Update to NSB

NSF Support of Computational Infrastructure to Transform Science and Engineering Frontiers

- National Computing Systems Deployments
- National Strategic Computing Initiative (NSCI)
- National Academy Study Final Report:

  Future Directions of NSF Advanced Computational Infrastructure to Support US Science in 2017 – 2022

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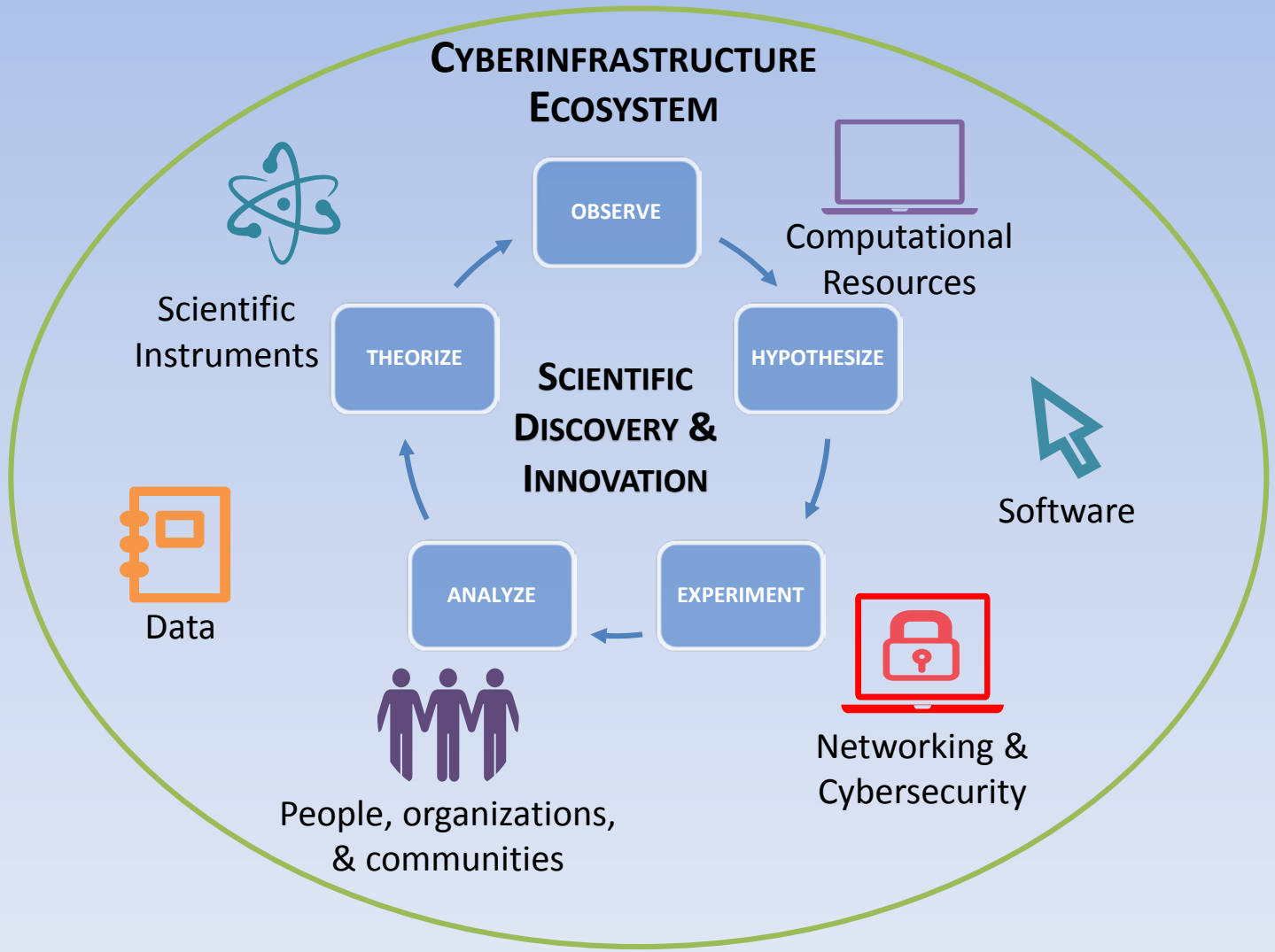
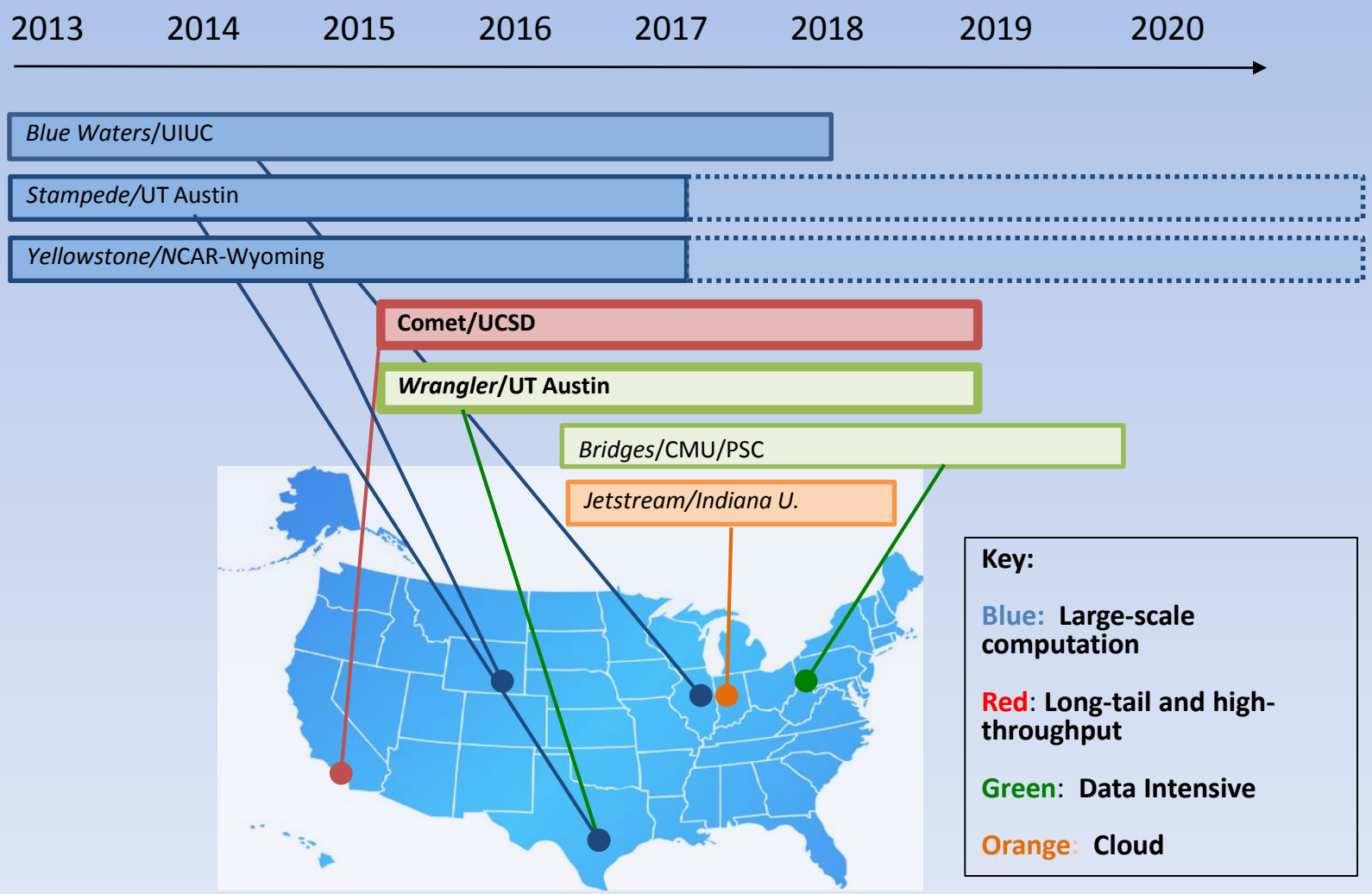
Computational Research Infrastructure

