

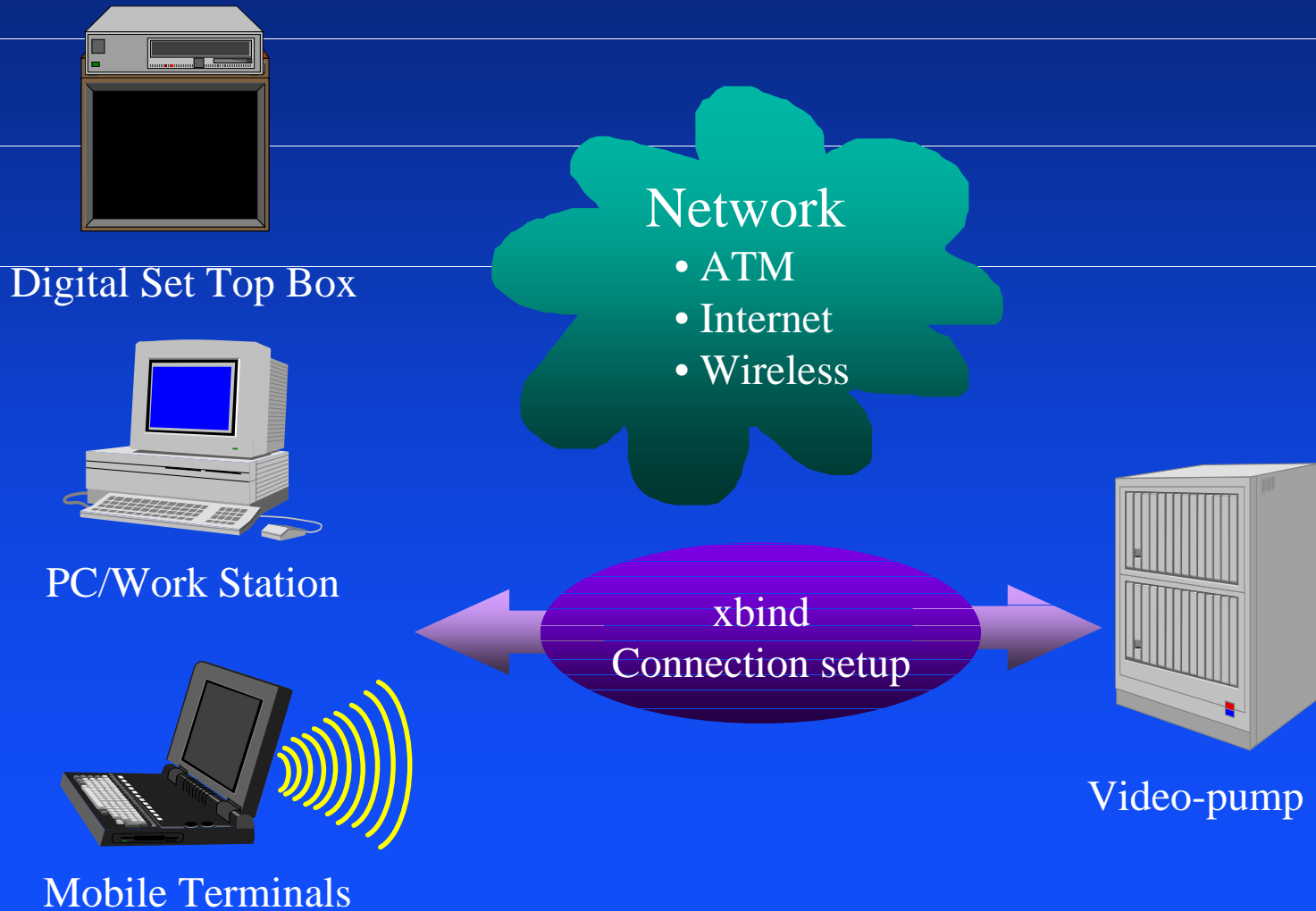
# Columbia's Video on Demand Testbed and Interoperability Experiment

