Perspectives on networking research: a look ahead

Jim Kurose 黒瀬

Distinguished University Professor
College of Information and Computer Sciences
University of Massachusetts, Amherst

Visiting Researcher
Sorbonne University
Paris, France

November 2024

NSF Networking programmatics*

Networking Technology and Systems (NeTS: Core)

- Long-running program for *any/all networking research topics*
- "novel frameworks, architectures, protocols, methodologies and experimental approaches including measurement and tools for the design and analysis, development, operation, and management of robust and highly dependable networks"
- CNS (NeTS+CSR+other) budget: $245M/year

Platforms for Advanced Wireless Research (PAWR)

- Four city-scale, wireless research testbeds

Powder: 5G, RAN, orchestration

AERPAW: arial wireless

COSMOS: ULL, ultra-high BW

ARA: smart-and-connected rural

- $100M public-private partnership

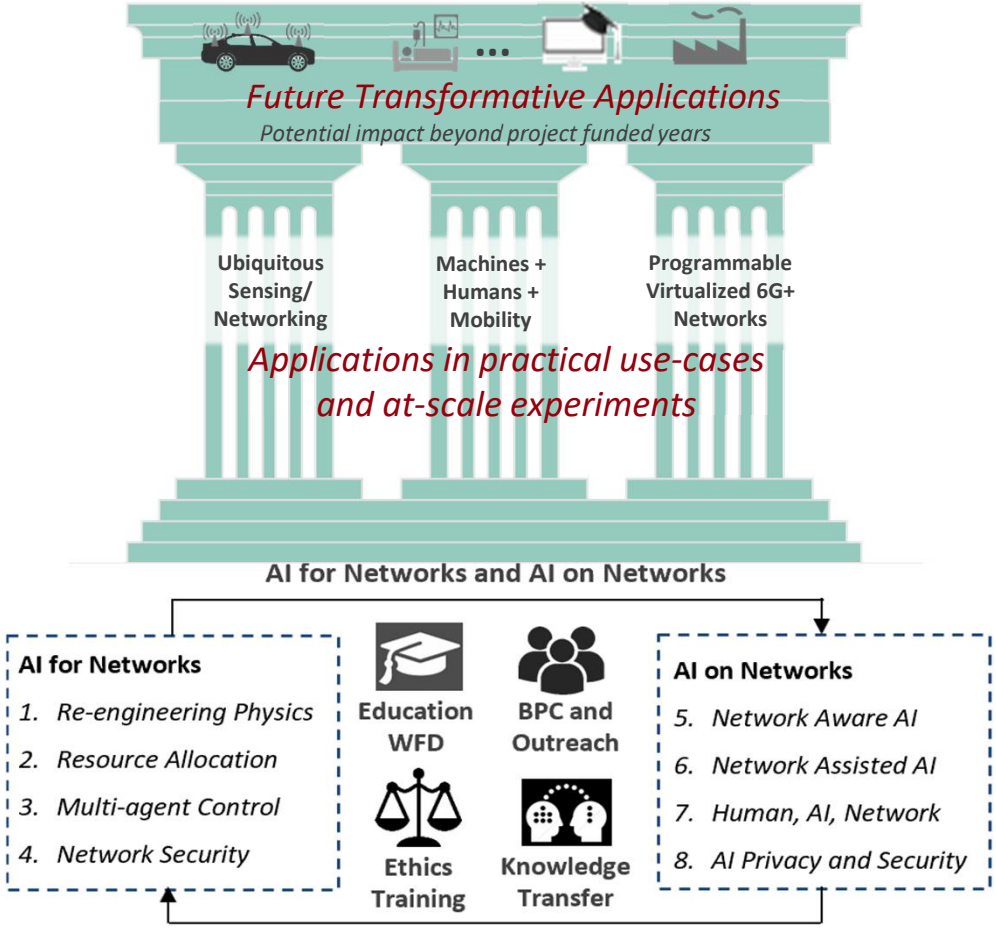
RINGS: Resilient & Intelligent NextG Sys.