An ecosystem with collaborative, dynamic, and interoperable elements motivated by modern science and engineering



NSF-supported National Computing Resources

Enabling a forward-looking, cohesive computational foundation to further U.S. research & education

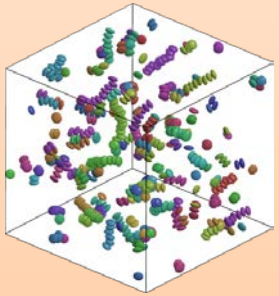


2015 NSF Supported Deployments

Recognize increasing scientific breadth and computational diversity

Comet: UCSD/SDSC/PI Norman

- Increases access, usability, capacity
- Reaches beyond campus scale
- Bridges to science gateways/portals

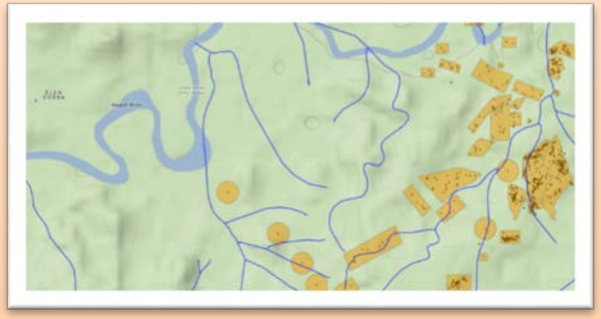


Sample Project: Colloids and self-assembling systems

- Simulates colloids of hard particles, including spheres, convex polyhedra, convex spheropolyhedra, and general polyhedra

Wrangler: UT Austin/TACC/PI Stanzione

- Provides groundbreaking data analytics at scale
- Novel configuration (I/O, file system)



Sample Project: PaleoCore

- Numerous projects in East Africa
- Custom databases: paleoanthropological, archeological data
- How to share and analyze data across multiple projects?

National Strategic Computing Initiative (NSCI)

Executive Order signed by President Obama on July 29, 2015

Maximizing HPC benefits for economic competitiveness and scientific discovery

NSF called on to provide leadership

- Scientific discovery advances
- Broader HPC ecosystem for scientific discovery
- Workforce development

Objectives

- 100x performance increase in HPC simulations
- **Technical synergy in platform for modeling/data analytics**
- **Research to take scaling beyond current device limits**
- **Increase capacity and capability of national HPC ecosystem**
- Public/private partnership

Executive Council

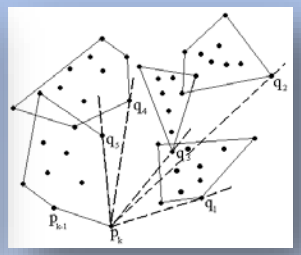
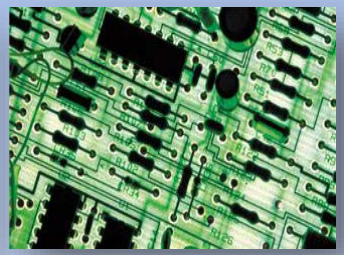
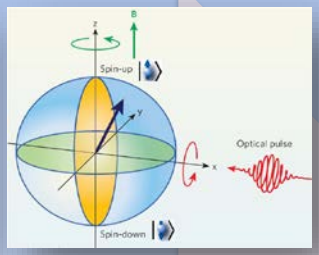
- Co-chairs: OSTP and OMB Directors

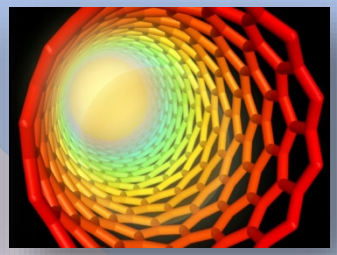
Implementation plan

- Initial implementation plan submitted to Executive Council within 90 days
- NSF plan builds on the current foundation, while setting an ambitious future
  - Co-led by MPS/CISE with participation by all directorates

NSCI Objective 3

Establish, over the next 15 years, a viable path forward for future HPC systems in the post Moore's Law era



