

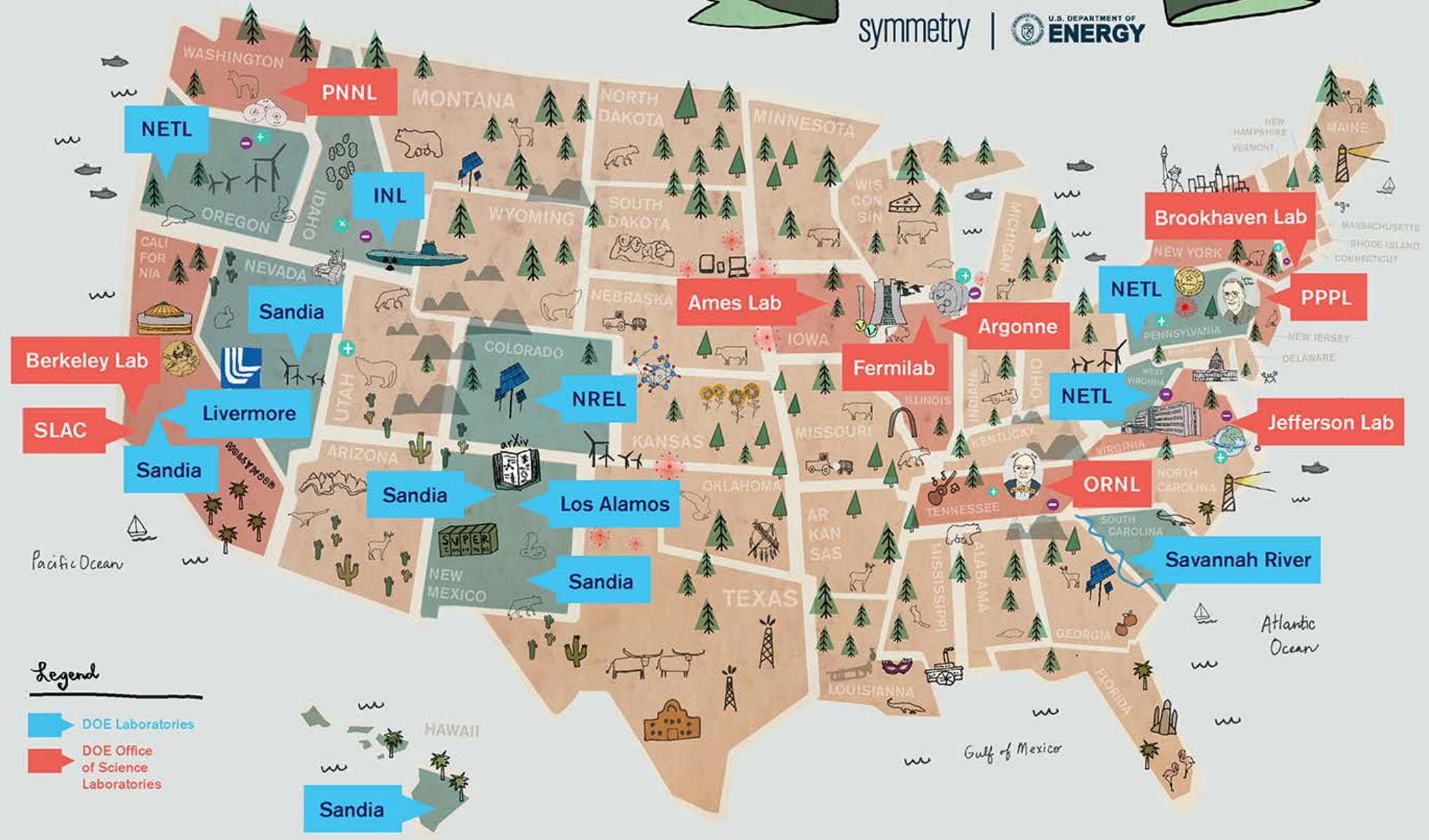
Why we need better networked systems

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