Northeastern

SANDIE: Named Data Networking for Data Intensive Science

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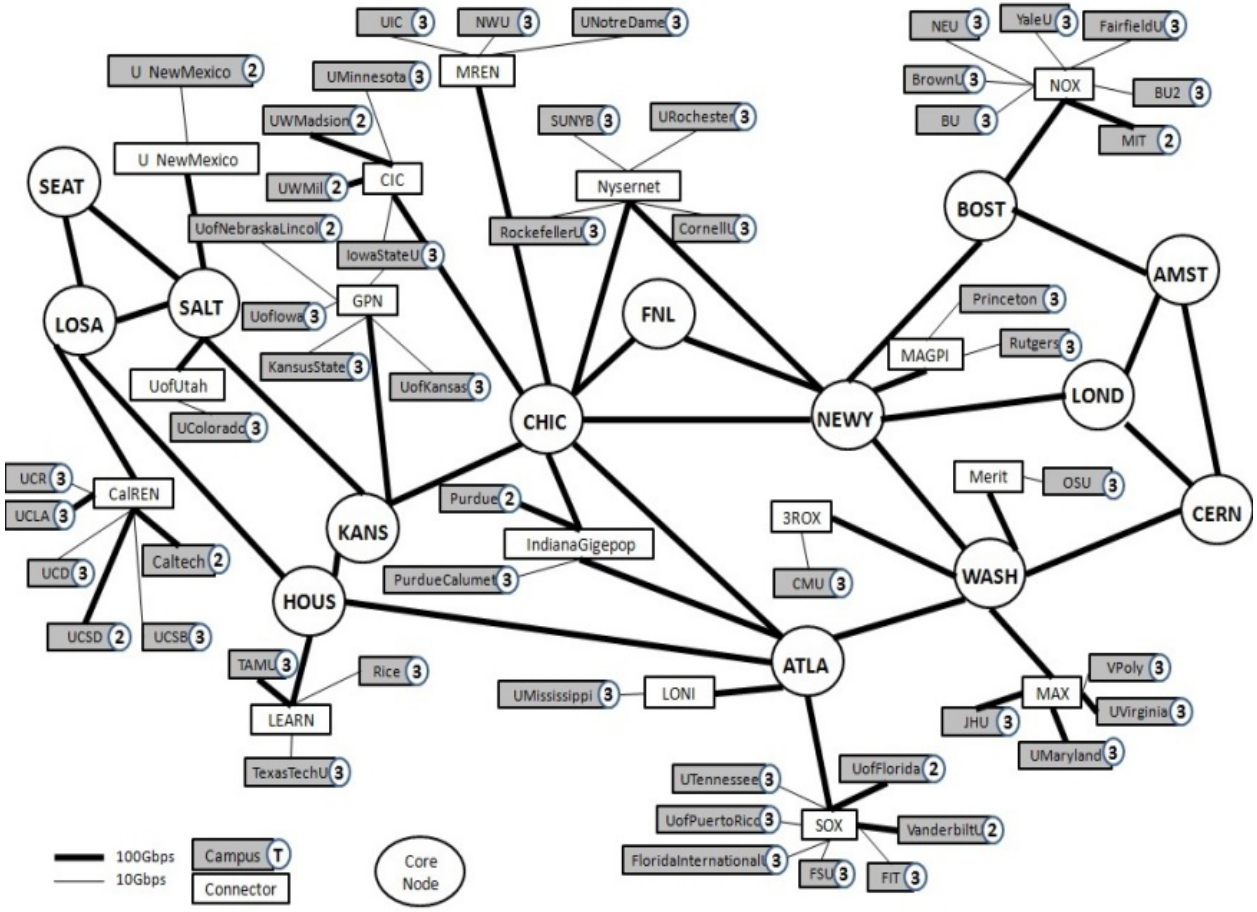
Data-intensive Science and LHC

- Data-intensive science: extract knowledge from massive datasets with growing scale and complexity.
- Global data distribution, processing, access, analysis; coordinated use of large but limited computing, storage and network resources.
- **NDN a natural fit for data-intensive science.**
- Large Hadron Collider (LHC) high energy physics program is **world's largest data intensive application**, handles about 1 Exabyte (1 million terabytes) by 2018.
- LHC network connects CERN to 500 tiered sites worldwide.
- Used to make Nobel-prize discoveries such as Higgs Boson.
- LHC network traffic projected to grow by another 2 orders of magnitude by 2026.
- Increased complexity of data.
- Present system cannot scale to meet needs of HC Run3 (2021-23).