H. Kalva, A. Eleftheriadis, and  
S.-F. Chang

Dept. of Electrical Engineering  
Columbia University

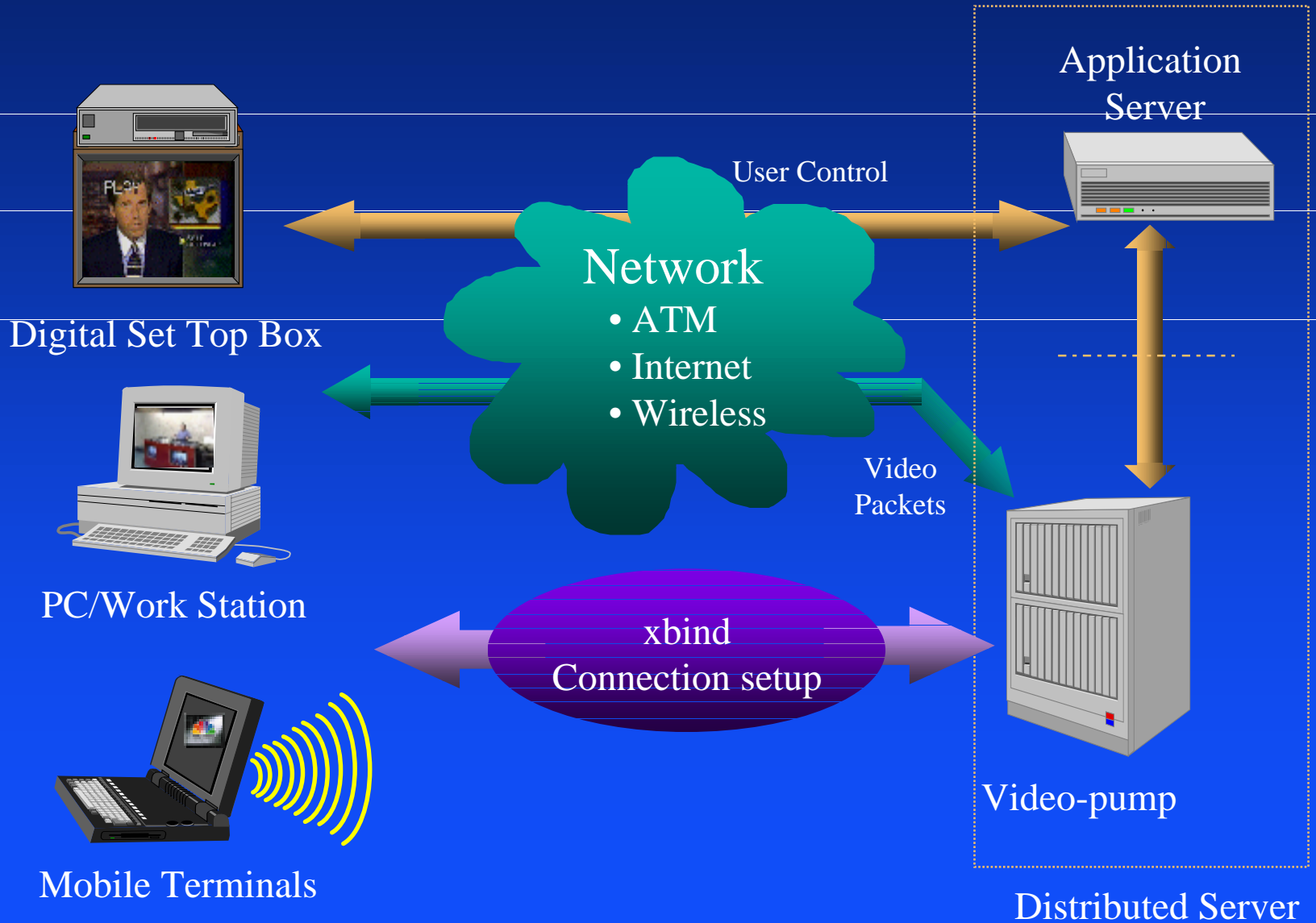
[www.ee.columbia.edu/advent](http://www.ee.columbia.edu/advent)

