

The Importance of Cyberinfrastructure for Research and Education

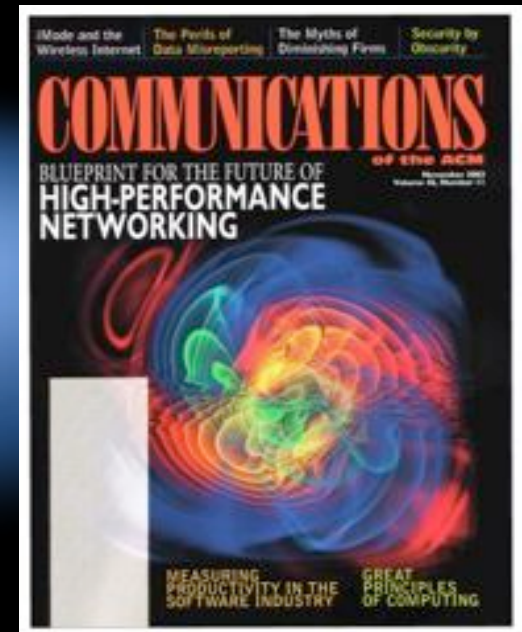
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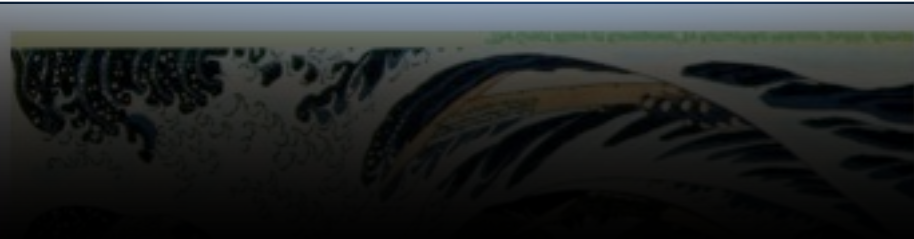
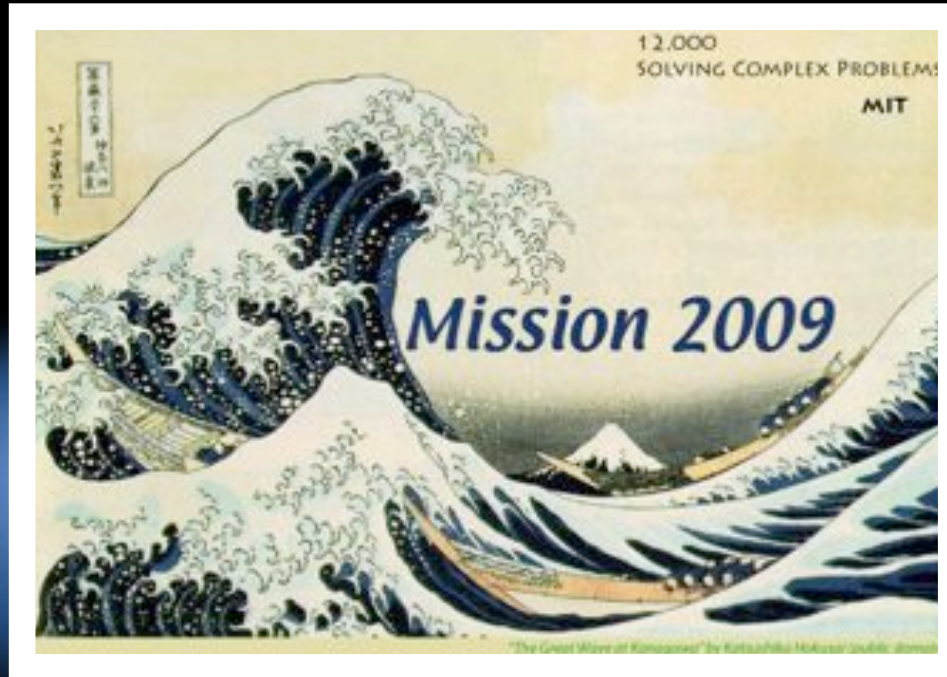


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Where Discoveries Begin

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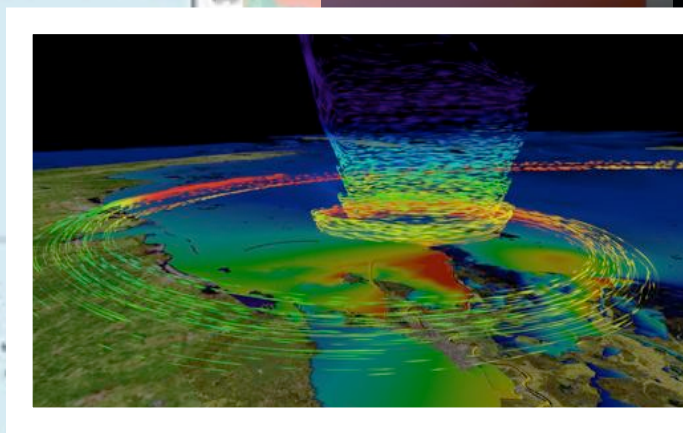
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Complex Problems *Require advanced CI*



An Important Complex Problem

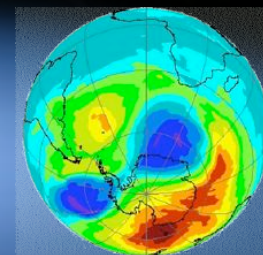
Where is it going to go?



Collaborations for Complex Problems

Great Challenge of 21st Century

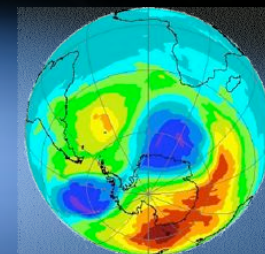
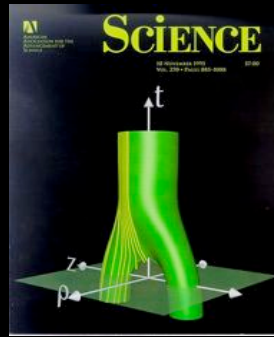
- Every field of science
 - General Relativity
 - High Energy Physics
 - Geosciences, Bio, SBE...
 - And all combinations...
- Cyberinfrastructure & SBE play central role in collaborations for complex problems
 - No single community can attack challenges
 - Technical and social/behavioral
 - Compute & Data intensive
 - OCI, SBE emerging together as critical



Collaborations for Complex Problems

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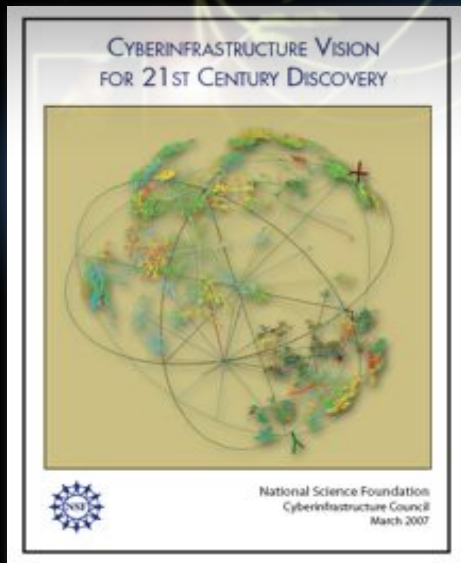
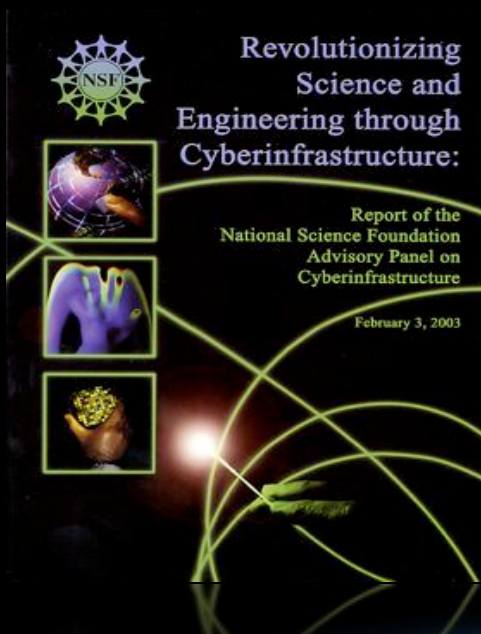


Science, Engineering, Society are being Transformed

- Complex problems require totally new methodologies
 - Scale computing beyond current experience...
 - Large scale data, beyond...
 - Large scale collaborations, beyond...
- Good news!
 - Cyberinfrastructure!
- Not so good news!
 - We are not moving fast enough, spotty CI coverage!



