OCARNet: Ohio Computing and Communications ATM Research Network

Raj Jain and D.K. Panda, The Ohio State University

R.J. Clark and Y. Pan, University of Dayton

S.J. Chapin, Kent State University

J. Sang, B.A. Blake, and C.H. Lin, Cleveland State University

A. Stutz, Ohio Supercomputer Center

G. Wallis OARnet

New Address: Raj Jain, Washington University in Saint Louis, jain@cse.wustl.edu, http://www.cse.wustl.edu/~jain

- What is ATM?
- Our Proposal
- Activities in Other States

Asynchronous Transfer Mode

- ATM is a new computer networking technology that allows video, audio, and data integration at a high speed
- Today's Internet provides data transfer
  Tomorrow ATM technology will allow multimedia and video conferencing by providing service guarantees and high speed
- Today's Internet has 1.5 Mbps and 45 Mbps links.
  ATM provides 155 Mbps, 622 Mbps, 2048 Mbps and up.
  (factor of 3 to 1300 faster)
- ATM $\Rightarrow$ Do not need separate networks for computing, entertainment (cable), and voice (telephone)

Applications of ATM

- High-speed multimedia communication
- Distance learning
- Visualization
- Healthcare: Telemedicine, Remote Diagnosis
  Remote access to health database
- Collaboration: Shared-screen systems
- Telepresence: Virtual proximity. Can control remote camera.
  - Real estate purchasers can drive down the virtual city
- High-Performance Computing