# VoD Testbed Architecture



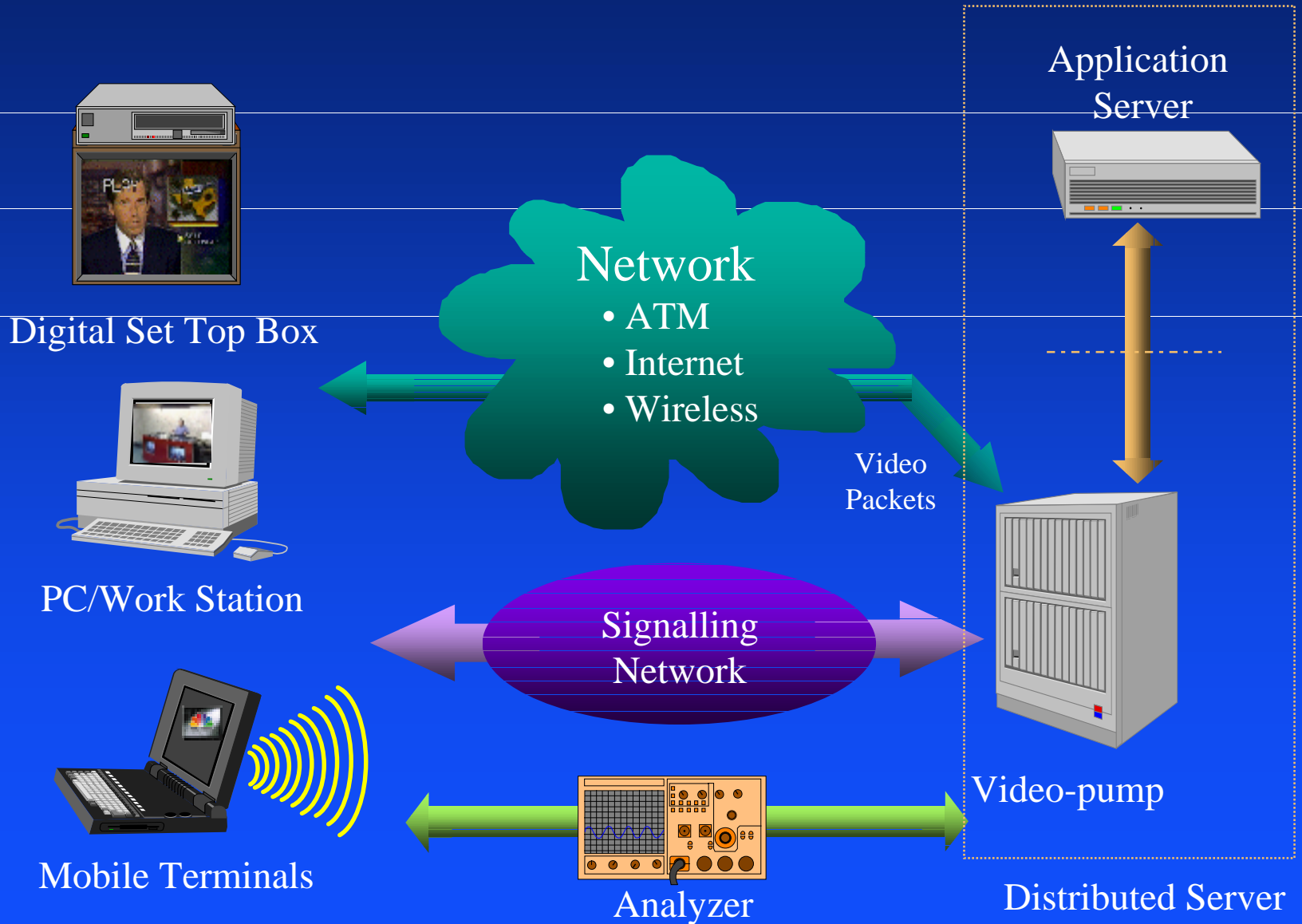
Video on Demand

# VoD Testbed Architecture



Video on Demand

# VoD Testbed Architecture



# DAVIC Interoperability Tests

## July 1996 DAVIC 1.0 Tests

- ◆ Columbia University
- ◆ CSELT, Italy
- ◆ GCL, Japan
- ◆ GTE Laboratories
- ◆ NIST
- ◆ NTT, Japan
- ◆ DeTeBerkom, Germany
- ◆ Hewlett Packard, Canada

# Testbed Components

## ■ Server

- ◆ SGI Onyx, 6 CPUs, 1GB RAM, 40GB Array
- ◆ Fore ATM TAXI (100 Mbps) NIC

## ■ Encoders

- ◆ OptiVision (MPEG-1)
- ◆ C-Cube (MPEG-2)
- ◆ IBM (MPEG-2)

## ■ ATM Network:

- ◆ OC-3c, TAXI, DS-3
- ◆ Fore, NEC, Scorpio switches

## Testbed Components (cont'd)

### ■ IP Network

- ◆ Cisco AGS+ router with shared 10 Mbps segments (10-Base2 and 10-BaseT)