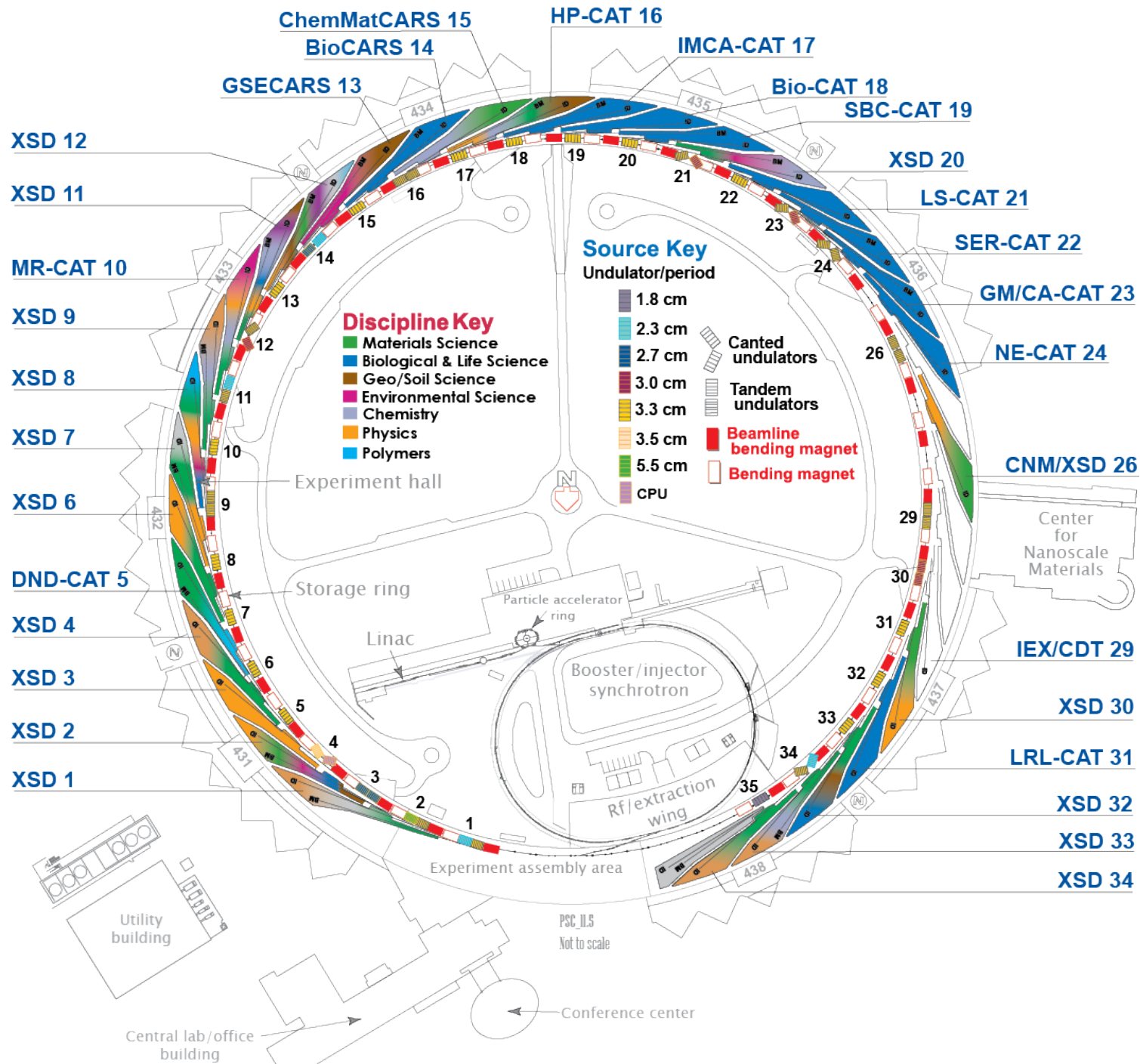
symmetry | U.S. DEPARTMENT OF ENERGY