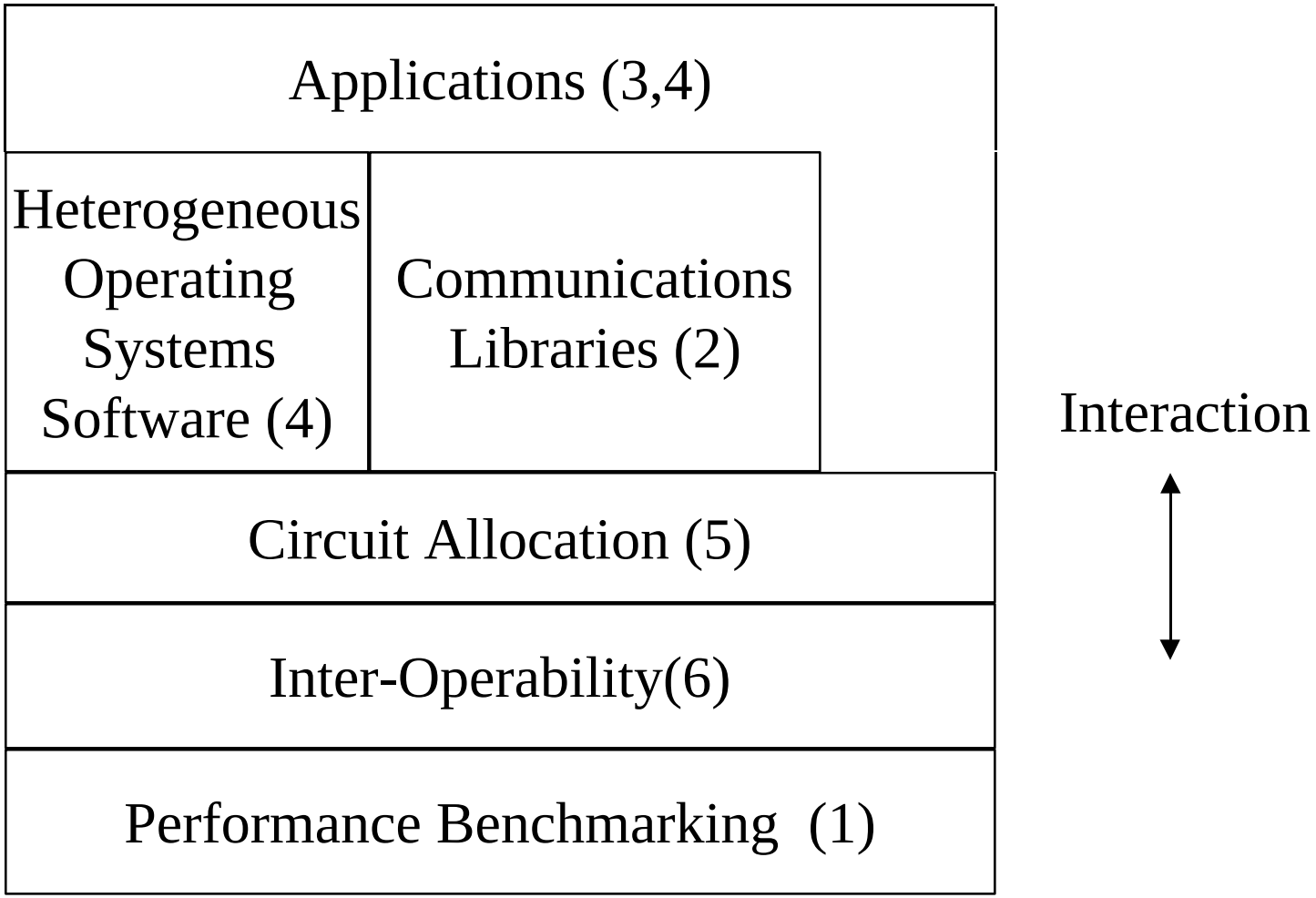
ATM Research Opportunities

- All computer companies, telephone companies, and cable companies are developing ATM products and services
- Federal government is spending a large part of its High Performance Computing and Communications (HPCC) budget on networking research and particularly on ATM research
- ATM is key in plans for National Information Infrastructure (NII) and Global Information Infrastructure (GII)
- ATM $\Rightarrow$ New Style of networking
  $\Rightarrow$ New Styles of Computing
  Widely Distributed Computer Systems
  Networks of Workstations (NoW)

