



# Software at NSF/OCI

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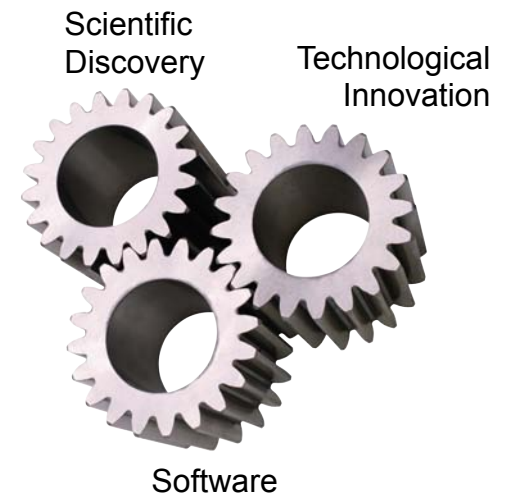
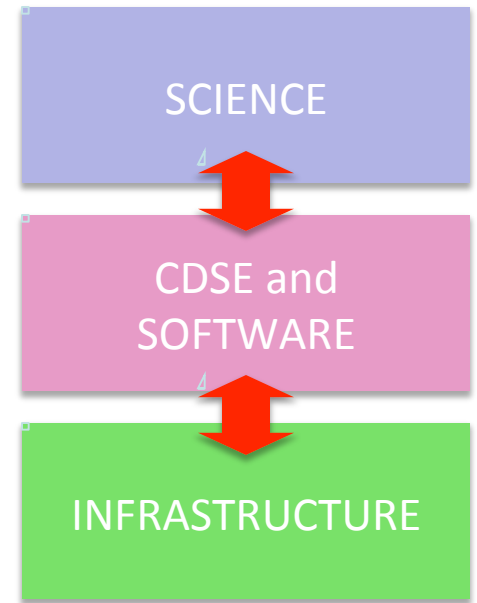
# Cyberinfrastructure

- Cyberinfrastructure consists of computing systems, data storage systems, advanced instruments and data repositories, visualization environments, and people, all linked together by software and high performance networks to improve research productivity and enable breakthroughs not otherwise possible – Craig Stewart
- Software: part of an infrastructure, developed by individuals and groups, international, developed for a purpose, used by a community



# Software as Infrastructure

- Software is an integral enabler across **all science and engineering disciplines** of computation, experiment, and theory and central component of new cyberinfrastructure
- Software enables education; education enables software
- Applications becoming more complex: multiscale/multimodel simulation codes, new data analytics and statistics, etc.
- Environments and applications becoming more complex: heterogeneous, distributed, massively parallel, etc.
- Software engineering: robustness, usability, reliability, V & V, etc.
- Research environment's challenges: motivation, credit, funding, licensing, multiple disciplines, international, etc.



*Science drives technology innovation **and vice versa***



Support the foundational **research** necessary to continue to efficiently advance scientific software

Create and maintain a software ecosystem providing new **capabilities** that advance and accelerate scientific inquiry at unprecedented complexity and scale

Enable transformative, interdisciplinary, collaborative, **science and engineering** research and education through the use of advanced software and services

Transform practice through new **policies** for software addressing challenges of academic culture, open dissemination and use, reproducibility and trust, curation, sustainability, governance, citation, stewardship, and attribution of software authorship

Develop a next generation diverse workforce of scientists and engineers equipped with essential skills to use and develop software, with software and services used in both the research and **education** process



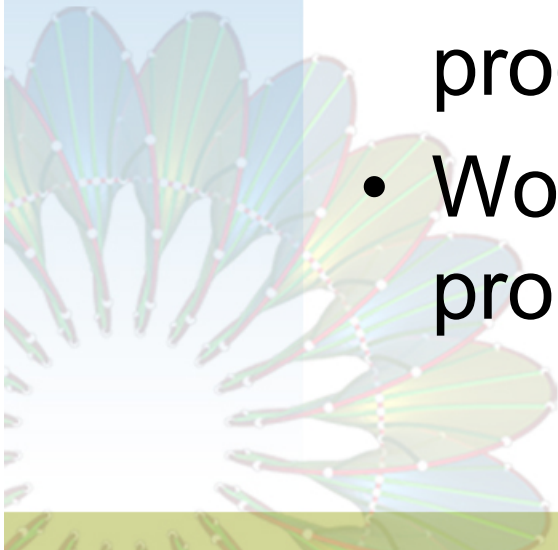
# OCI's Goals for Software

- Contribute to development and deployment of comprehensive, integrated, sustainable, and secure cyberinfrastructure at the national or international scale
- Have an effective cyberinfrastructure impact with clearly defined benefits across multiple research disciplines
- Promote the transition from basic research to effective practice
- Build on existing or upcoming OCI investments, as well as major cyberinfrastructure investments from other units



