

# **ATM Networking and Telecommunication Research At OSU**

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Pi

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# Networking Faculty

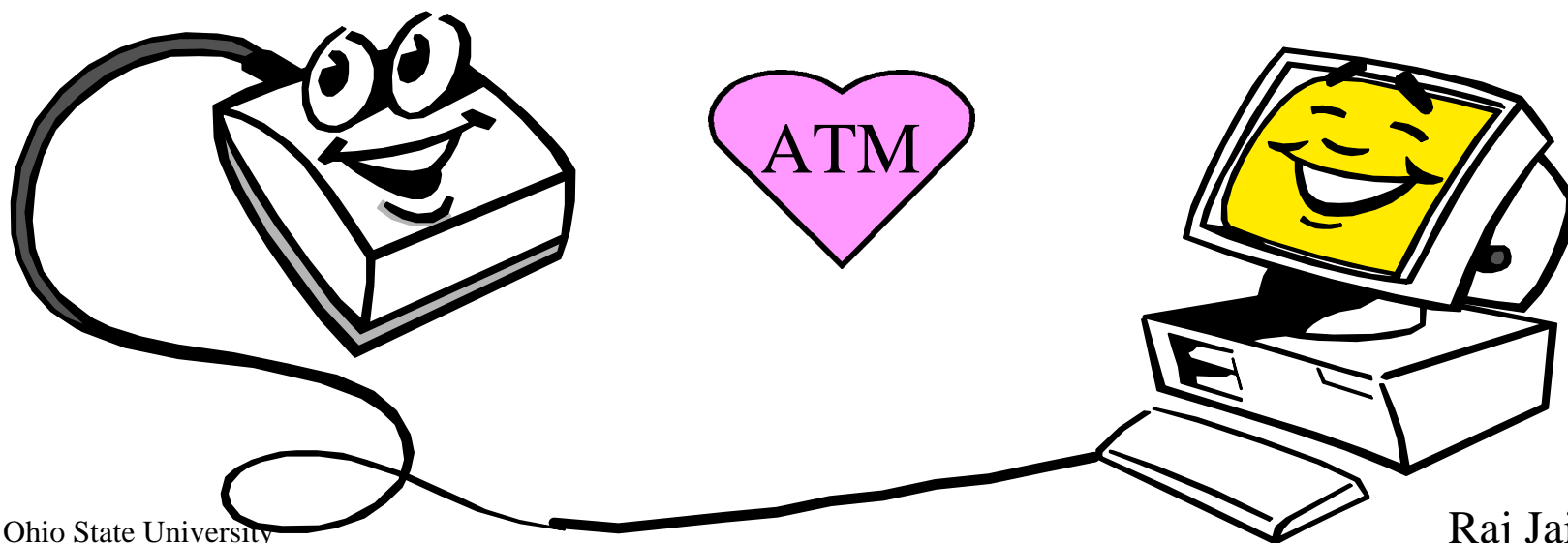
- ❑ ATM Networks
  - Raj Jain, Gojko Babic, Arjan Duresi
- ❑ Wireless Networks
  - Steve Lai
- ❑ Multimedia Networking
  - Wu Chi Feng and Raj Jain
- ❑ Protocol Engineering - Mike Liu
- ❑ Other Collaborators: Panda, Page, Arora, Jennifer Hou, and Stan Ahalt