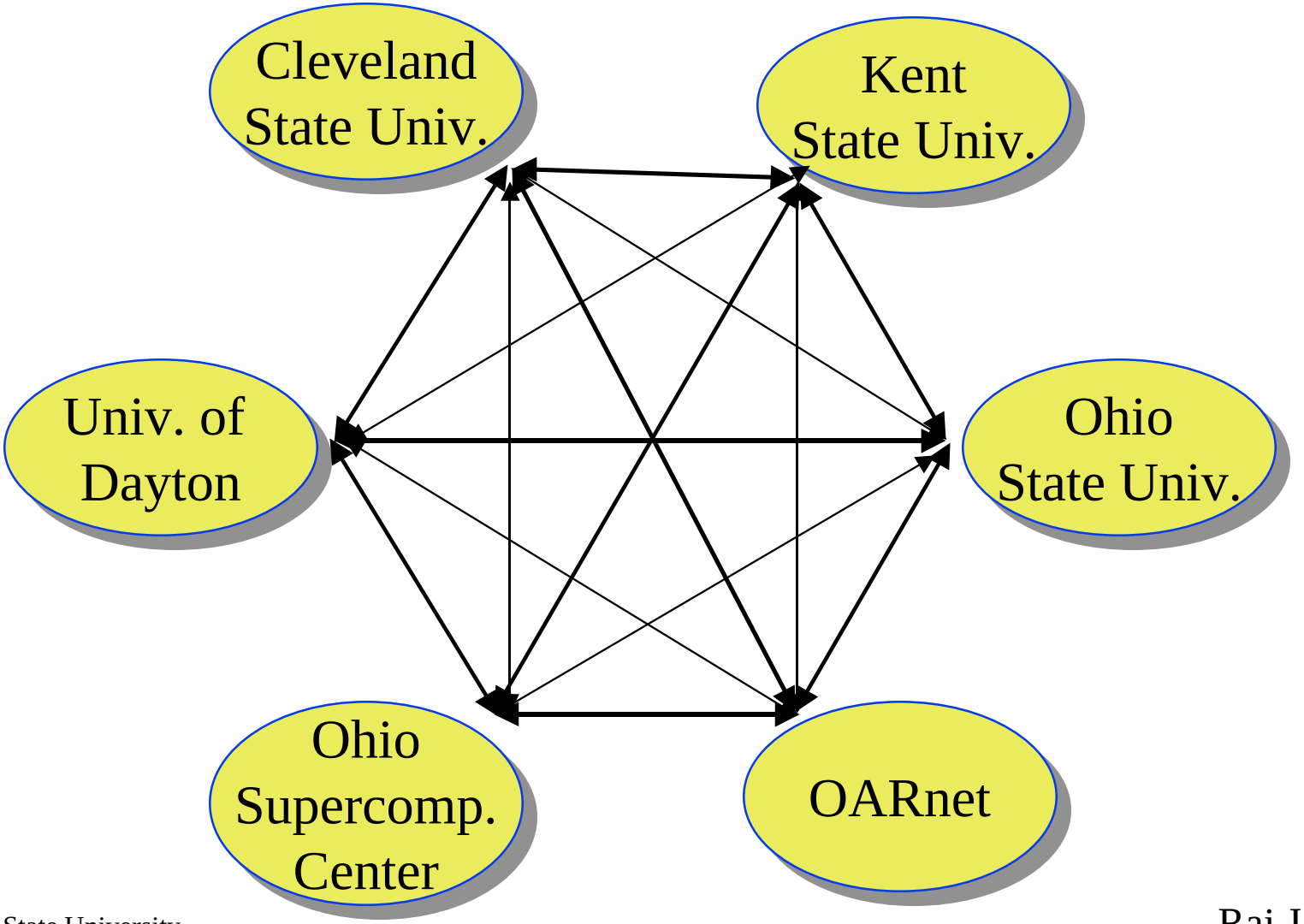
Proposed Research Projects

1. Performance Benchmarking Lab
2. Communications Libraries for Networks of Workstations
3. Applications of Networks of Workstations
4. Heterogeneous Operating Systems Software
5. Circuit Allocation and Management
6. Inter-Operability and Network Management