NSF Vision



1. Virtual
Organizations for
Distributed Communities

2. High
Performance
Computing

3. Data &
Visualization/
Interaction

4. Learning & Work Force
Needs & Opportunities



National CI Blueprint

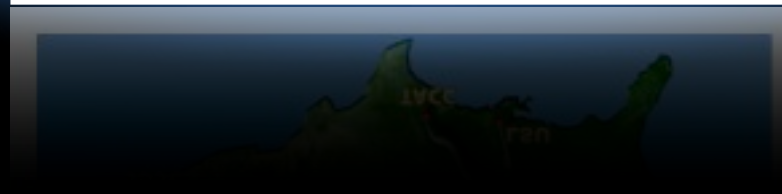


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National CI Blueprint



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National CI Blueprint



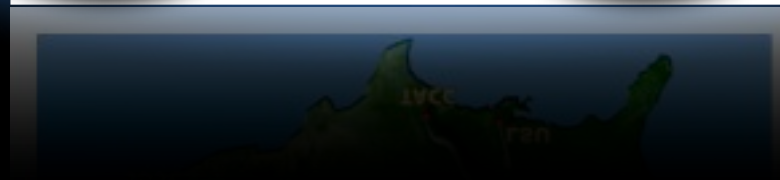
Track 2

Track 2