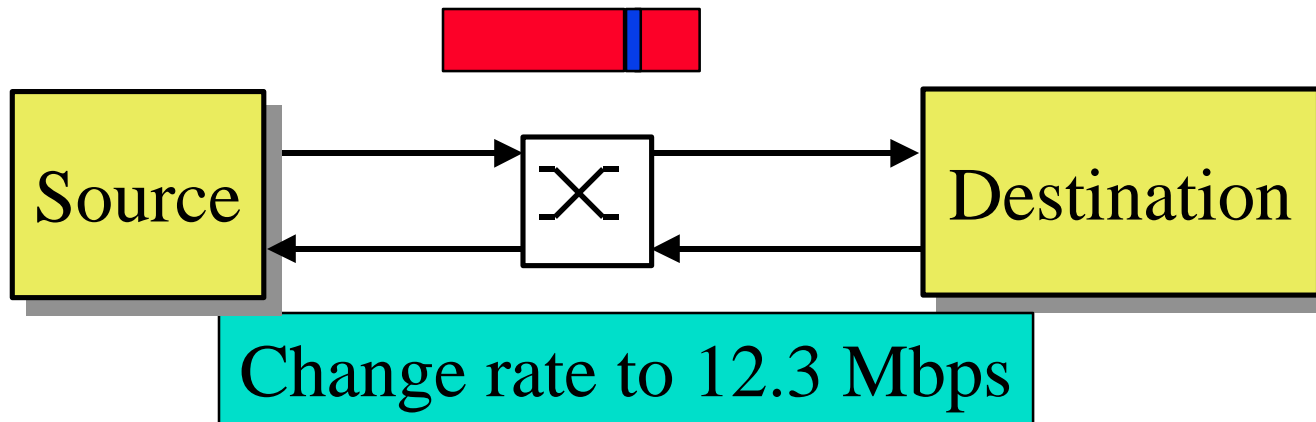
- ❑ ATM Traffic Management
- ❑ Voice and Video over ATM
- ❑ OSU National ATM Performance Testing Lab
- ❑ OCARnet: Ohio University Network
- ❑ Lab Facilities

# ATM

- ❑ ATM = Asynchronous Transfer Mode
- ❑ ATM Net = Data Net + Phone Net
- ❑ Combination of Internet method of communication (packet switching) and phone companies' method (circuit switching)



# Traffic Management



- ❑ Invented DECbit scheme in 1986: Bit  $\Rightarrow$  Go up/Down
  - Used now in Frame Relay (FECN)
  - Used in ATM (EFCI)
- ❑ In July 1994, we proposed Explicit Rate Approach. Current standard.
- ❑ Two patents. Collaboration with industry.

# Voice/Video over ATM

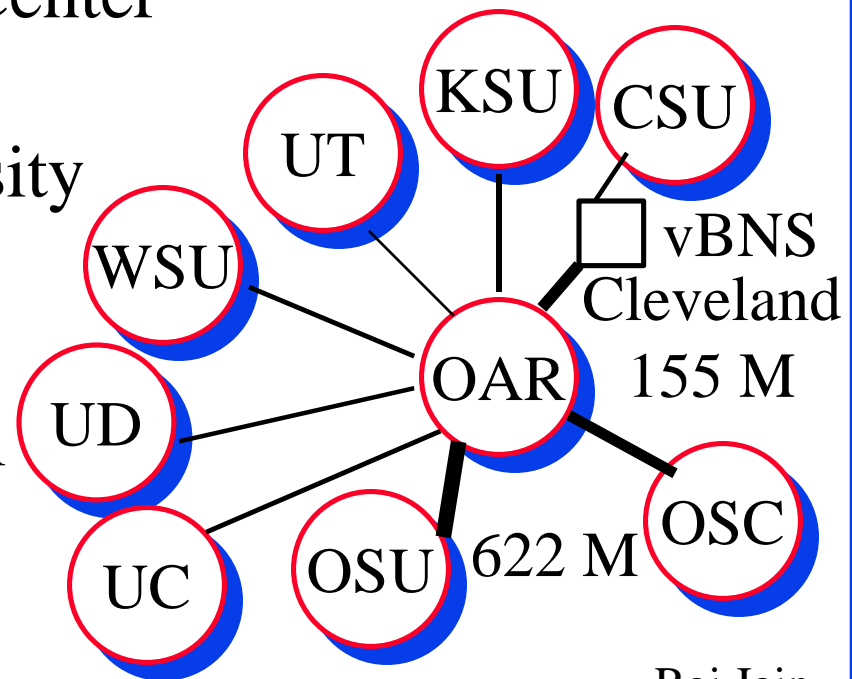
- ❑ Silence suppression
  - ⇒ Unused bandwidth can be used by data
  - Cannot be used by voice.
- ❑ Hierarchical compression of Video
  - Different users can see different bandwidth video
- ❑ Multipoint ABR
- ❑ Real-time ABR