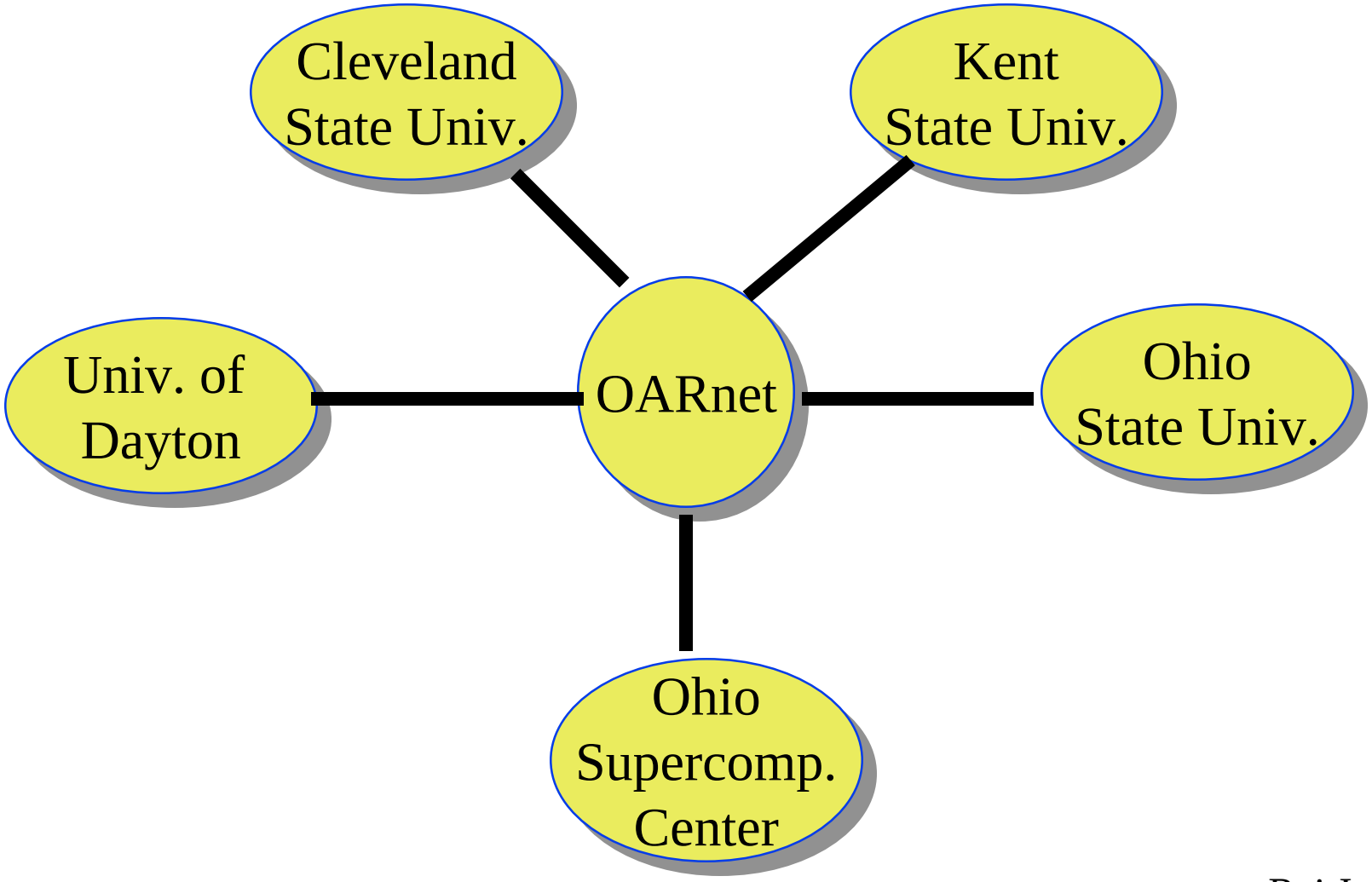
Layered View



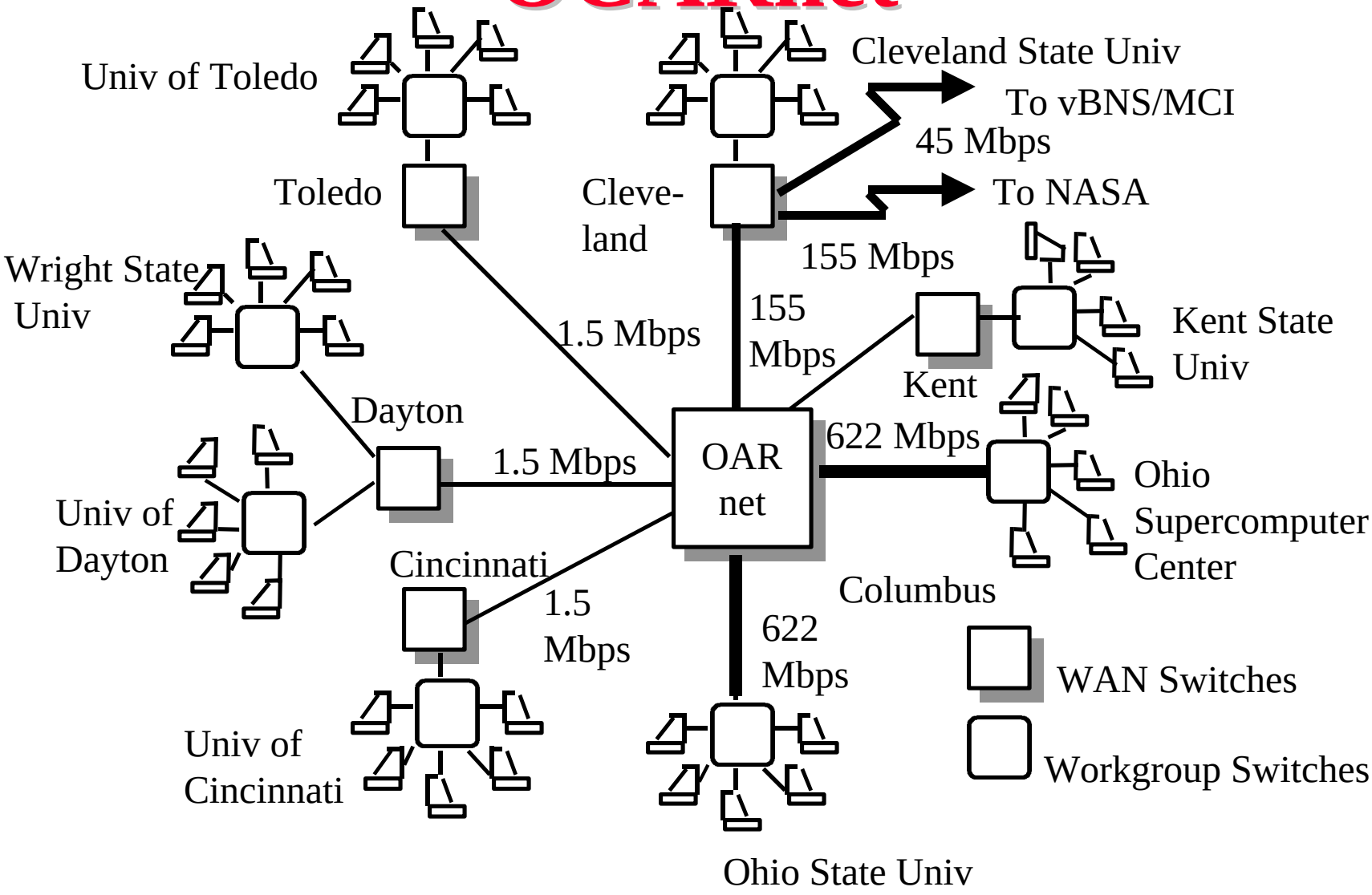
Interaction Among Partners



Network Topology



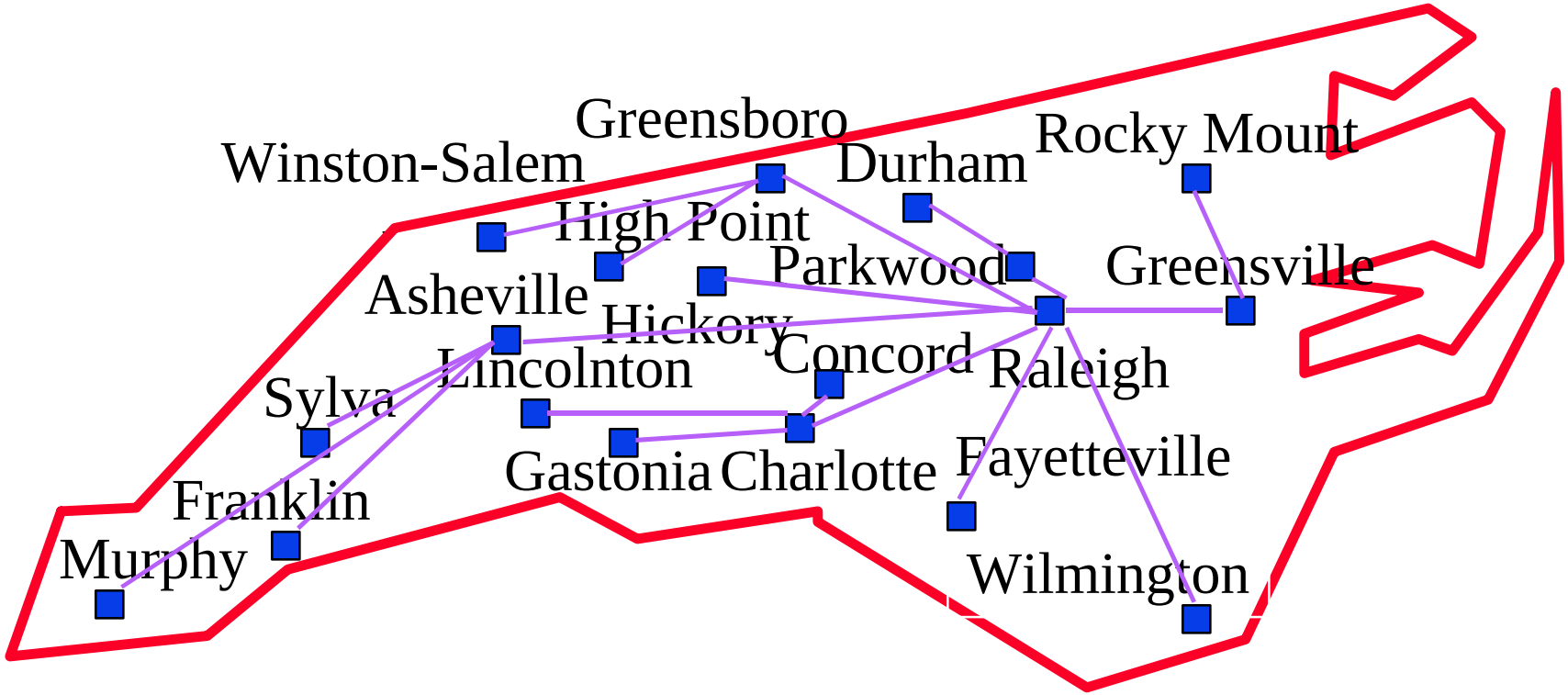
OCARnet


Univ of Toledo
Toledo
Cleveland State Univ
To vBNS/MCI
45 Mbps
Cleve-
land
To NASA
155 Mbps
Wright State
Univ
1.5 Mbps
155
Mbps
Kent State
Univ
Kent
Dayton
622 Mbps
OAR
net
1.5 Mbps
Ohio
Supercomputer
Center
Univ of
Dayton
Cincinnati
Columbus
1.5
Mbps
622
Mbps
WAN Switches
Univ of
Cincinnati
Workgroup Switches
Ohio State Univ

ATM Activities in Other States

- Georgia Research Alliance: Georgia Tech, GSU, Emory (Medicine), Georgia Medical College, BellSouth
- North Carolina:
  - North Carolina Information Highway (NCIH)
  - Connects all state colleges and universities and several state agencies
- New York: NYSERNET (Syracuse University)
- California: BAGNET (Bay Area Gigabit Network)
- Missouri: Washington University, St. Louis (Medical School and Computer Science)

North Carolina Info Hwy



- Location of switches in 1994
  Ref: IEEE Network, November/December 1994

Georgia