### ■ Wireless Network

- ◆ AirLAN bridge at 2 Mbps

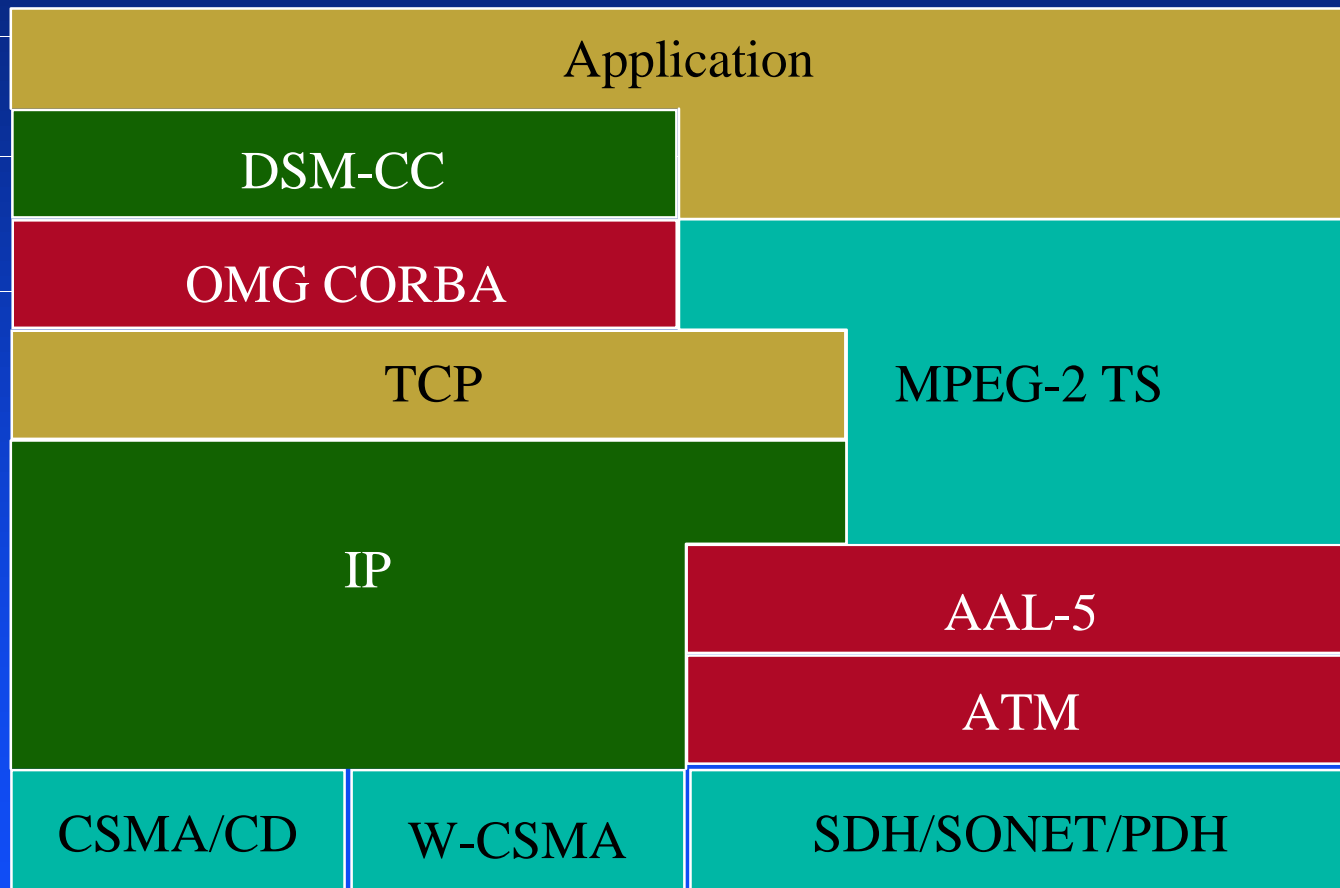
### ■ Clients:

- ◆ Philips Set-Top Box (MPEG-2)
- ◆ PCs with OptiBase VideoPlex (MPEG-2)
- ◆ IBM Thinkpad 760CD (MPEG-2)