# OSU National ATM Benchmarking Lab

- ❑ Started a new effort at ATM Forum in October 1995
- ❑ Defining a new standard for frame based performance metrics and measurement methodologies
- ❑ We have a measurement lab with the latest ATM testing equipment. Funded by NSF and State of Ohio.
- ❑ The benchmark scripts can be run by any manufacturer/user in our lab or theirs.
- ❑ Modeled after Harvard benchmarking lab for routers

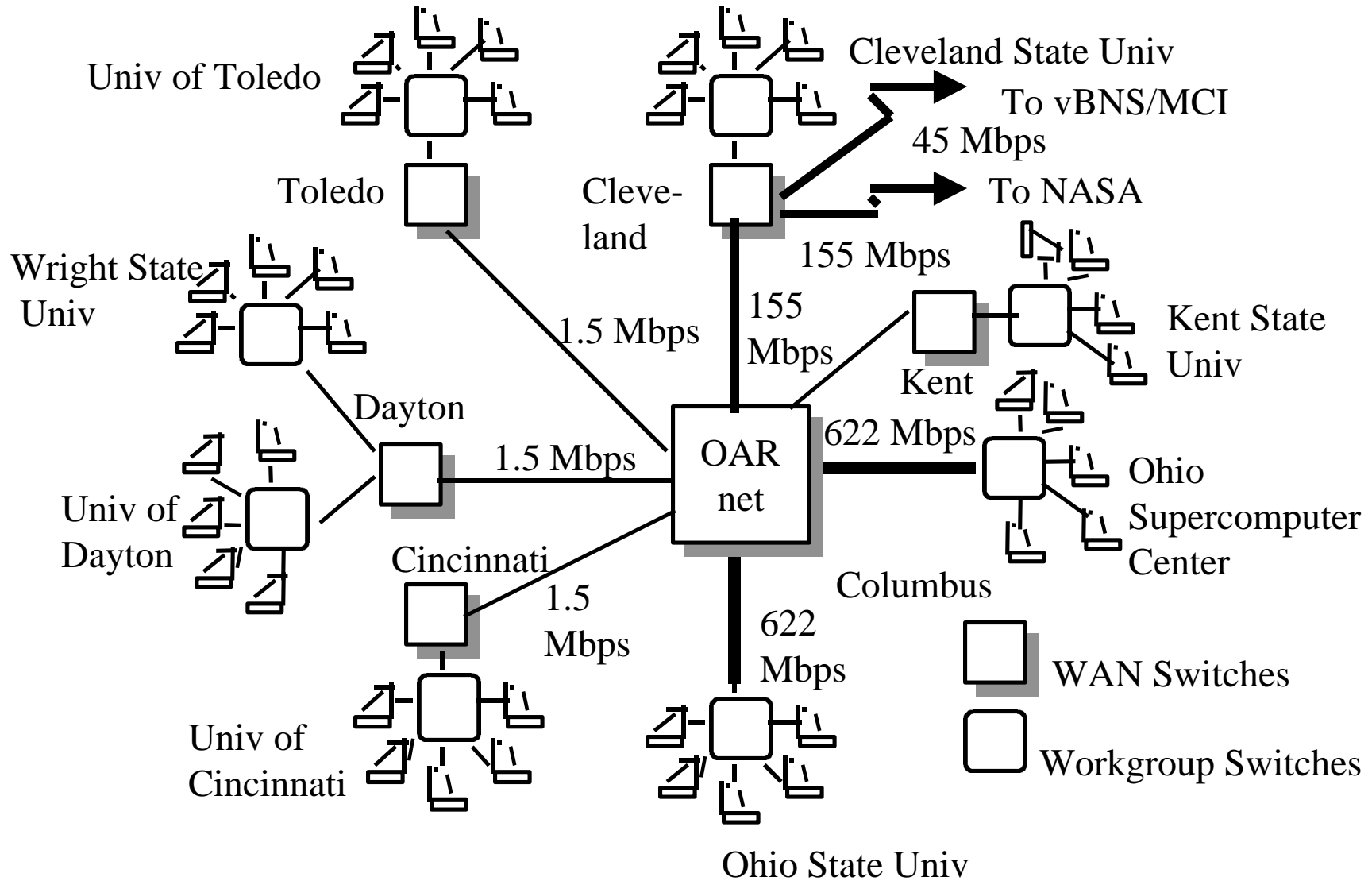
# OARnet

- ❑ Ohio Computing and Communications ATM Research Network
- ❑ Nine-Institution consortium lead by OSU
  - Ohio State University
  - Ohio Super Computer Center
  - OARnet
  - Cleveland State University
  - Kent State University
  - University of Dayton
  - University of Cincinnati
  - Wright State University
  - University of Toledo