Track 2



National CI Blueprint



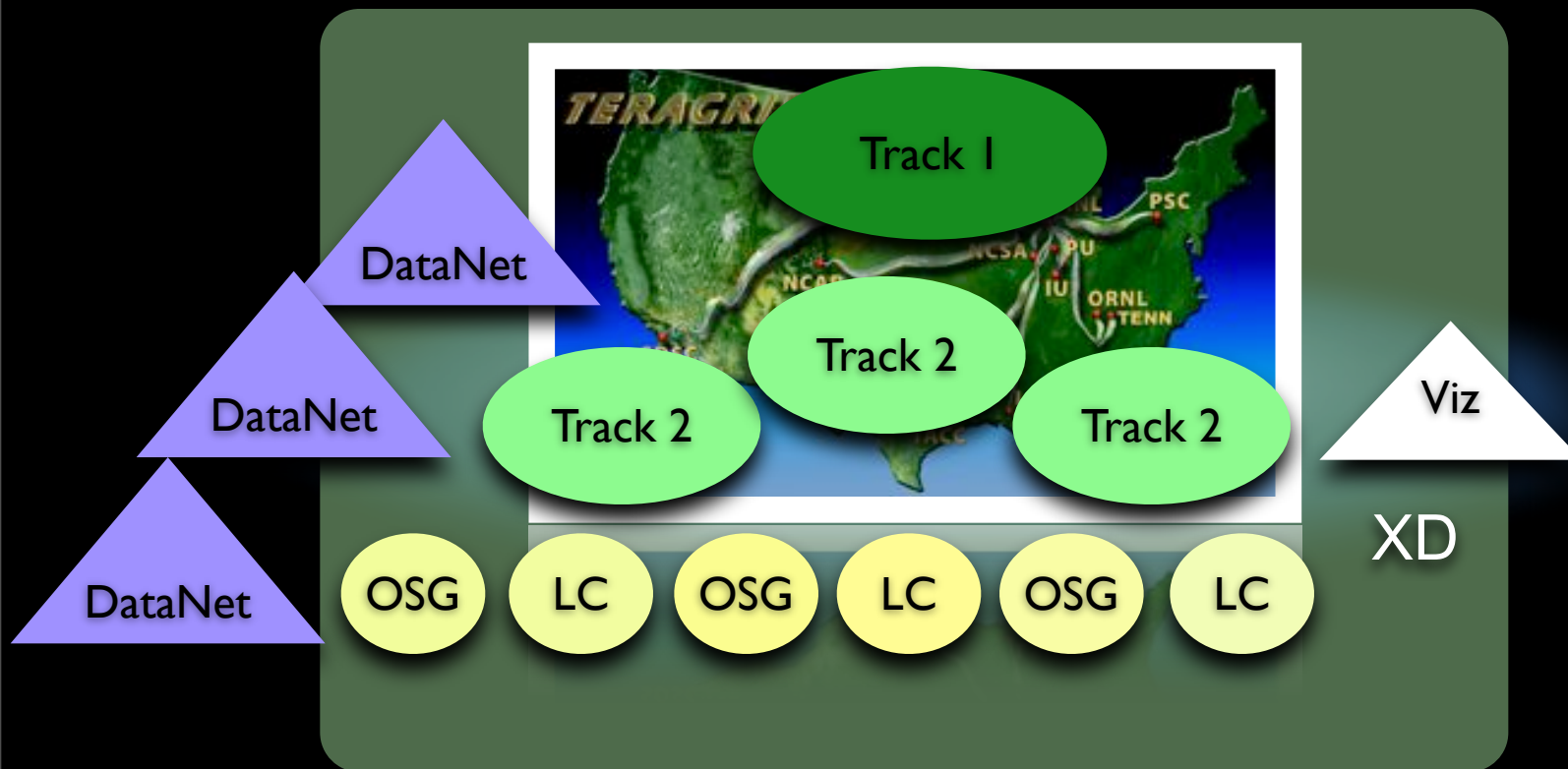
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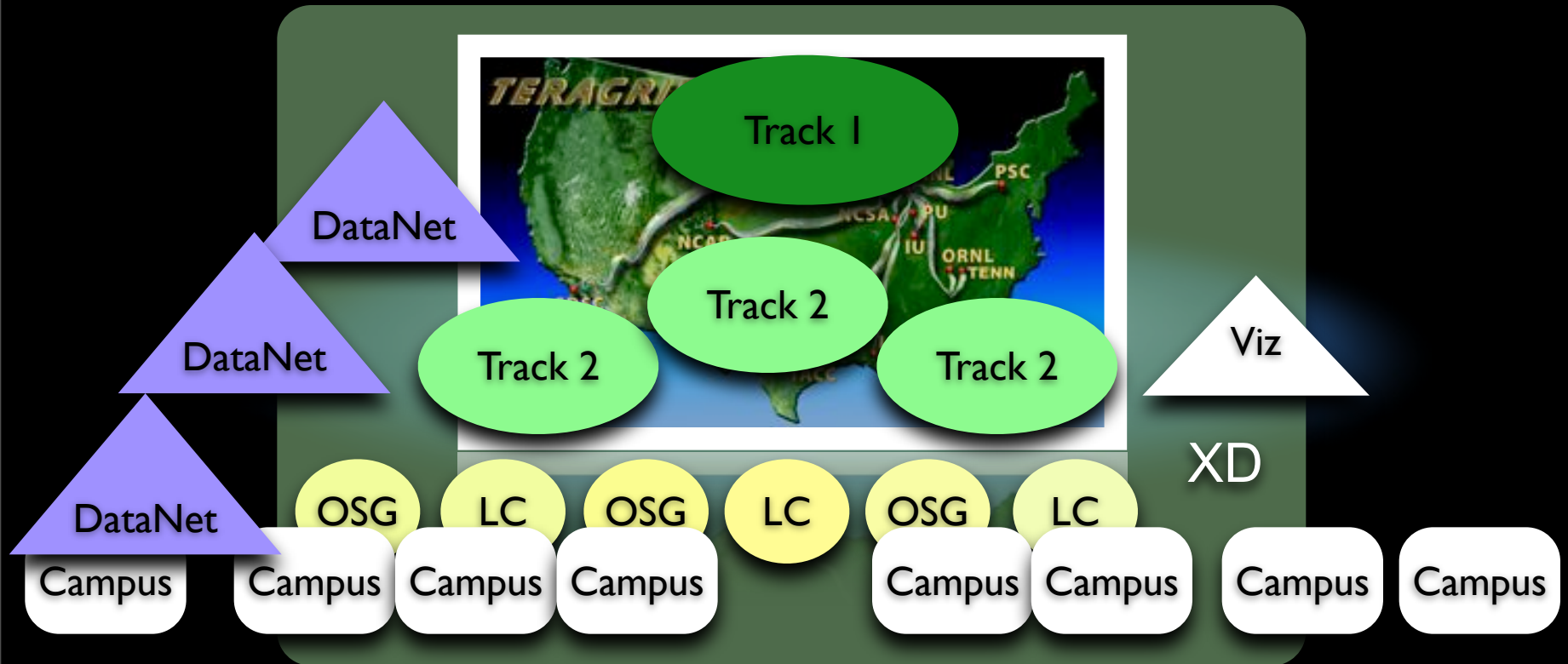
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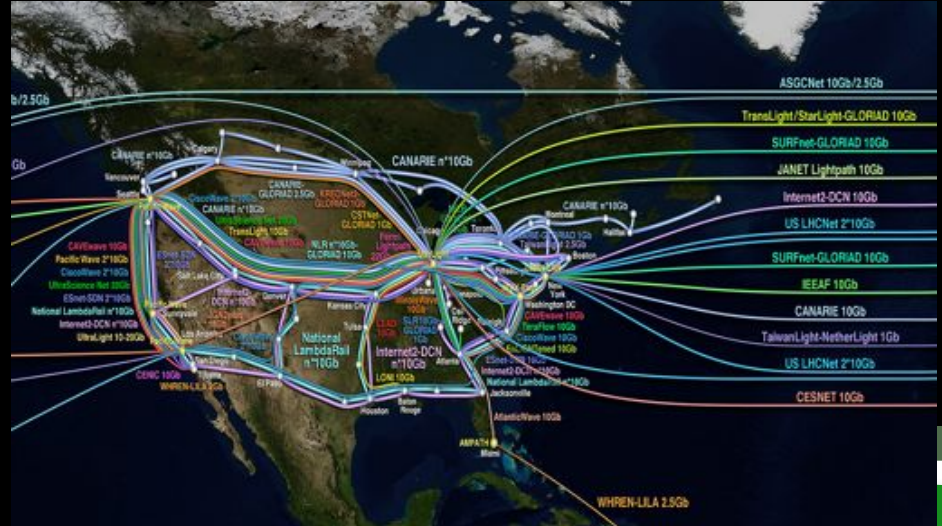
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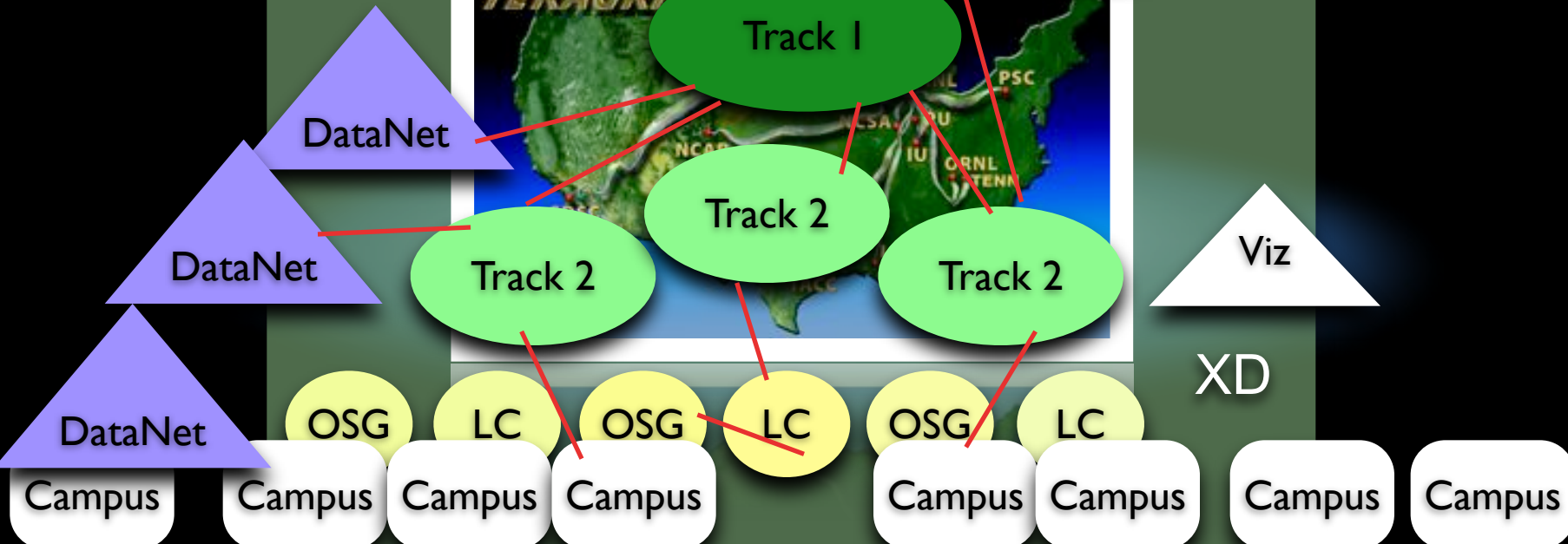
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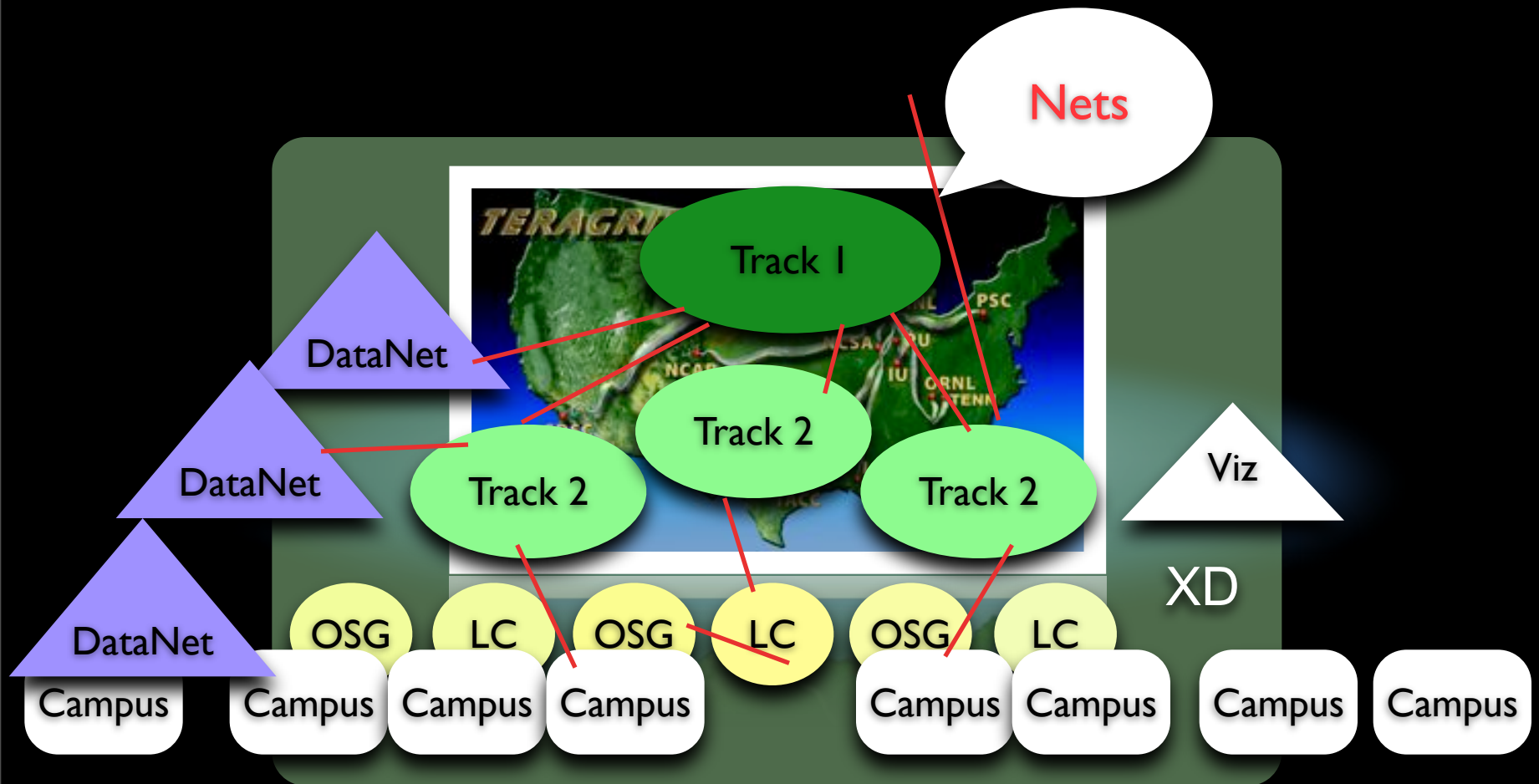
Blueprint