Happening now

- Multi-core and many-core processors
- Domain-specific integrated circuits
- Energy-aware computing
- Hierarchical memories
- High-speed Interconnects

Longer term

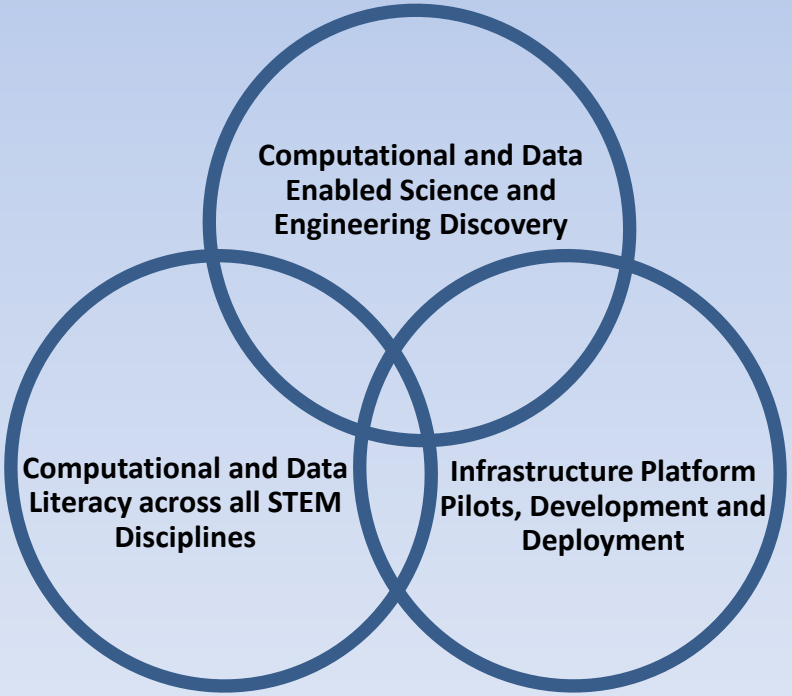
- Usable parallelism, concurrency, and scalability
- Resiliency at scale
- Decreased power consumption
- Architectures that reduce data movement
- New materials (e.g., carbon nano-tubes, graphene-based devices)
- Non-charge transfer devices (e.g., electron spin)
- Bio, nano, and quantum devices

NSF Role: Support foundational research
Leadership by CISE, ENG, MPS, and BIO
Build on existing interagency and industry partnerships

NSCI Objectives 2 and 4

2: Increase synergy between technology base used for modeling and simulation and that used for data analytic computing

4: Increase the capacity and capability of an enduring national HPC ecosystem, employing a holistic approach … networking, workflow, downward scaling, foundational algorithms and software, and workforce development



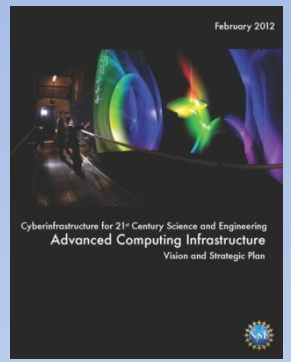
NSF Roles:

- Accelerate scientific discovery advances
- Participation by all NSF directorates
- Expand international, interagency, public sector, and industry collaborations

Emphasis on re-use, agility, interoperability, sustainability

Looking to the Future:
Continuing Community Engagement

- **NSF Advanced Computing Infrastructure for 21st Century Science and Engineering: Vision and Strategic Plan (Feb 2012)**
- **Future Directions of NSF Advanced Computational Infrastructure to Support US Science in 2017 – 2022**
  - National Academy of Sciences (NAS)
  - Interim report (Oct 2014), Final report (Fall 2015)
- **National Strategic Computing Initiative (NSCI)**
  - Initial implementation plan to be approved by the NSCI Executive Council
  - Synergistic initiatives identified
    - Materials Genome, Advanced Manufacturing, BRAIN, etc.
- **Advisory Committee for Cyberinfrastructure (ACCI)**
  - November 5-6, 2015



Interim report Co-chairs:
W. Gropp/UIUC
R. Harrison/Stony Brook