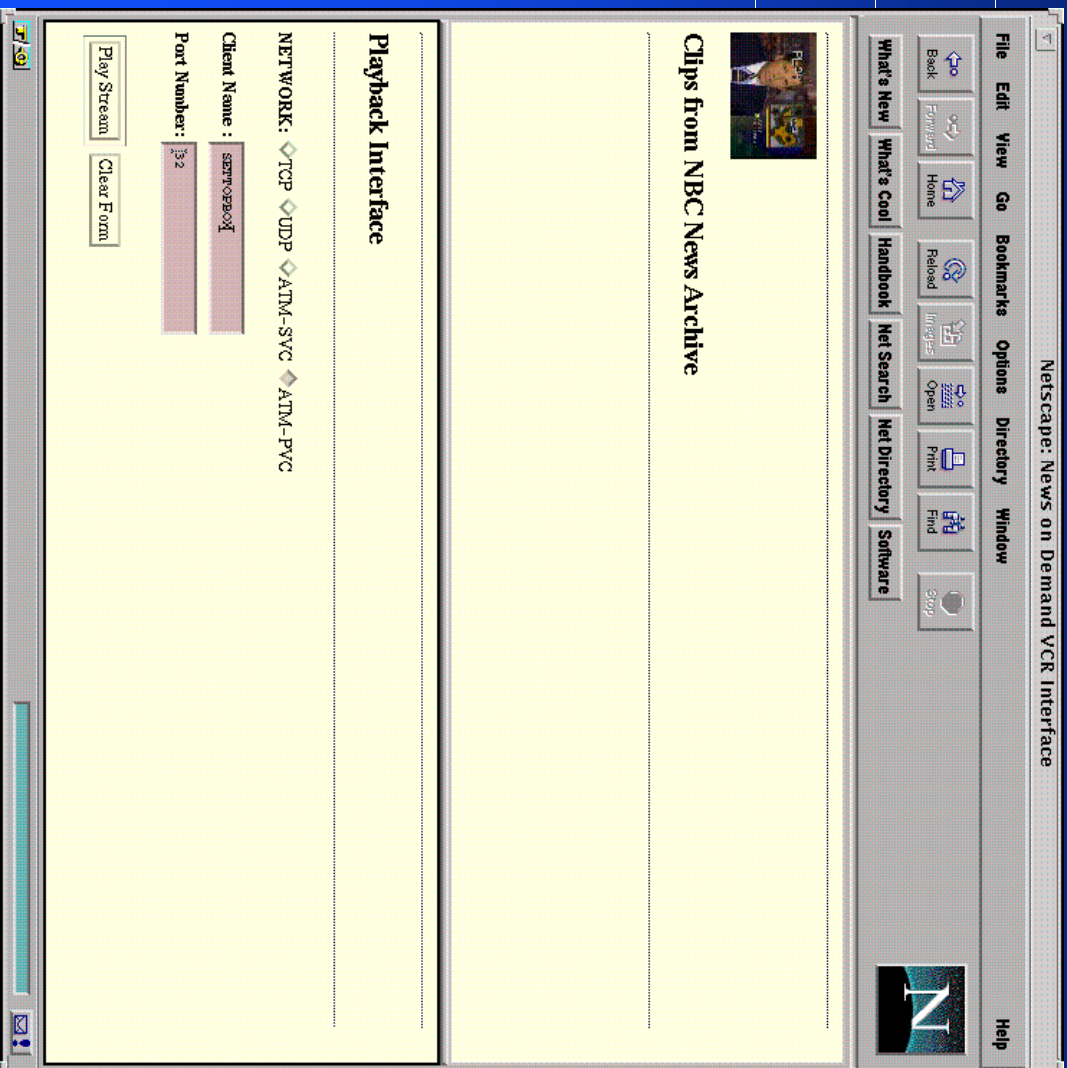
# Protocol Stack

Video on Demand



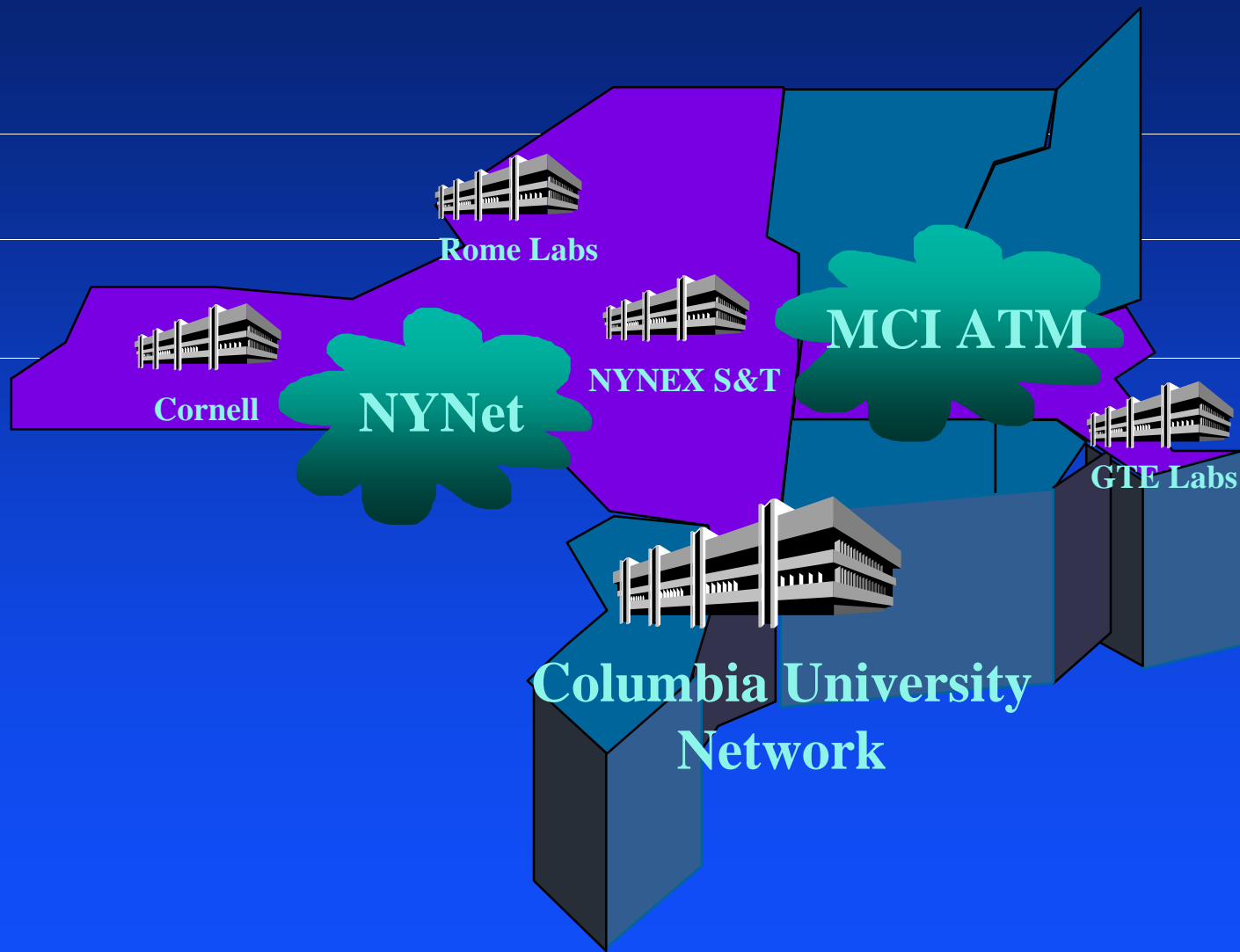
# Video on Demand

# VOD