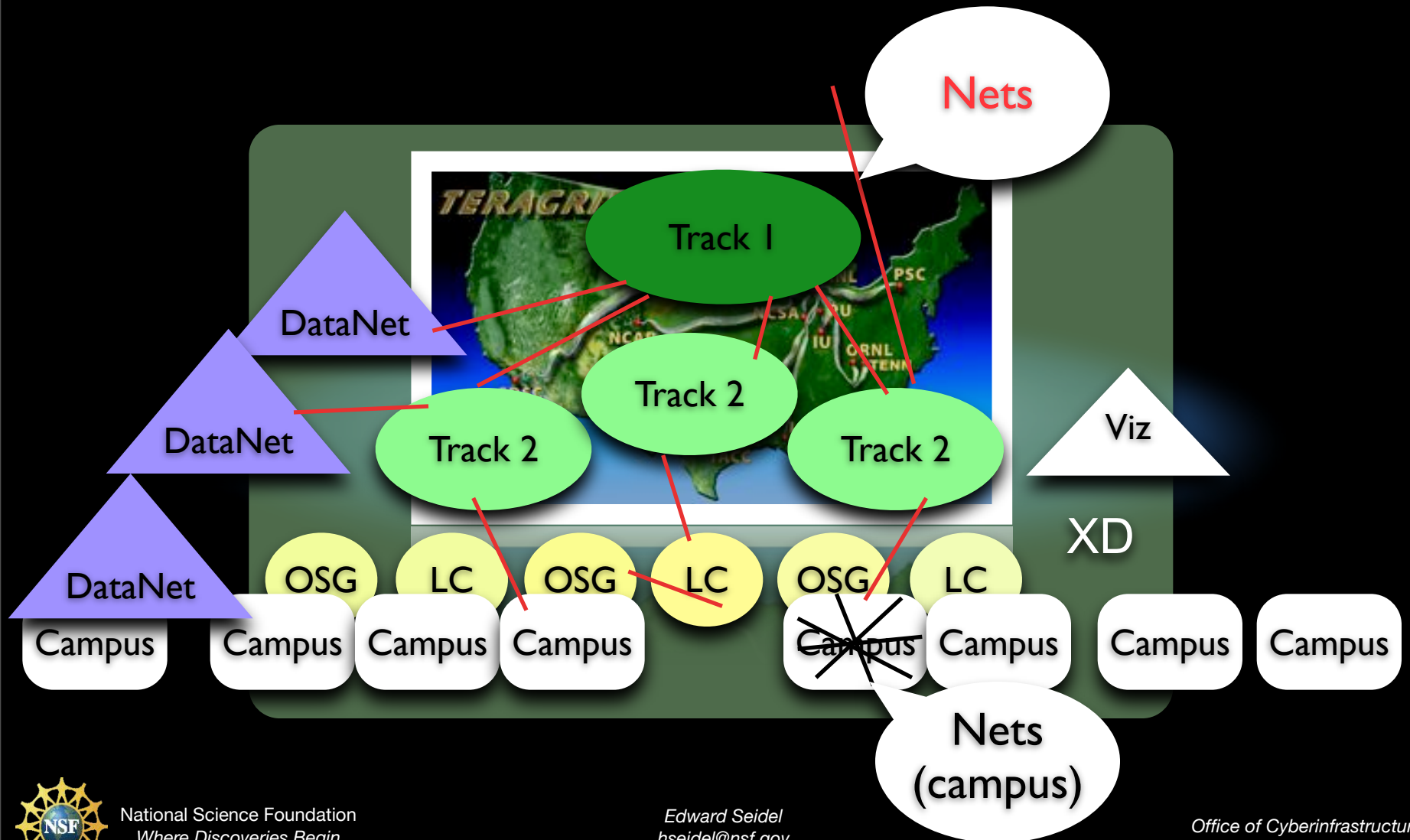
Nets



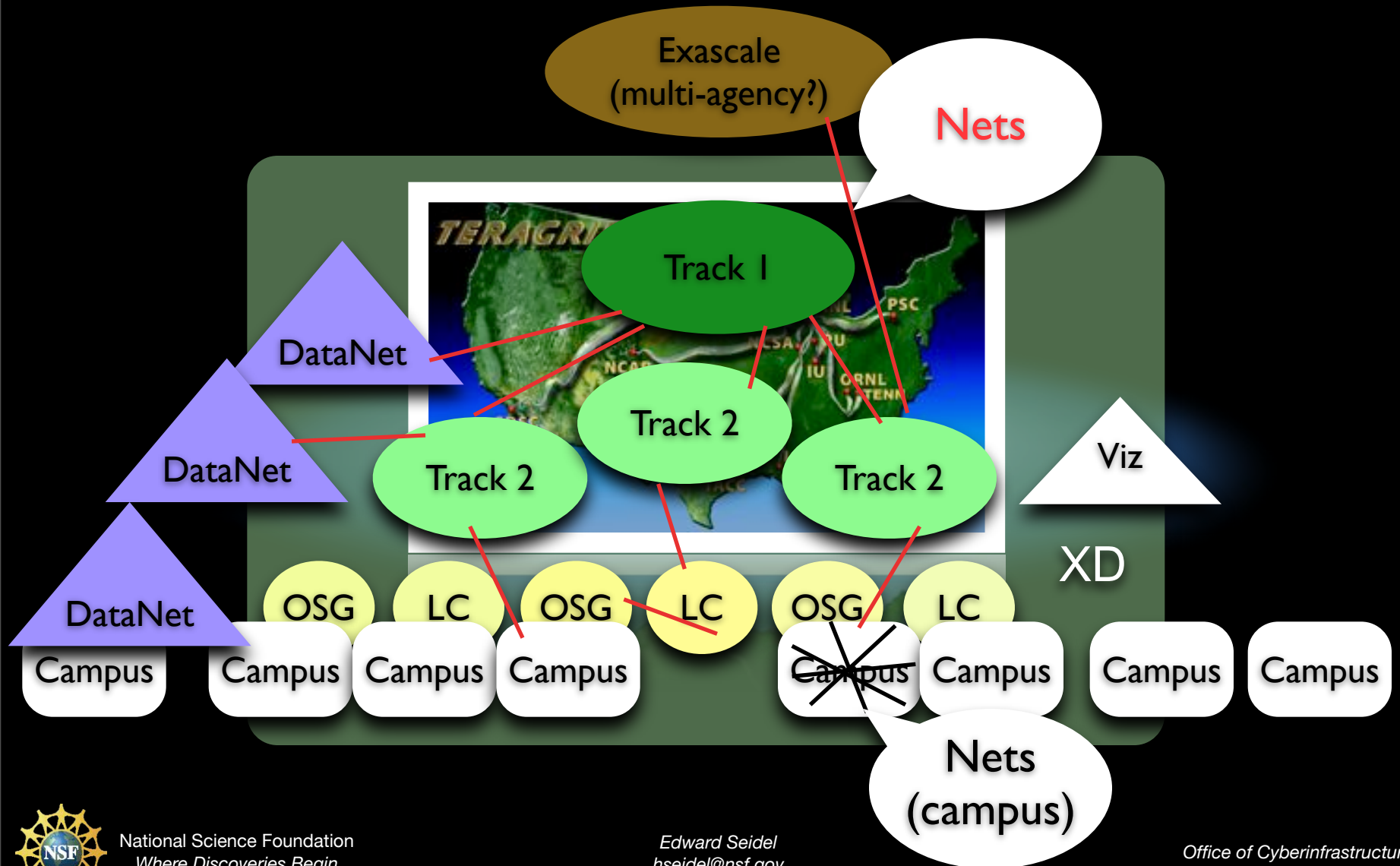
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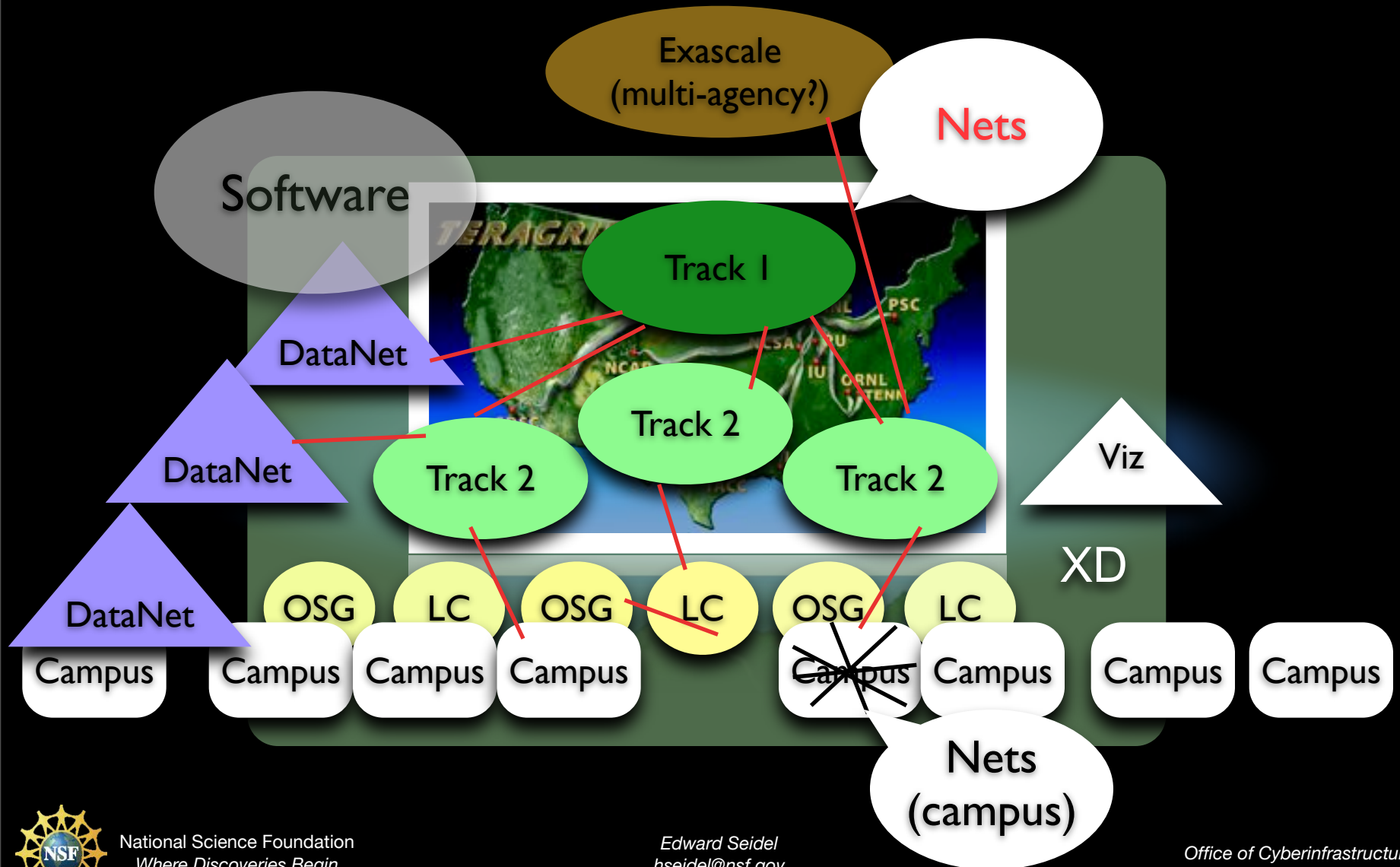
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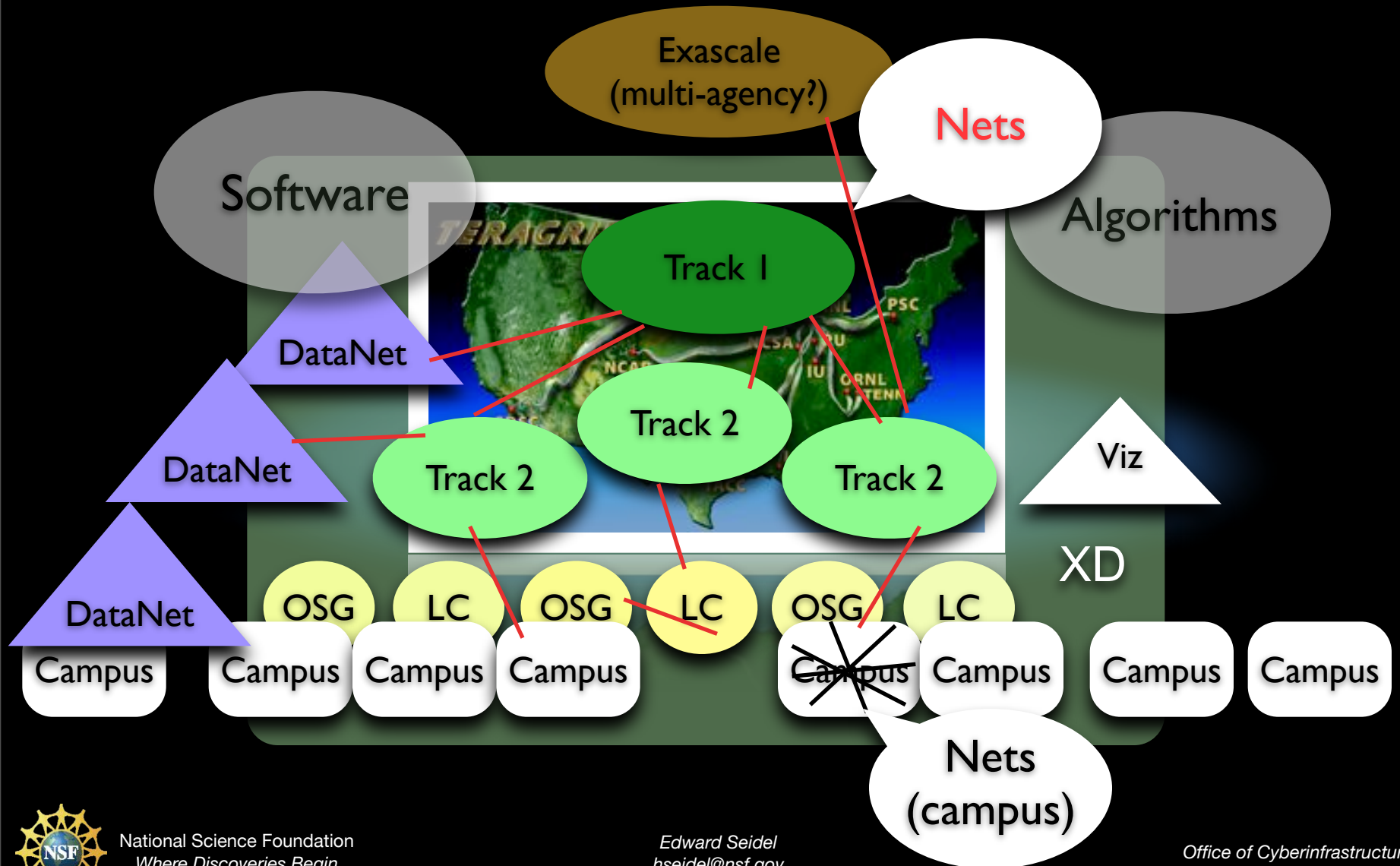