Legend

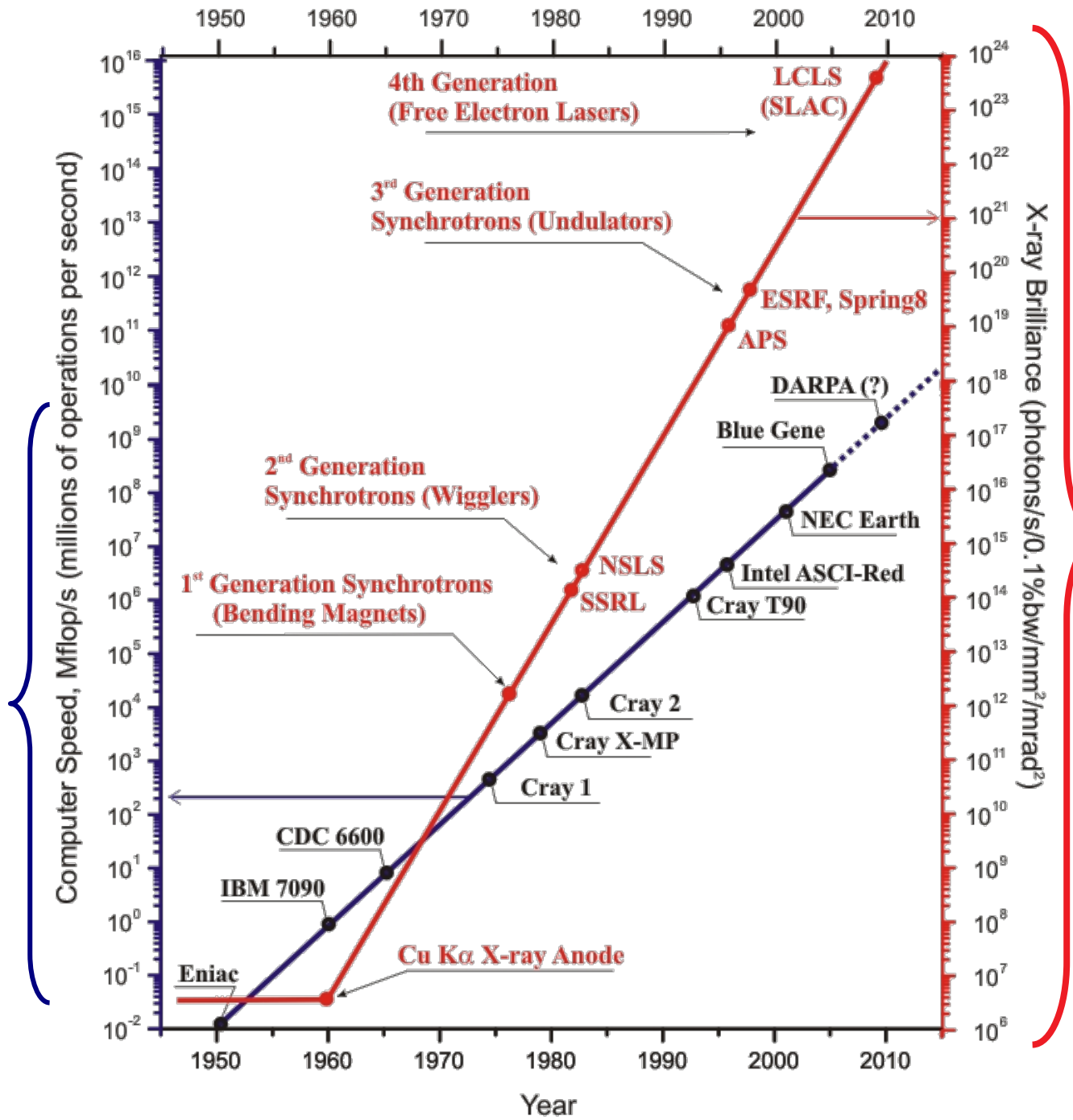
- DOE Laboratories
- DOE Office of Science Laboratories





