

## Fall 2023 Opening Plenary Footnotes Clifford Lynch, CNI Executive Director

These are some “footnotes”—citations and links—for more information about topics mentioned in my December 11, 2023, opening plenary at the Fall 2023 CNI Member meeting. They are intended as starting points, not comprehensive introductions or surveys of the topics. Note that many of these are links that I have shared previously in [CNI-ANNOUNCE](#) messages. I hope they are helpful.

### Infrastructure

#### Exascale

- Broad exascale program: This is complex and wide-reaching and involves many agencies. For some insight, see the NITRD pages:
  - <https://www.nitrd.gov/pubs/FY2024-NITRD-NAIIO-Supplement.pdf>
  - <https://www.nitrd.gov/coordination-areas/high-end-computing/>
- Also, an interesting read: <https://www.hpcwire.com/2023/11/14/forget-zettascale-trouble-is-brewing-in-scaling-exascale-supercomputers/>
- Frontier at Oak Ridge National Labs: <https://www.olcf.ornl.gov/frontier/>
- Aurora at Argonne National labs: <https://www.alcf.anl.gov/aurora>
- TACC: <https://lccf.tacc.utexas.edu>

#### National AI Research Resource

- <https://www.nsf.gov/cise/national-ai.jsp>

#### Cloud Labs and “Self-Driving Labs”

- Carnegie Mellon Cloud Lab: <https://cloudlab.cmu.edu>
  - Fall 2021 CNI Closing Plenary (*Carnegie Mellon University’s Cloud Lab Project*): <https://youtu.be/j8bvZZzYGiw?si=LNIMos5lyw0EpII6>
- Emerald Cloud Lab: <https://www.emeraldcloudlab.com>
- NSF Workshops
  - October 2023 CMU: [https://www.cmu.edu/mcs/news-events/2023/1120\\_nsf-workshop.html](https://www.cmu.edu/mcs/news-events/2023/1120_nsf-workshop.html)
  - November 2023 Georgia Tech: <https://nsf-sdl-2023.github.io>
  - January 24 NC State: <https://research.ncsu.edu/futurelabsworkshop/about/>
- Ecosystem for Research Networking CryoEM project: <https://www.ern.ci/cryoem-remote-instrument/>
- Nature paper on “self-driving labs”: <https://www.nature.com/articles/s44160-022-00231-0>

## Digital Twins

- National Academies work
  - <https://www.nationalacademies.org/our-work/foundational-research-gaps-and-future-directions-for-digital-twins>
  - <https://nap.nationalacademies.org/catalog/26894/foundational-research-gaps-and-future-directions-for-digital-twins>

## Cybersecurity

I've not included links here; news coverage can be easily found. There have been many high-profile attacks on critical infrastructure, hospitals, city governments, school districts, and the like; most of these are ransomware or ransomware/information resale/doxing variants, at least apparently. There have been several notable attacks on major cultural heritage organizations (outside the context of active conflicts like Ukraine), notably the British Library, as well as operational library systems large and small, notably Toronto Public Library. A key question that I did not explore is how much of this activity is basically criminal in nature (to extract money) and how much of it is motivated or at least encouraged by nation-state or other ideological or politically driven strategies (see for example <https://www.washingtonpost.com/technology/2023/12/11/china-hacking-hawaii-pacific-taiwan-conflict/>). Note it's often very difficult to clearly distinguish the activities of criminal gangs from the intelligence or military activities of various nation-states.

It is very clear that the scale of the cybersecurity threats of all types is growing rapidly, and the number of successful attacks seems to be growing.

## Bonus topic: Quantum (discussed in Q&A)

- National Academies Report  
<https://nap.nationalacademies.org/catalog/25196/quantum-computing-progress-and-prospects>
- A very readable and fairly nontechnical overview of quantum technologies broadly: *Law & Policy for the Quantum Age* (Hoofnagle CJ, Garfinkel SL. Law and Policy for the Quantum Age. Cambridge: Cambridge University Press; 2022. doi:10.1017/9781108883719).
  - Note that there is an open access version available for download at <https://www.cambridge.org/core/books/law-and-policy-for-the-quantum-age/026A5CE2FE7FE277B94DA01A519B2DAD>
- IBM Quantum initiatives: <https://www.ibm.com/quantum>
- IBM Quantum roadmap: <https://www.ibm.com/quantum/blog/quantum-roadmap-2033>

## AI & Machine Learning

- ARL/CNI Task Force on AI Scenarios for the Research Enterprise
  - <https://www.cni.org/news/rl-cni-appoint-joint-task-force-on-scenario-planning-for-ai-ml-futures>

- <https://www.arl.org/wp-content/uploads/2023/10/ARL-CNI-Task-Force-on-Scenario-Planning-Charge.pdf>
- AI Alliance: <https://thealliance.ai/news>
- National Academies AI and Scientific Discovery Workshop: [https://www.nationalacademies.org/event/40455\\_10-2023\\_ai-for-scientific-discovery-a-workshop](https://www.nationalacademies.org/event/40455_10-2023_ai-for-scientific-discovery-a-workshop)

### **Training Data**

- Decline in quality when synthetic data is used: <https://arxiv.org/abs/2307.09009>
- Running out of training data paper: <https://arxiv.org/abs/2211.04325>
- Stability of services: <https://arxiv.org/abs/2307.09009>

### **LLMs and Scholarly Information**

- AuroraGPT at Argonne: <https://www.hpcwire.com/2023/11/13/training-of-1-trillion-parameter-scientific-ai-begins>
- Allen Institute: <https://blog.allenai.org/announcing-ai2-olmo-an-open-language-model-made-by-scientists-for-scientists-ab761e4e9b76>

### **Definitions of Open AI**

- <https://deepdive.opensource.org/wp-content/uploads/2023/02/Deep-Dive-AI-final-report.pdf>
- [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=4543807](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4543807)

### **Scholarly Communications**

#### **Developments in RDM**

- Two CNI Executive Roundtables (forthcoming – watch for announcement [on CNI-ANNOUNCE](#) & CNI website)

#### **Prediction Databases**

- Materials science stability prediction database
  - <https://www.nature.com/articles/s41586-023-06735-9>
  - <https://deepmind.google/discover/blog/millions-of-new-materials-discovered-with-deep-learning/>
  - <https://arstechnica.com/ai/2023/11/googles-deepmind-finds-2-2m-crystal-structures-in-materials-science-win/>
- Protein Folding
  - <https://www.nature.com/articles/d41586-020-03348-4>

### **Longer-Term Trends**

- Recalibrating “truth”— Standards work on camera image integrity: <https://c2pa.org>