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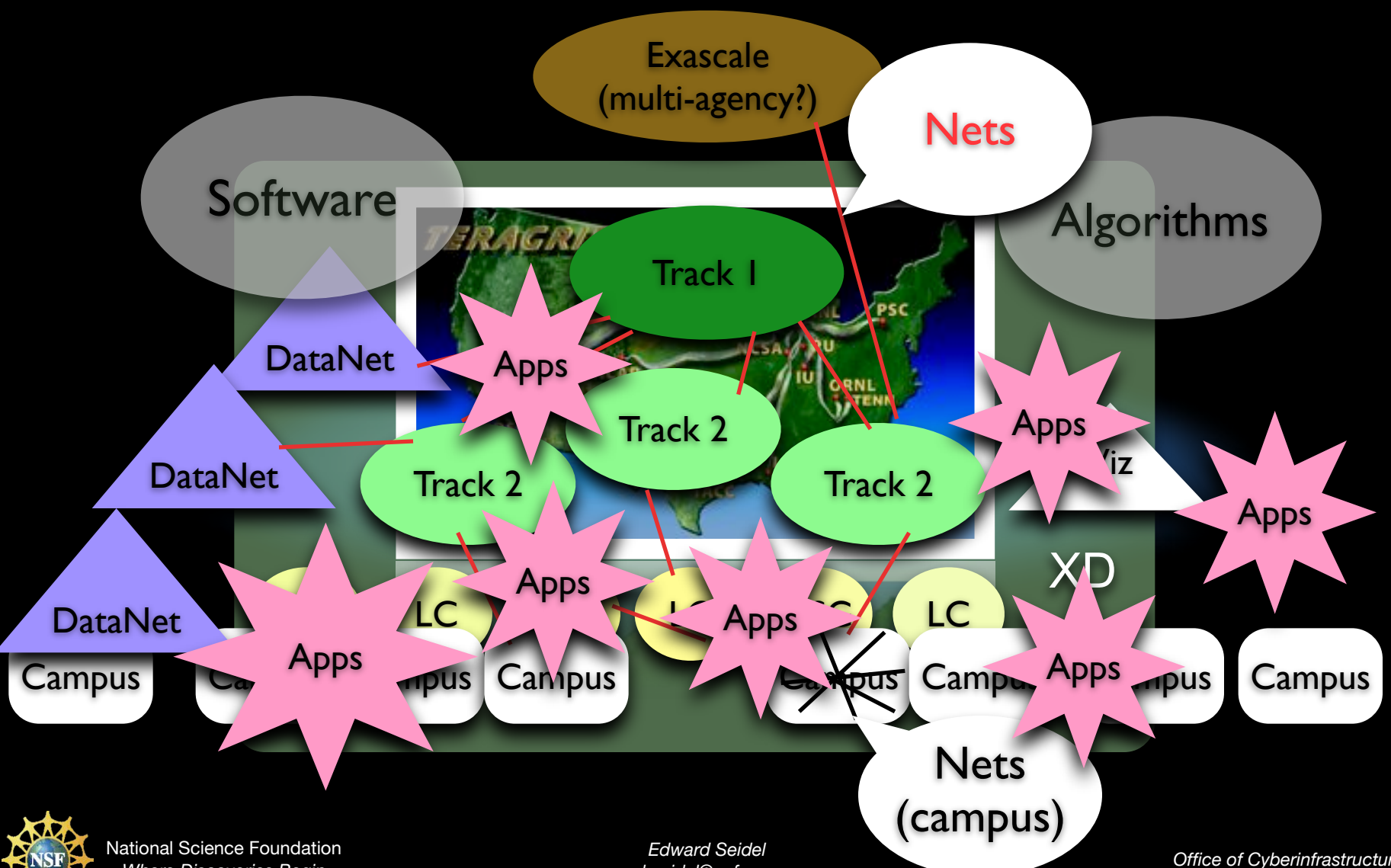
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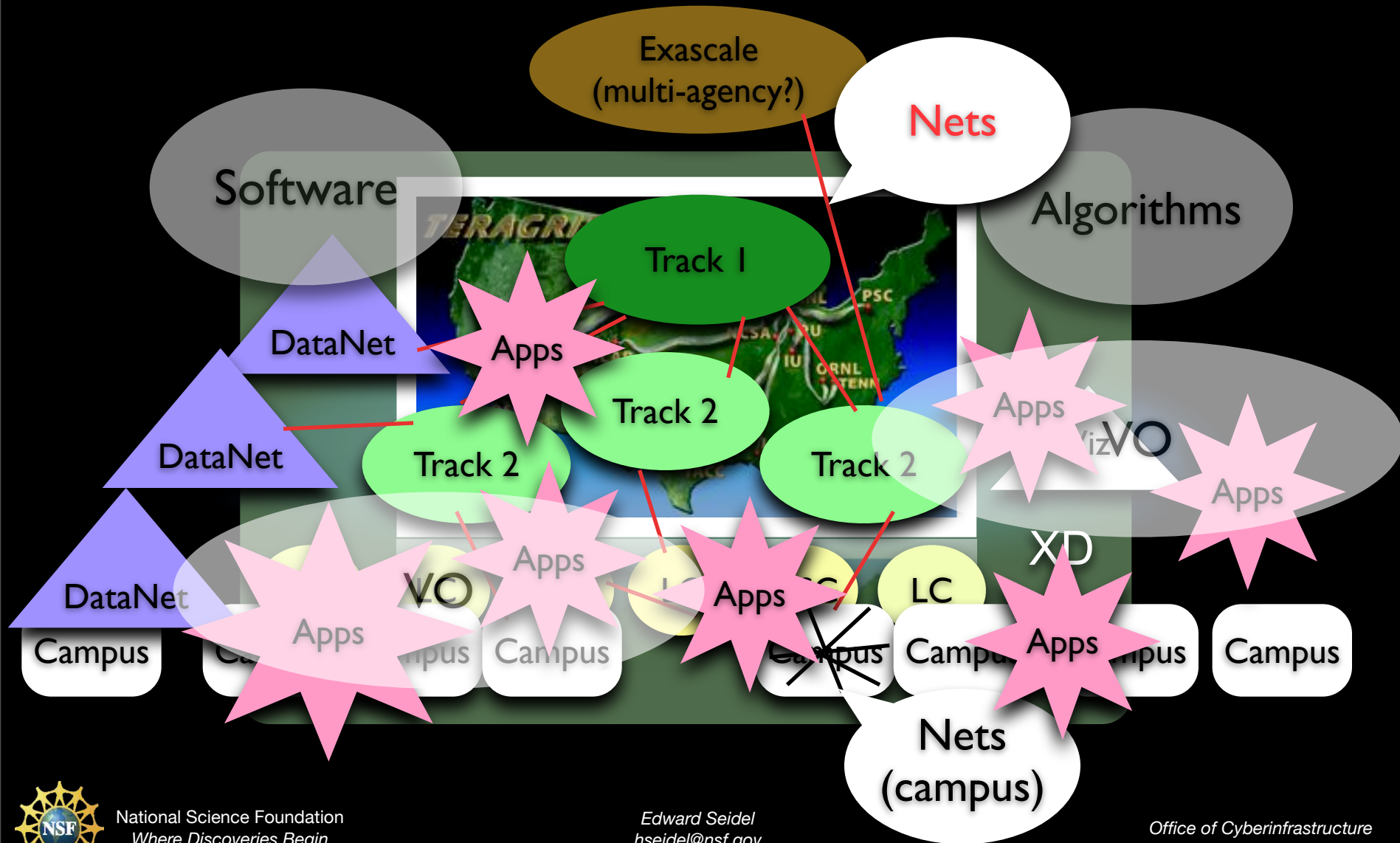
National CI Blueprint