Light source brilliance over time

12 orders of magnitude in 6 decades



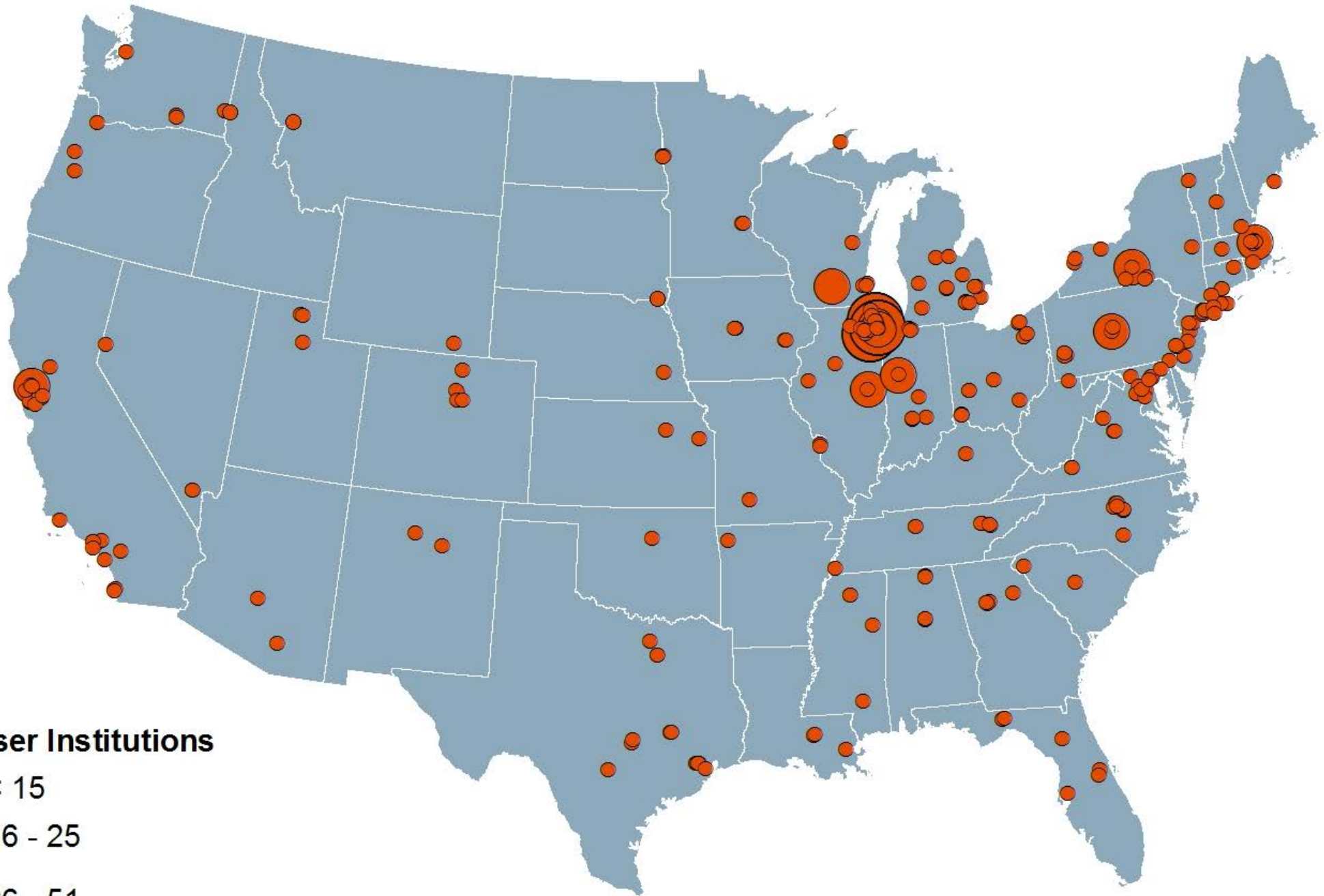
18 orders of magnitude in 5 decades!