User Interface



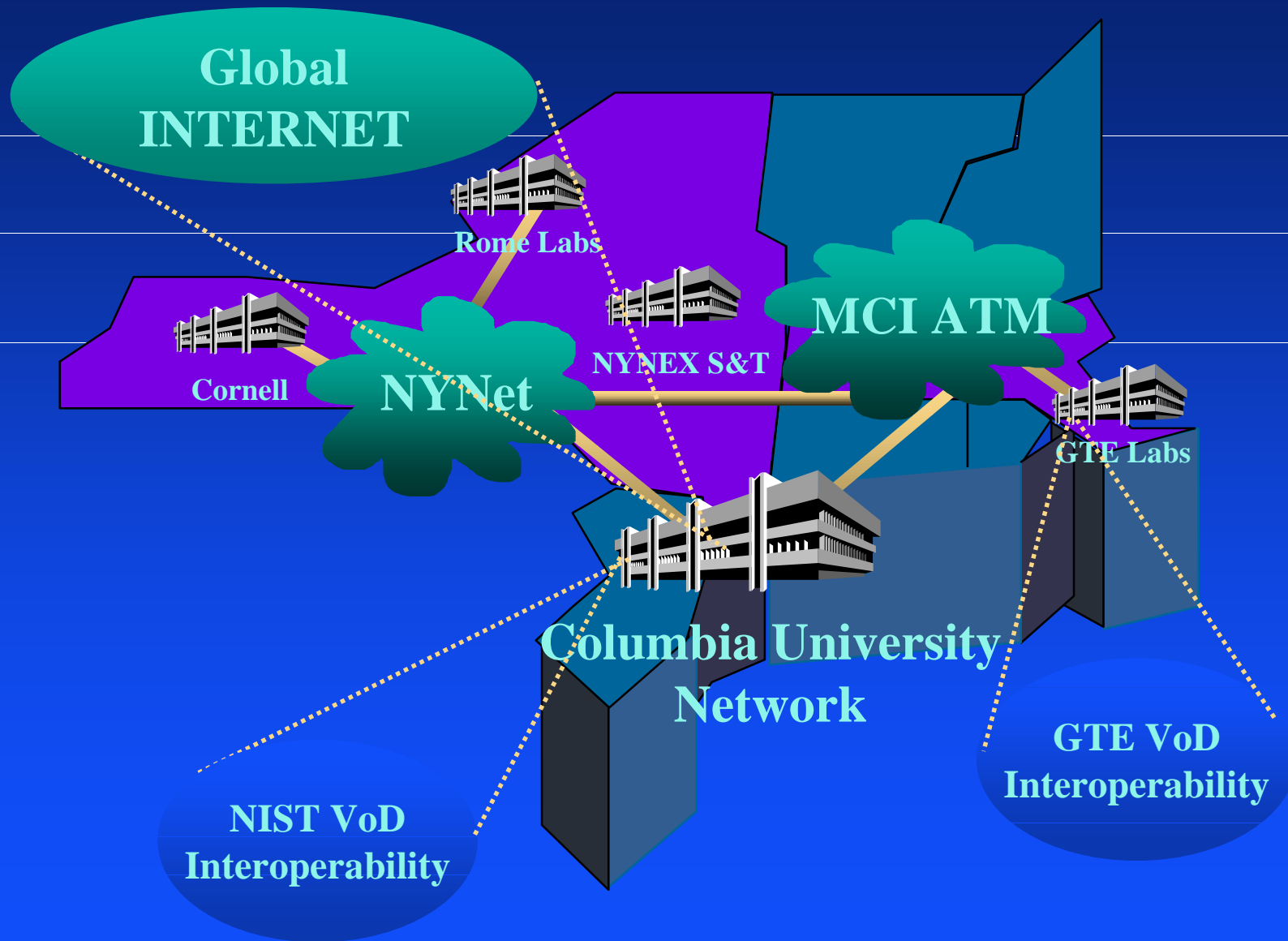
# Network Infrastructure

Video on Demand



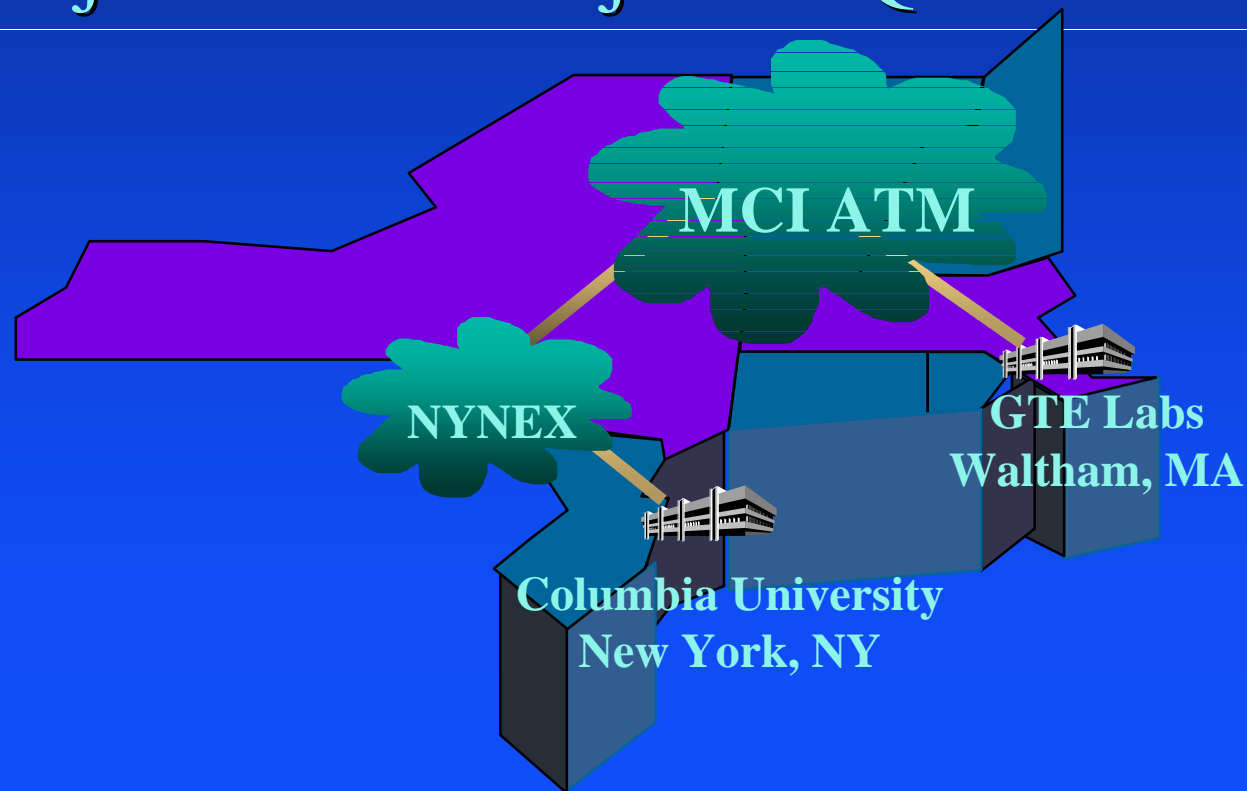