- Georgia Research Alliance: Georgia Tech, GSU, Emory (Medicine), Georgia Medical College, BellSouth
- Georgia Center for Advanced Telecommunications Technology (GCATT)
  - Multi-site ATM/SONET network
  - Chaired Faculty positions in Telecommunications
- Being extended to "Ring around Georgia"
  - A statewide ATM backbone to promote economic development
  - To understand the needs of users
  - To bring advanced technology to all communities

Potential For Growth in Ohio

- CompuServe's worldwide headquarters are in Columbus
- Litel Communications Inc. (LCI) headquartered in Columbus
- Ameritech
- Garrison Walters of OBR (in review of CS PhD programs) to Provosts and Graduate Deans:
  "*Increased investment in computer science is warranted; there are research areas in which Ohio could be highly competitive.*"

Related Activity: CATNet

- Columbus ATM Network
- Lead by Industry and Technology Council of Columbus
- Technology leadership provided by OSU
- Fiber links provided by Metricom
- Starting with 8 major Columbus companies
  - Ameritech
  - OCLC

Potential Partners in Ohio

OCARNet = Beginnings of a state-wide network

- Kent State University (Liquid Crystal Institute)
  - Paul Farrell, Mike Lee (Visualization)
- Case Western Reserve: Kumar (Distributed simulation)
- University of Cincinnati: S. Pande (Parallelizing compilers)
  - D. Hensgen (Heterogeneous Processing)
- Ohio University: S. Ostermann (Networking)
- Wright State University: J. Jean (Parallel processing)
- University of Akron: Fadi Sibai (Parallel Networks)
- University of Toledo: Douglas A. Smith (Parallel Perturbations)
- Youngstown State: John Buoni (Parallel Algorithms)

Summary

1. Potential for Excellence:
   OSU is already leading world-class ATM research
2. Leverage:
   Potential funding from HPCC, ARPA, DOE, NSF, and Industry
3. Research: Fundamental research in ATM, distributed computing, and distributed applications
4. Potential for Success:
   Researchers and service provider (OARnet)
5. Appropriateness: General purpose equipment, multiple uses
6. Potential for collaboration with industry (CATNet) and other universities
7. Potential for Economic Growth: Leadership on the information superhighway is critical to the future growth of any state