ALCF-4: 10^{18} ops/s
(2023)

1 Tb/s
~1 km
(5 usec)

(2024)
APS-U: 10^{22} std units



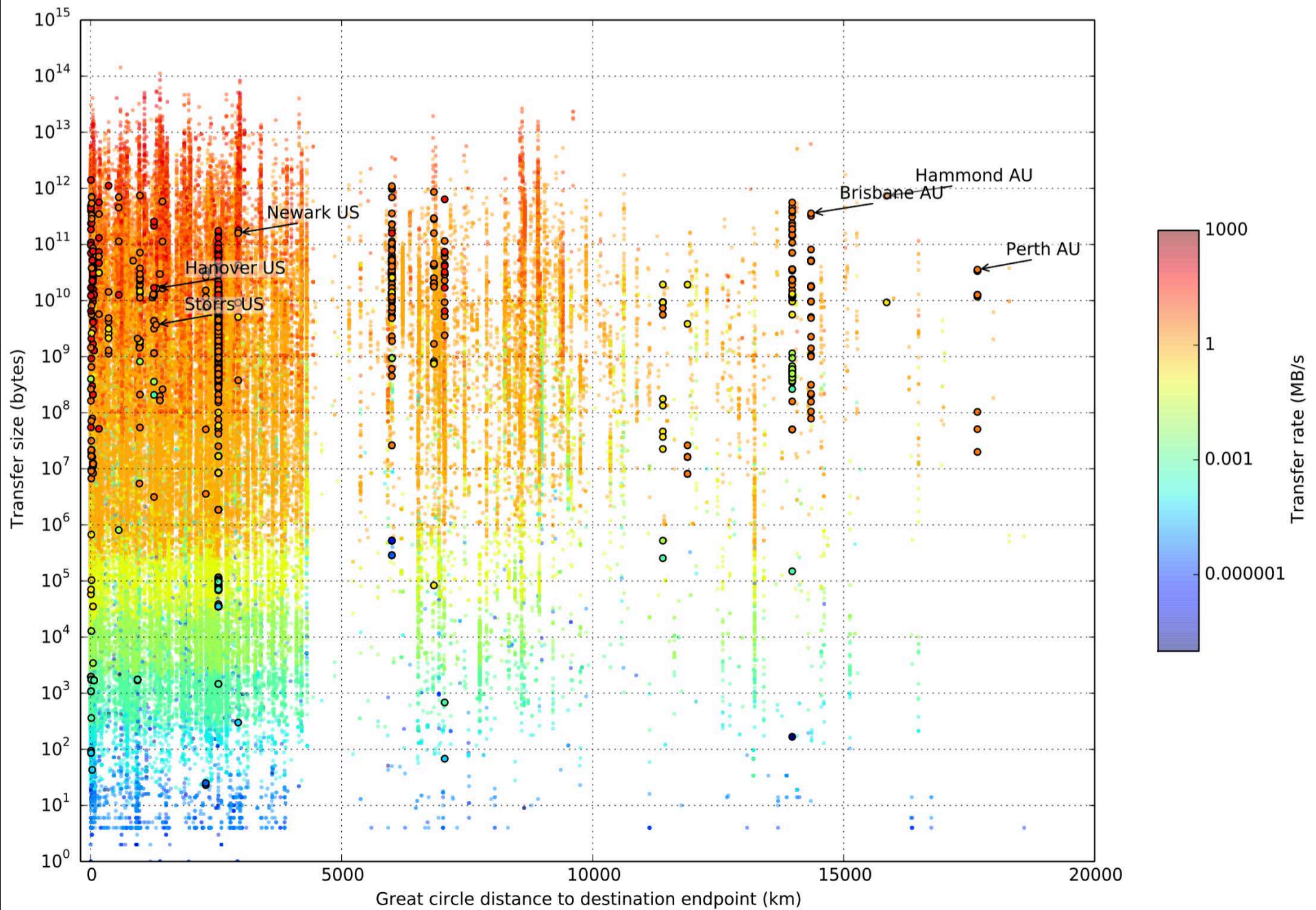
of User Institutions

-  < 15
-  16 - 25
-  26 - 51

One Advanced
Photon Source
data node:
125 destinations



Globus transfers, showing rate (via color) as a function of distance and volume.
The 1921 transfers from aps#clutch are highlighted.



The challenge: From networks to systems

- Exploding data volumes; new experimental modalities requiring rapid analysis, computer-in-the-loop control, multi-modal imaging, integrated knowledge bases
- Median end-to-end performance is poor despite excellent ESnet, expanding Science DMZs, etc.
- We need to learn how to build **systems** that can deliver predictable and high end-to-end performance that meets application needs