hardware necessary to support the applications. It may be that you will need accelerators such as GPUs or Intel® Xeon Phi™. You will want to consider the benefits of infiniband connections. Your HPC vendor will help you sort through all of these questions to propose the optimal system. Advanced Clustering offers a test cluster that enables you to run sample jobs on different architectures and topologies to find the best configuration for your proposed cluster.

6. Secure Institutional Support from the Start

Talk to the administrators, data center managers and technical support staff at your institution early in your proposal writing process to get their support. This is especially important if part of your proposal involves matching funds from the institution. Ph.D-granting universities are required to share 30% of the costs. You need to get the cost-sharing details in writing (with documents signed by high-ranking officials) and make them a part of your proposal, including physical power, cooling and space requirements. An HPC vendor can help you calculate the details of these requirements.

7. Provide Details about How Users will be Trained

The NSF wants to hear about how you will attract users and how you intend to train them to make use of your HPC cluster. Talk to your HPC vendor and devise a plan for cluster installation and user training. The vendor should be able to offer both as part of their service. Make sure the vendor you select offers on-site installation and training. You are also going to need a solid plan for increasing cluster utilization because the NSF wants to make sure the HPC resources you'd be gaining will be used as much as possible. Therefore cluster utilization will be key to your success as a grant writer and as a repeat grant winner.

Eight Steps to Winning a Grant

8. Don't Forget to Paint the Big Picture

Who will your project benefit? What problems will it solve? What impact will it have on the community or the world? Be able to talk in real terms. You can accomplish this by talking to those who will be your users. What will the instrument help them accomplish? Let them help you write use cases to illustrate how they will use the cluster and what impact that work will have in the larger world. Your HPC vendor can help here, too, by helping you quantify the results you'll get from the HPC system being requested. The more you can define a national or international significance for your project, the more successful you will be.

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