- Academic-industry collaboration $40M / 3 years)
- Research areas: physical and link layer, network and cloud, security, research infrastructure, verticals and use-based driven research

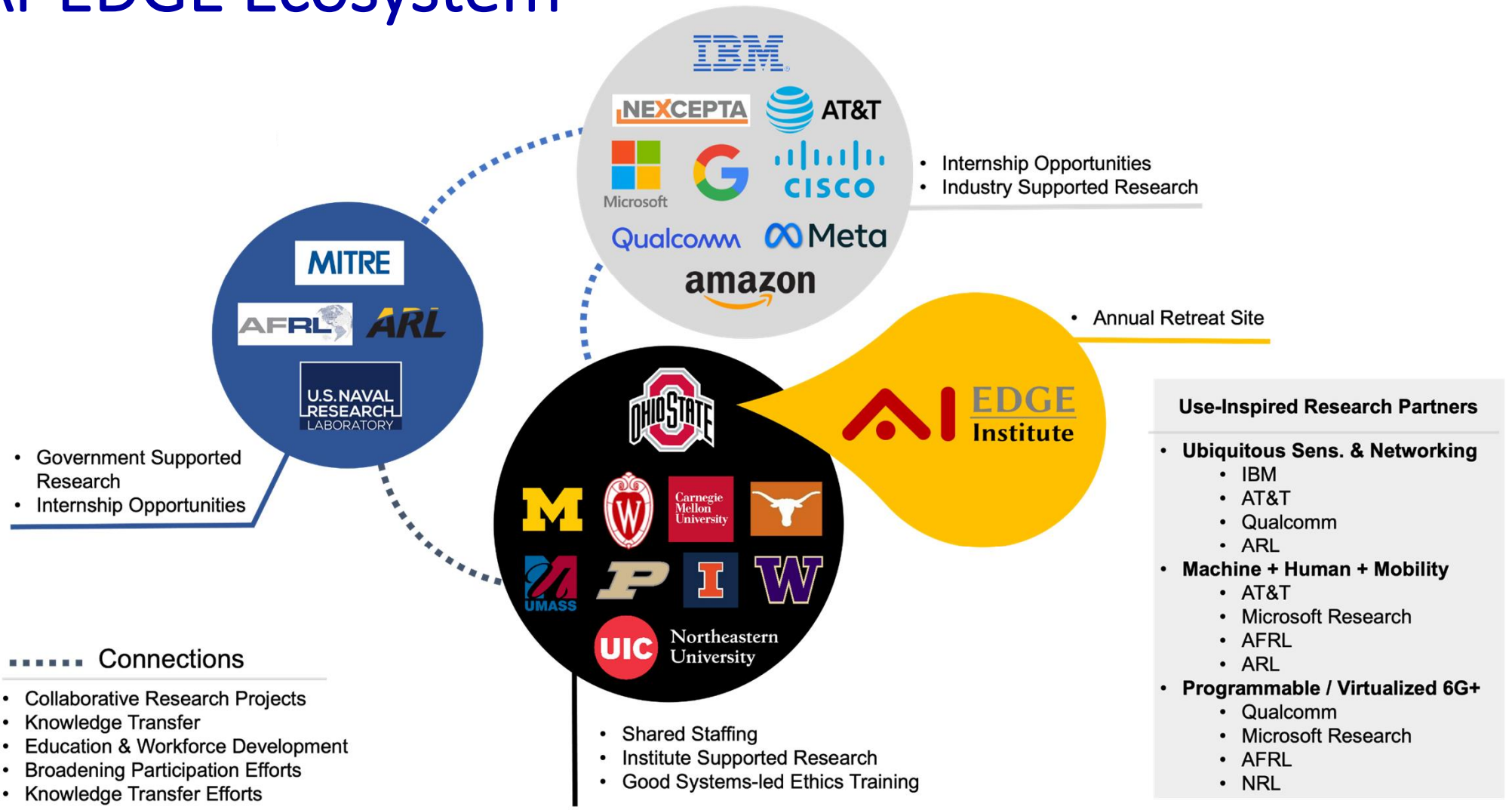
* the speaker lead the NSF CISE directorate 2015-2019, but has no current affiliation with NSF