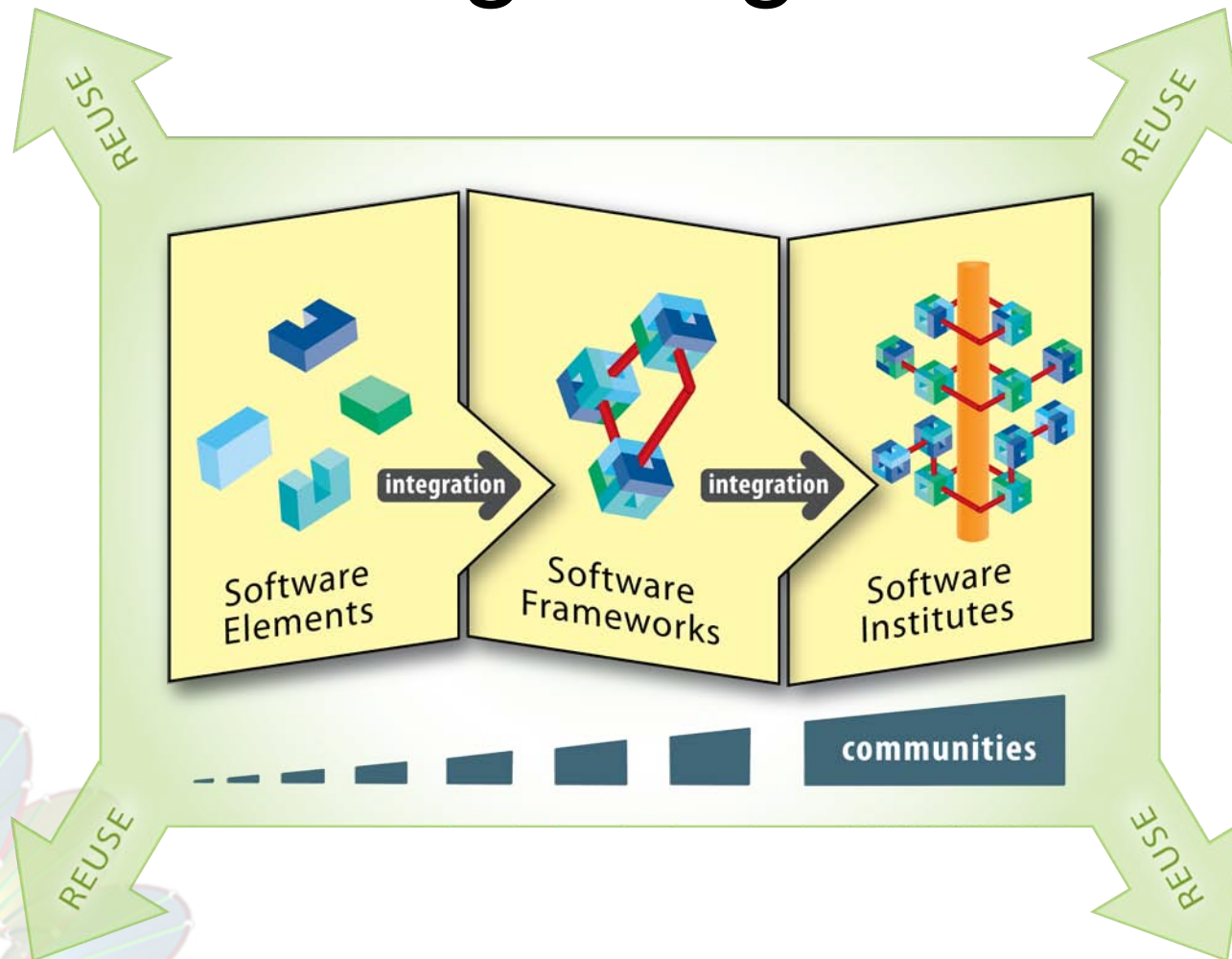
# Solicitation and Decision Process

- Cross-NSF software working group with members from all directorates
- Discusses solicitations, determines who will participate in each
- Discusses and participates in review process
- Work together to fund worthy proposals





# Putting it together



Look at NSF 11-539 and 11-589 for past solicitations;  
current NSF 12-576; new solicitations coming;  
consider supplements, EAGERS, etc.



# Some Open Software Questions

- Software that is intended to be infrastructure has challenges
  - Unlike in business, more users means more work
  - The last 20% takes 80% of the effort
  - What can NSF do to make these things easier?
- How should we measure impact of software?
  - Directly tied to funding decisions
- What fraction of funds should be spent of support of existing infrastructure vs. development of new infrastructure?
- What are the difference between software that's downloaded and software that's a service
- How do we decide when to stop supporting a software element?
- How do we encourage reuse and discourage duplication?
- How do we more effectively support career paths for software developers (with universities, labs, etc.)