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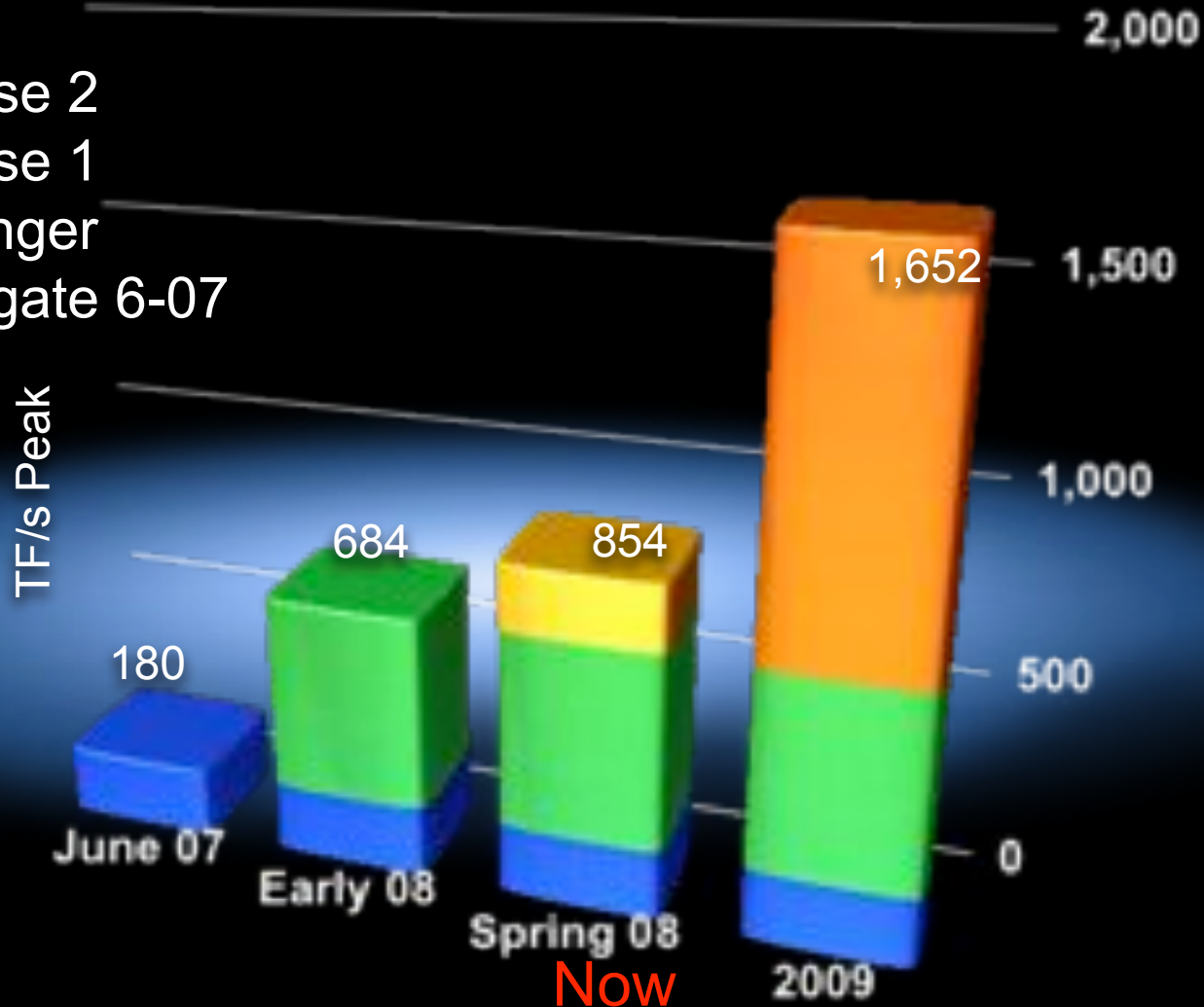
National CI Blueprint