AI-Edge NSF AI Institute

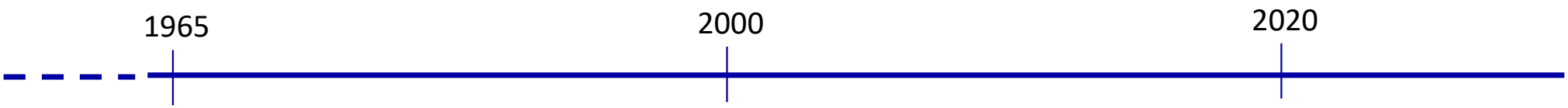
- one of 25 National AI institutes, in foundational AI and AI application use (NSF and other agencies)
- *Mission:* To create a research, education, knowledge transfer, and workforce development environment that will help establish US leadership in future generation edge networks (6G and beyond) and distributed AI for many decades to come



AI-EDGE Ecosystem



Perspective: From artifacts to systems to people



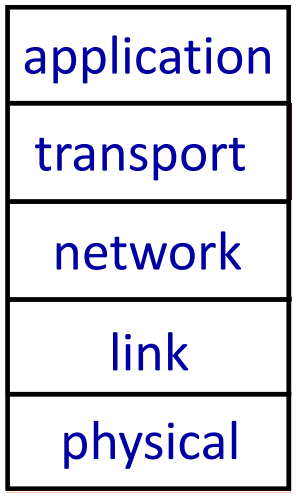
Artifacts operating systems, programming languages, databases, networks, architecture

Theoretical Foundations
(including AI)

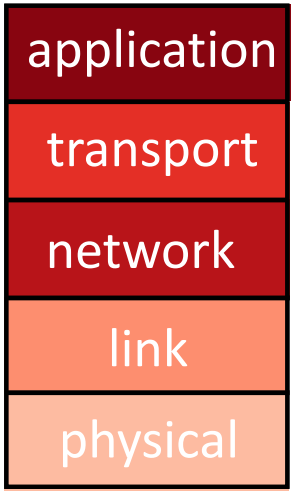
Systems, applications at scale: Internet, information search, WWW, social media, data science, data center applications

People: (mis)information, human augmentation; privacy; future-of-work at human-technology frontier; computing for common good; fairness, accountability, transparency, smart-and-connect communities, ethics

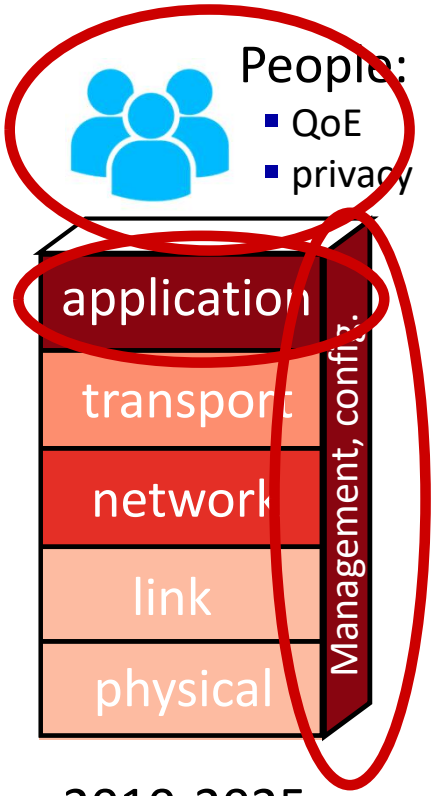
Perspective: “up the stack”