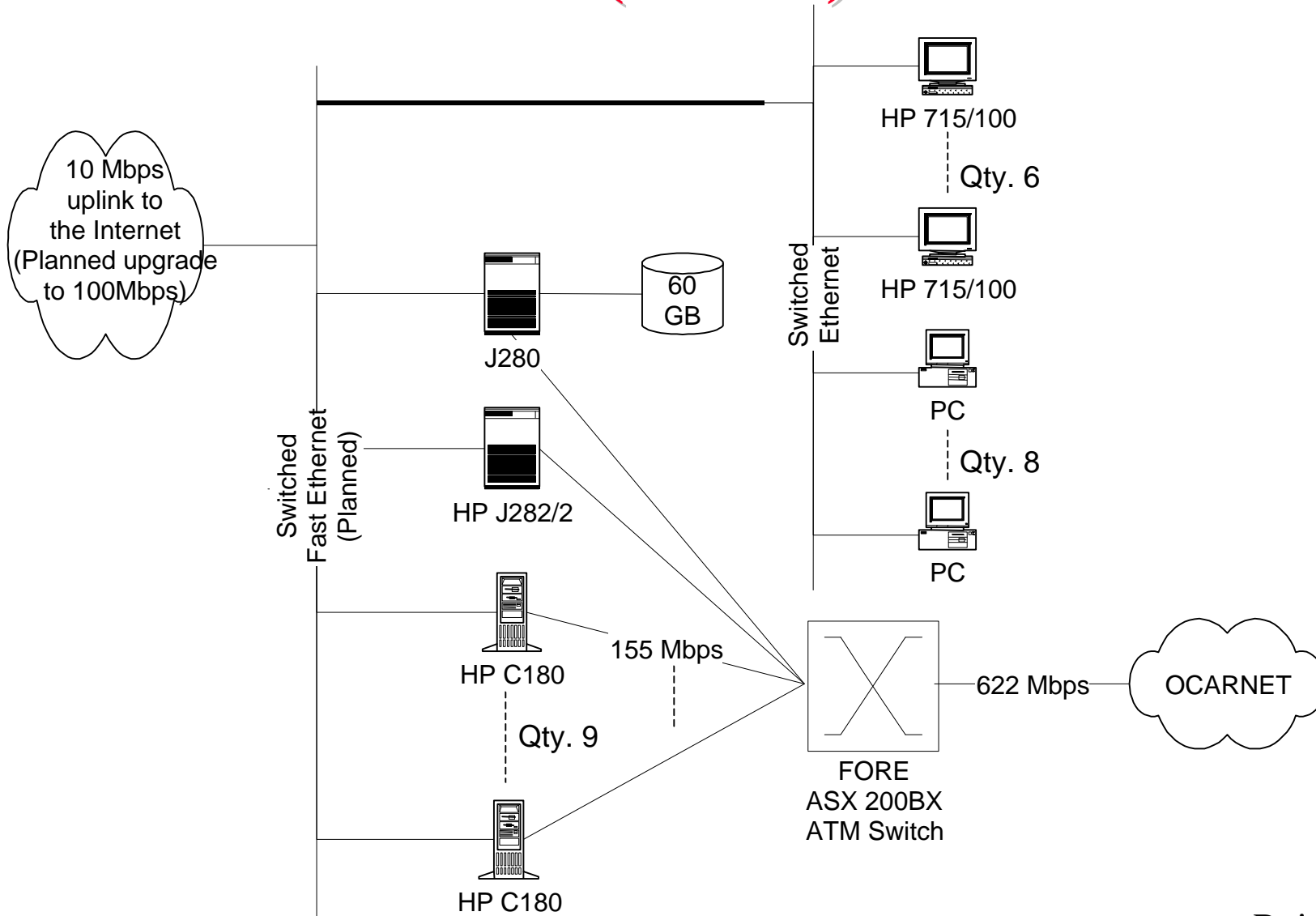
# OCARnet



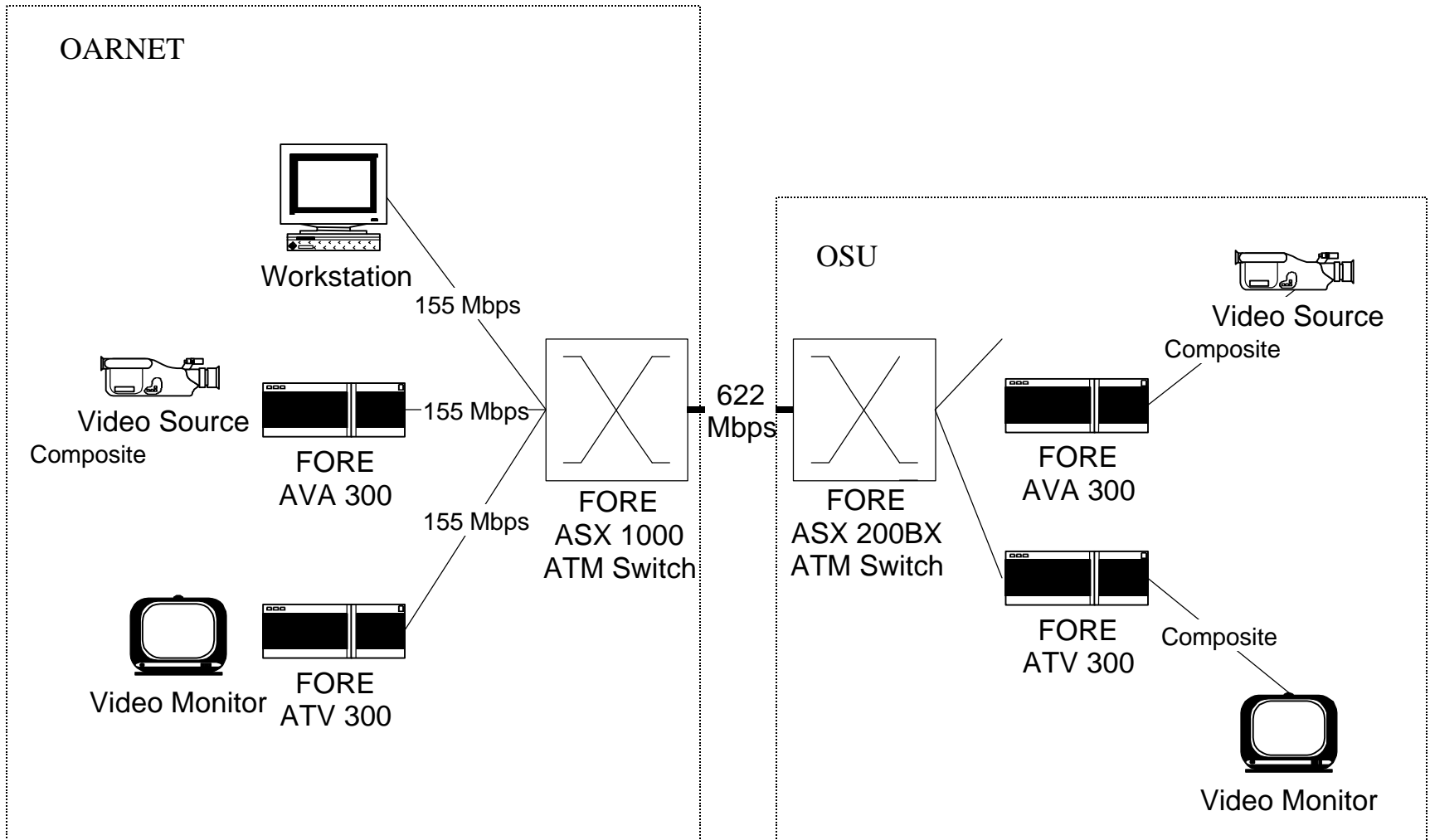
# Computation Facilities

- ❑ Numerous high-powered computers:  
1×715/64 (2.6 FP95) 6×715/100 (4.3 FP95),  
9×C180s (18.7 FP95), 1×J282/2 (19.3 FP95)  
6 P5-200 Desktops + 9 Laptop PCs
- ❑ J-280 fileserver with 64 GB
- ❑ 100 Mbps Ethernet and 155 Mbps ATM
- ❑ 622 Mbps Connection to OCARnet testbed
- ❑ Several switches with speeds from 25 to 622 Mbps
- ❑ World-class ATM Testing Lab with 25, 155, and 622 Mbps testing monitors