Impact

Greatly expanding capacity of the TeraGrid for digital exploration with reduced oversubscription and queue wait times.

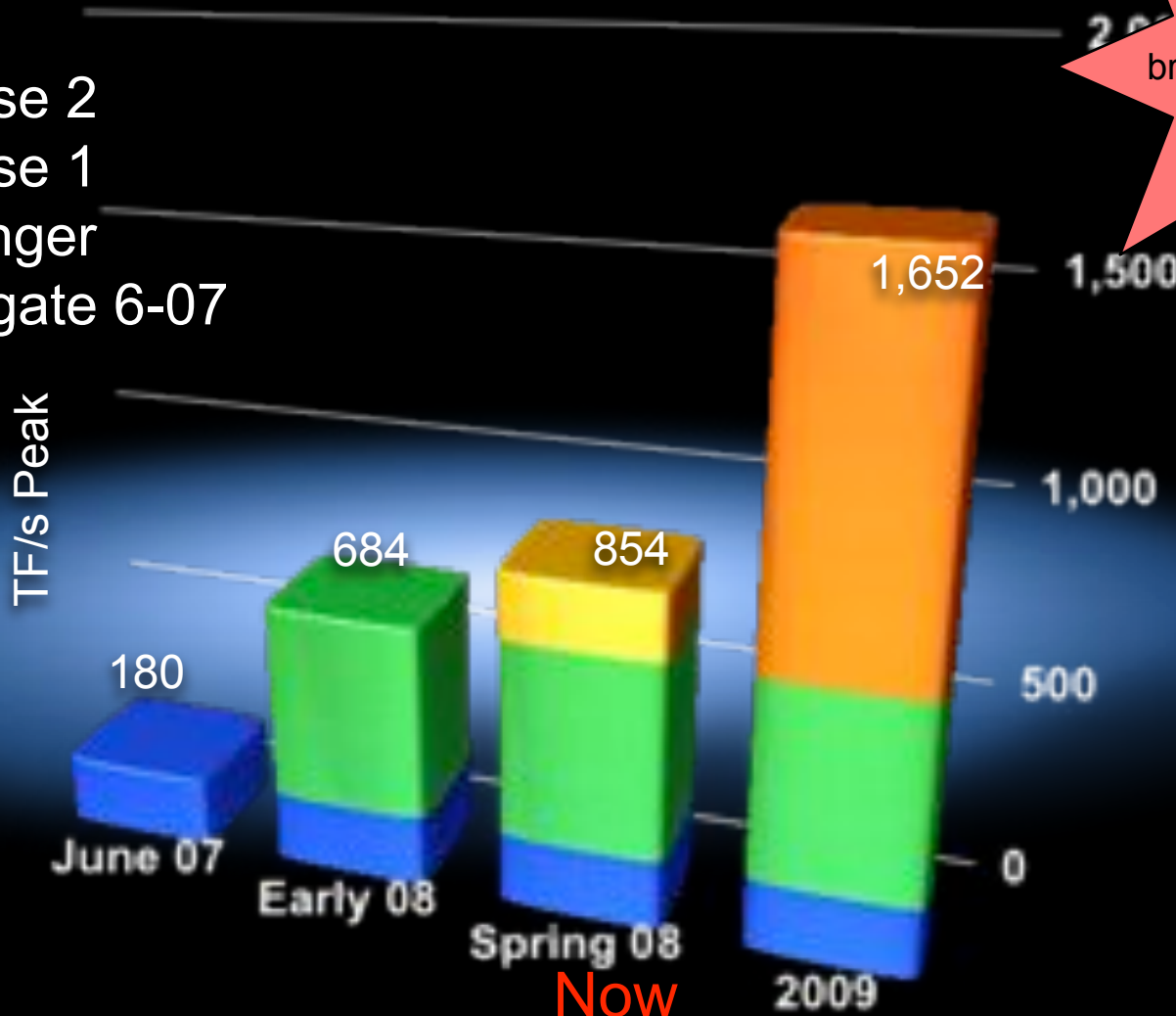
- UT-K Phase 2
- UT-K Phase 1
- TACC Ranger
- TG Aggregate 6-07



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Track 1, Track 2d bring this up by almost 10x!



TeraGrid Phase III (XD)

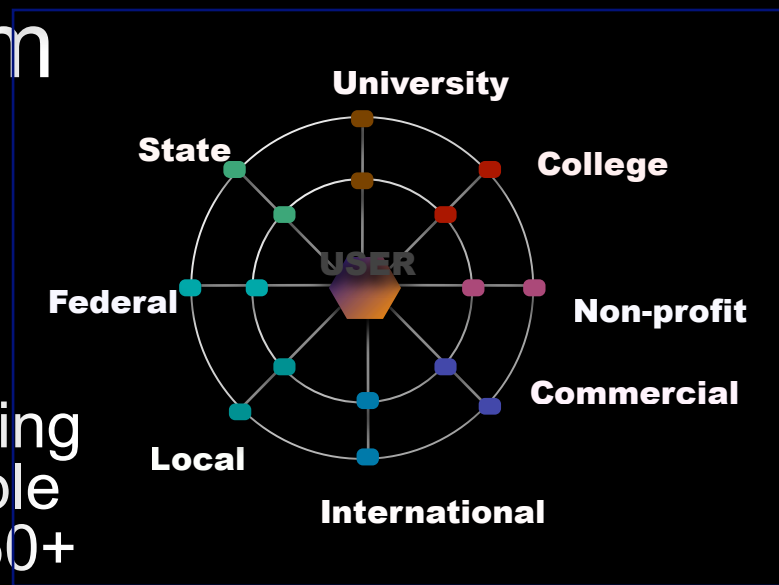
- XD is looking for innovative proposals for a new infrastructure to deliver the next generation of high-end national digital services
- Goal is to advance science and engineering by providing researchers and educators with the capability to work with extremely large amounts of digitally represented information and making it easy to move between local and national resources
- Anticipate researchers working with much larger range of digital artifacts, including digital text, digitized physical samples, real-time data streams, ...



\$100M DataNet Program

(Sustainable Digital Data Preservation & Access Network Partners)

- **Goals:**
 - Catalyze development of multi-disciplinary science & engineering data collections: open, extensible & evolvable, sustainable over 50+ years.
 - Support development of a new generation of tools & services facilitating data acquisition, mining, integration, analysis, visualization.
- **Status:** Recommendations to NSB in Dec. Round 2 pre-proposals due Nov. 13, w/invited full proposals due May 15, 2009.