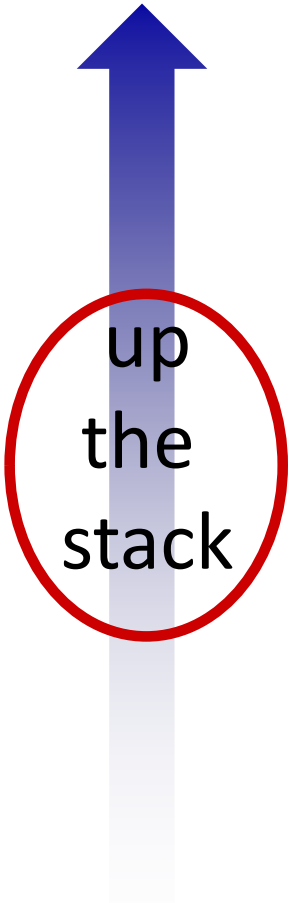
pre-2000:
artifact,
performance



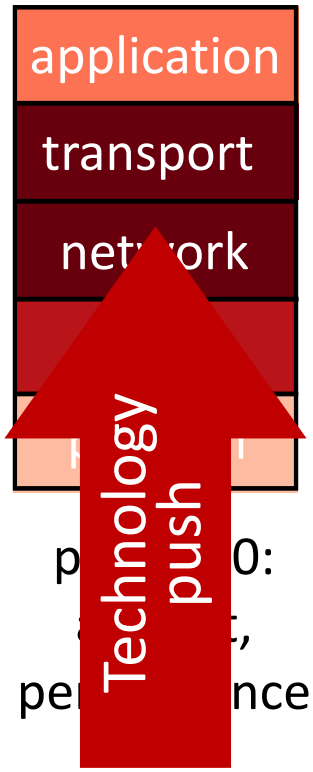
2000-2010:
distributed apps,
mobility
security



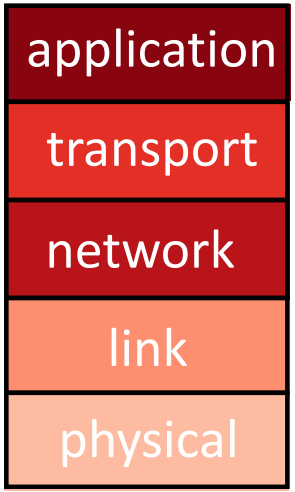
2010-2025:
data centers
SDN, mobility
security, privacy
management



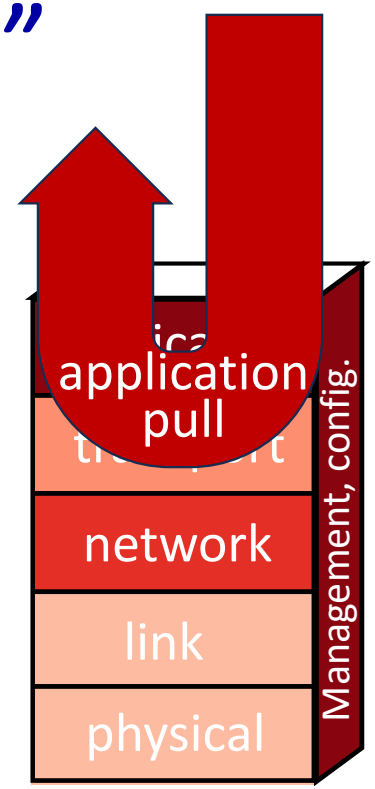
Perspective: “application pull”



p 0:
, per nce



2000-2010:
distributed apps,
mobility
security



2010-2025:
data centers
SDN, mobility
security, privacy
management

Perspective:

“ ... the key to doing impactful research in mobile networking is to have a compelling application domain.”

Larry Peterson, “What I Did Over Summer Break: A Tale of Two 5G Workshops” systemsapproach..org blog, September 2024

Perspectives: summary

- many research opportunities in current and NextG wireless systems
  - continued broad interest in funding agencies
  - AI/ML in NextG systems
- collaborations between government, academia, industry
- research: curiosity driven research together with use-inspired research
  - before, or while moving on to NextG, what are the challenges in ”CurrentG”?
  - access to wireless infrastructure (e.g., private 5G) beyond testbeds