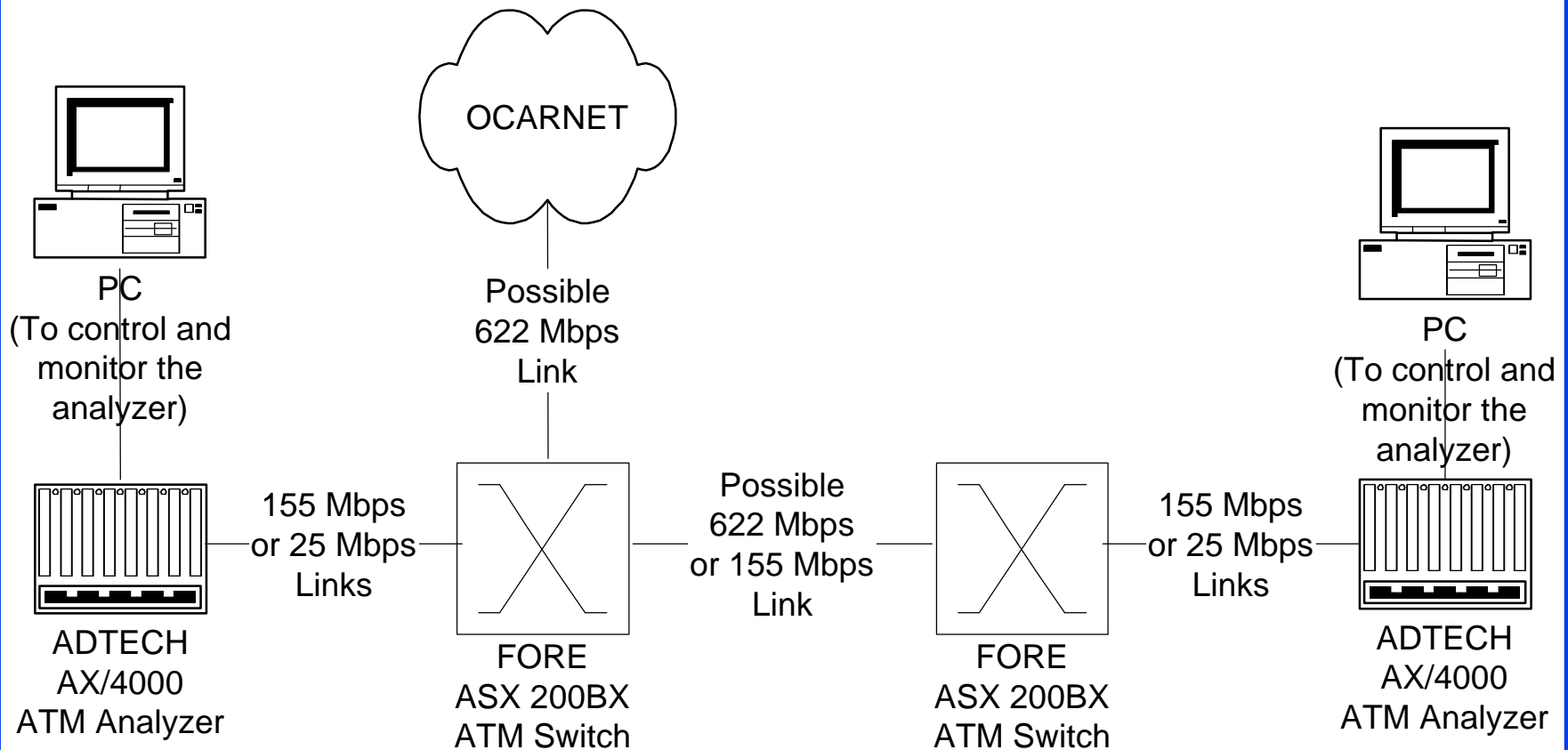
# Facilities (Cont)



# Video Testbed



# Performance Testing Facility



# Lab Exercises for Students

- ❑ NSF funding to develop networking lab exercises for students
- ❑ Ten labs covering: Ethernet, FDDI, IP, TCP, ATM, etc.
- ❑ Any university in the nation will be able to download and use them in their networking courses
- ❑ All our course handouts are already on-line. Also, putting voice and video on the net.

# Grants

- ❑ "End-to-End QoS," DARPA, \$100k (\$800k eventually) with Jennifer Hou of EE.
- ❑ "Multimedia over ATM," Ameritech Foundation, \$21k
- ❑ "ATM Testbed," \$400k, from NSF+OBOR+OSU, with Panda, Page, Arora
- ❑ "OCARNet," OBOR, \$2M+ with Panda and others (\$671k for CIS)
- ❑ "Audio and Video over ATM," AT&T/Lucent Foundation, \$40k, With Wu-Chi Feng

# Grants (Cont)

- ❑ "vBNS Gateway for Ohio," NSF, \$350k, with Panda and OSC
- ❑ "Compressed Video via ATM," OSU, \$55k, with Ahalt/EE
- ❑ "Laboratories for Data Communications," NSF, \$356k, with Lai
- ❑ "Congestion Avoidance," NSF, \$375,000
- ❑ \$75k from FORE Systems
- ❑ \$42k from AdTech Electronics Engineering



# Summary



- ❑ Leading the ATM traffic management and Performance benchmarking
- ❑ Good computing and experimental resources
- ❑ On-line dissemination of education and research results
- ❑ Emphasizing topics of interest to industry
- ❑ Collaboration with other faculty, departments, organizations

# Our Publications

All our ATM Forum contributions and papers are available **on-line** at

<http://www.cis.ohio-state.edu/~jain/>

- Specially see “Recent Hot Papers”