Video on Demand

# Network Infrastructure



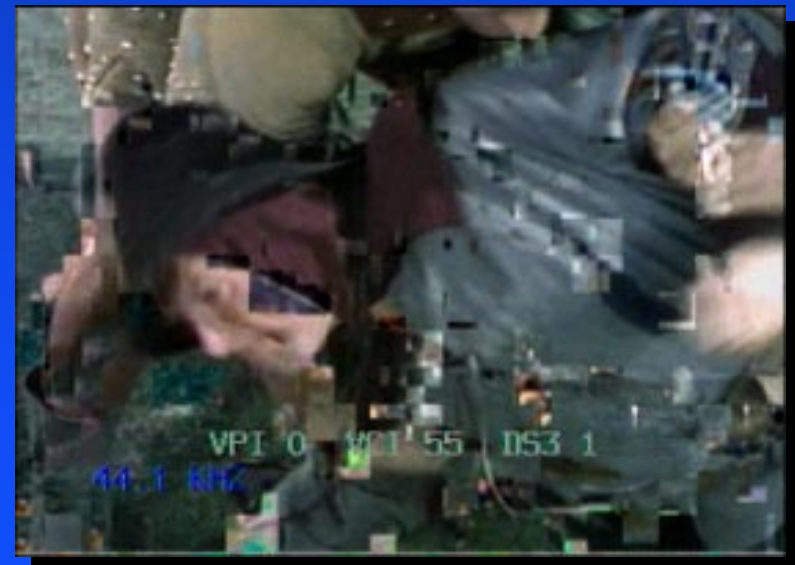
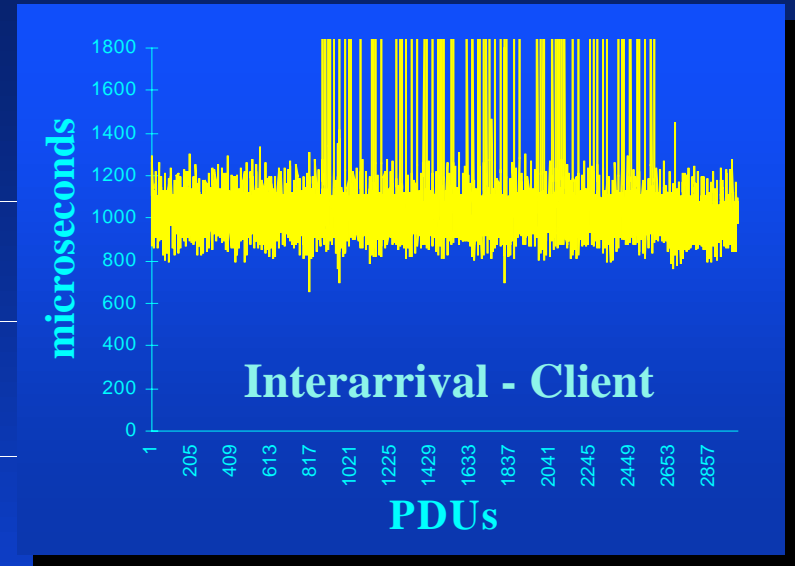