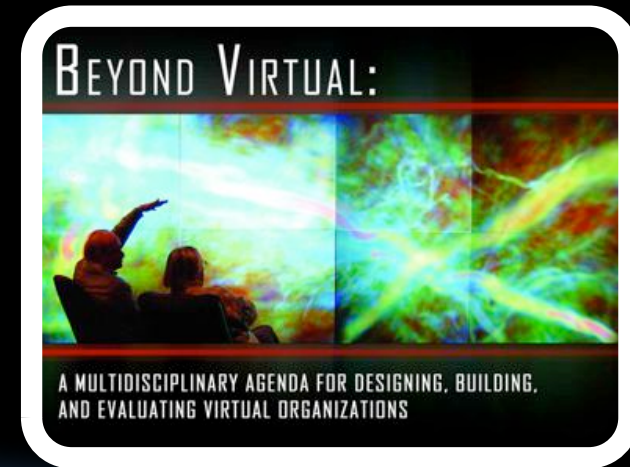


- **User-centric**
- **Multi-Sector**
- **Sustainable**
- **Extensible**
- **Evolvable**
- **Nimble**
- **Reliable**



Virtual Organizations & VOSS

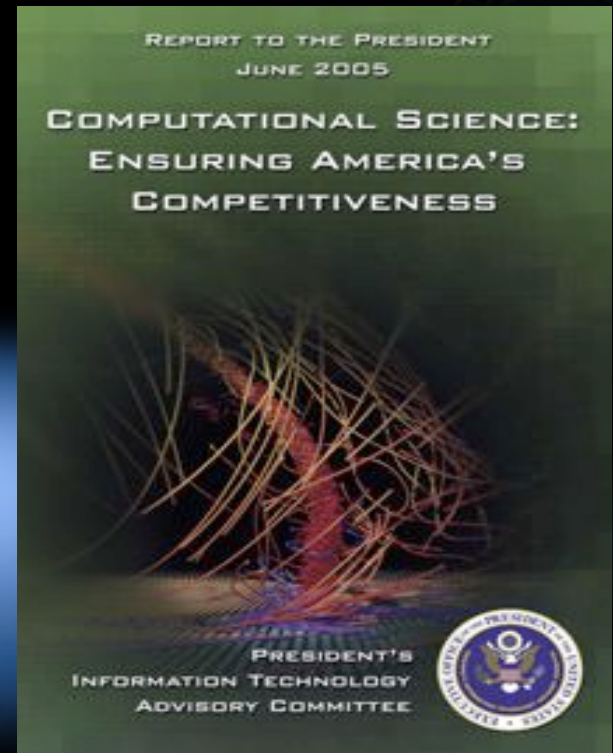
- VOSS
 - What constitutes effective virtual organizations? How do they enhance scientific, engineering, and education production and innovation?
 - Anthropology, CS, complexity, economics, ...
 - Science Gateways
 - NanoHub, NEES, LEAD...
 - Grand Challenges: Collaborations for complex problems



Collaborations for Complex Problems PITAC Report Summary



“Universities must significantly change organizational structures: multidisciplinary & collaborative research are needed [for US] to remain competitive in global science”



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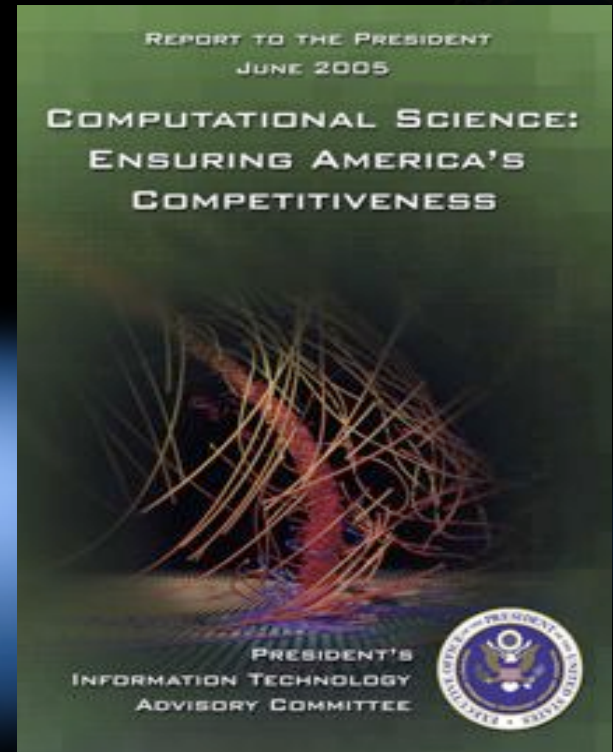
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Office of Cyberinfrastructure
Social, Behavioral & Economic
Sciences Directorate

Collaborations for Complex Problems PITAC Report Summary



“Together with theory and experimentation, computational science now constitutes the “third pillar” of scientific inquiry, enabling researchers to build and test models of complex phenomena...”



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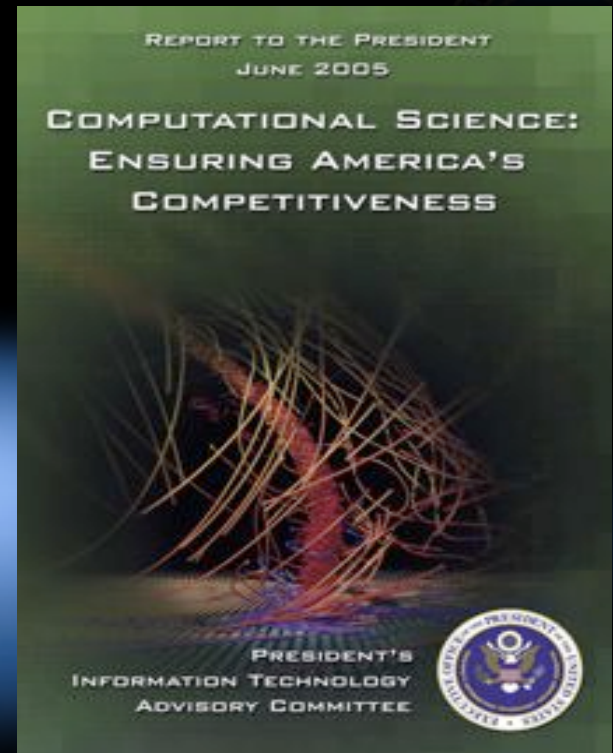
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Collaborations for Complex Problems PITAC Report Summary



“...inadequate and outmoded structures within the Federal government and the academy today do not effectively support this critical multidisciplinary field”



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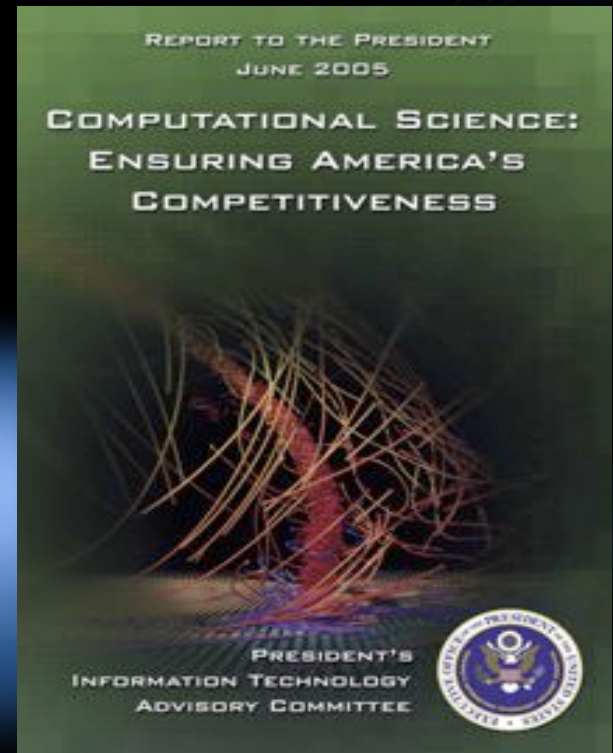
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Collaborations for Complex Problems PITAC Report Summary



“Among the obstacles to progress are rigid disciplinary silos in academia...that stifle the development of multidisciplinary research and educational approaches essential to computational science. [We] must fundamentally change organizational structures to promote and reward collaborative research.”



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My Ideas for Rough Plan for Future

- Attempt to fill out holes in current CI coverage
 - Software, applications, networks
 - Alternate computing modalities
 - Workforce development!!
 - Taskforces for community input
- Expand preliminary work on VOs across NSF
- Launch new complex problems at frontiers of science and engineering
 - This is all computational science: needs a home!
 - CI-driven, with above pieces in place first



What are SBE Frontier Problems?

- How can we move forward together?
- Examples:
 - Disaster and emergency response forecasting
 - How does the human brain function?
 - Understanding world economy?
- Each of these frontier problems will involve computing, data, sensors, observation, networks, VOs, ...
- Please discuss!