SANDIE Project

- $1M, 2-year US NSF CC* grant starting July 2017.
- Northeastern (lead), Caltech, Colorado State.
- Use NDN principles to redesign high energy physics (HEP) Large Hadron Collider (LHC) program network.
- Will deploy 10 NDN edge caches with SSDs and 40G/100G network interfaces at 7 sites (Northeastern, Caltech, CSU, Fermilab, ..)
- Combine with larger core caches in strategic locations.
- Coordinate with compact preprocessing of data objects (e.g. MiniAOD, MicroAOD, data scouting, n-tuples).
- Leverages NDN-based tested for climate applications at CSU.

LHC Network Map



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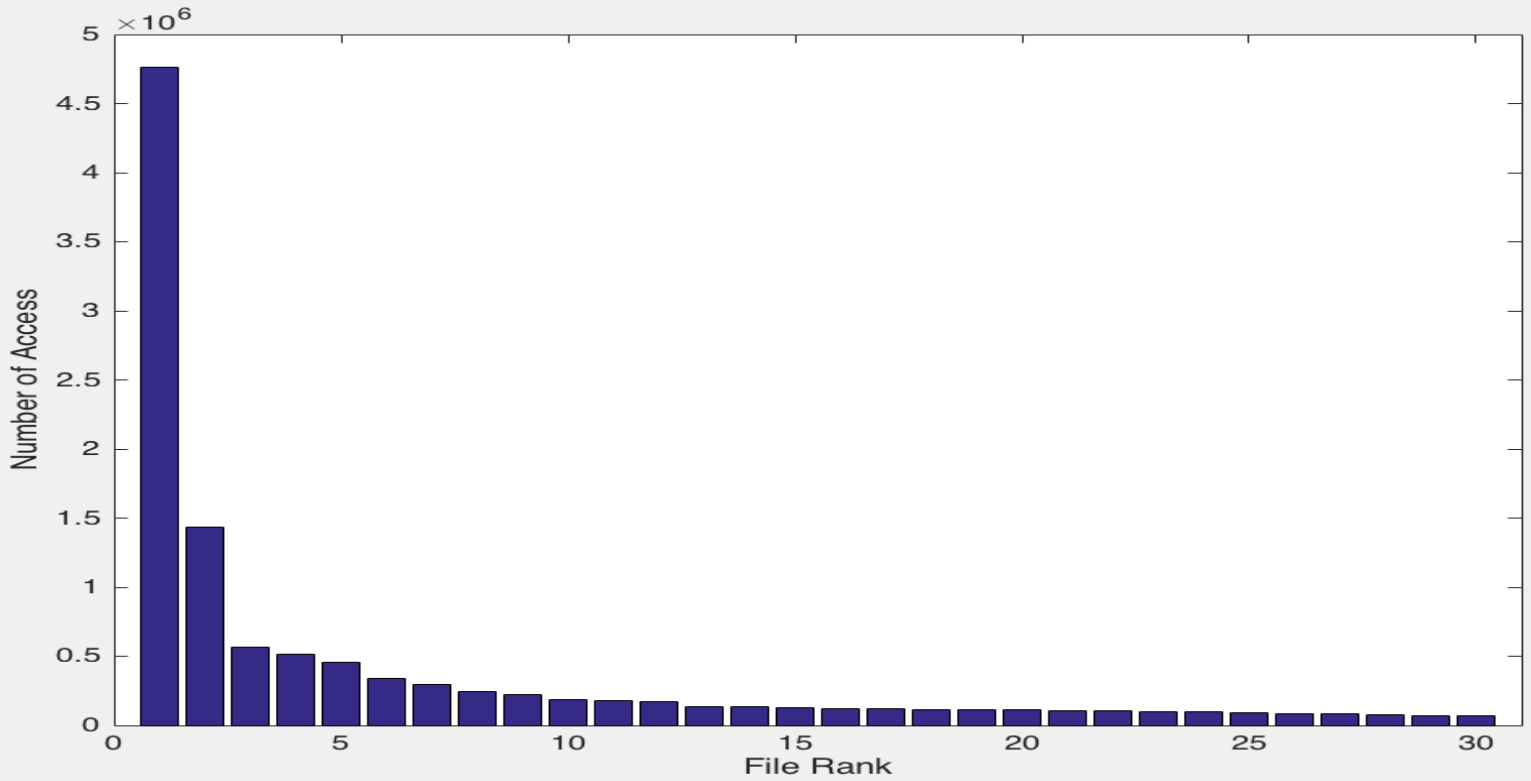
LHC Data Access Patterns



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58035992	149.86 PB	0.00 MB	163.82 GB	2.58 GB	2.59 GB

Project Aims

- Derive NDN-based operational model for data distribution, processing, gathering, analysis to benefit LHC and other major data-intensive scientific programs (e.g. LSST, SKA).
- Simultaneous optimization of caching (“hot” datasets), forwarding, and congestion control in network core and site edges; leverages PI previous work.
- Network core and edge node design and performance optimization.
- Development of naming scheme and attributes for fast access and efficient communication in HEP and other fields.
- Scalability of NDN system in amount and type of data supported as well as geographic extent.