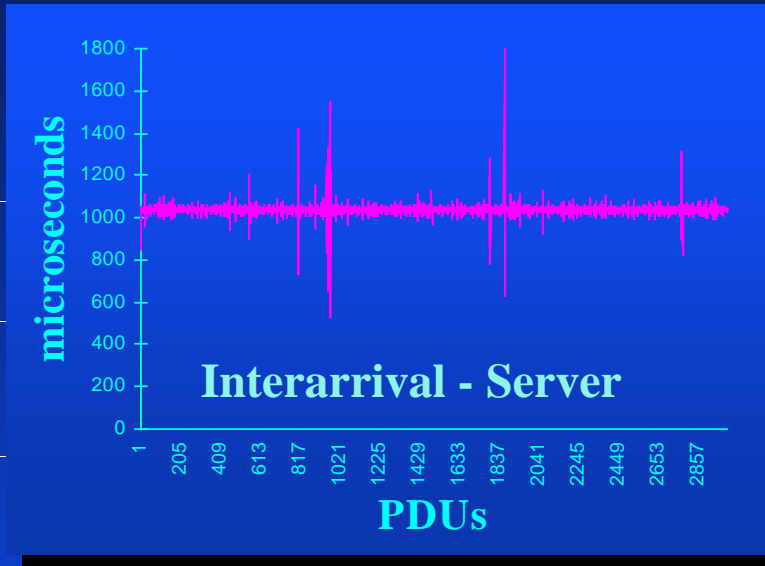
# VoD Performance in ATM-WAN

- ATM-LAN vs ATM-WAN
- One of the First WAN-ATM VoD Trials
- Objective and Subjective QoS



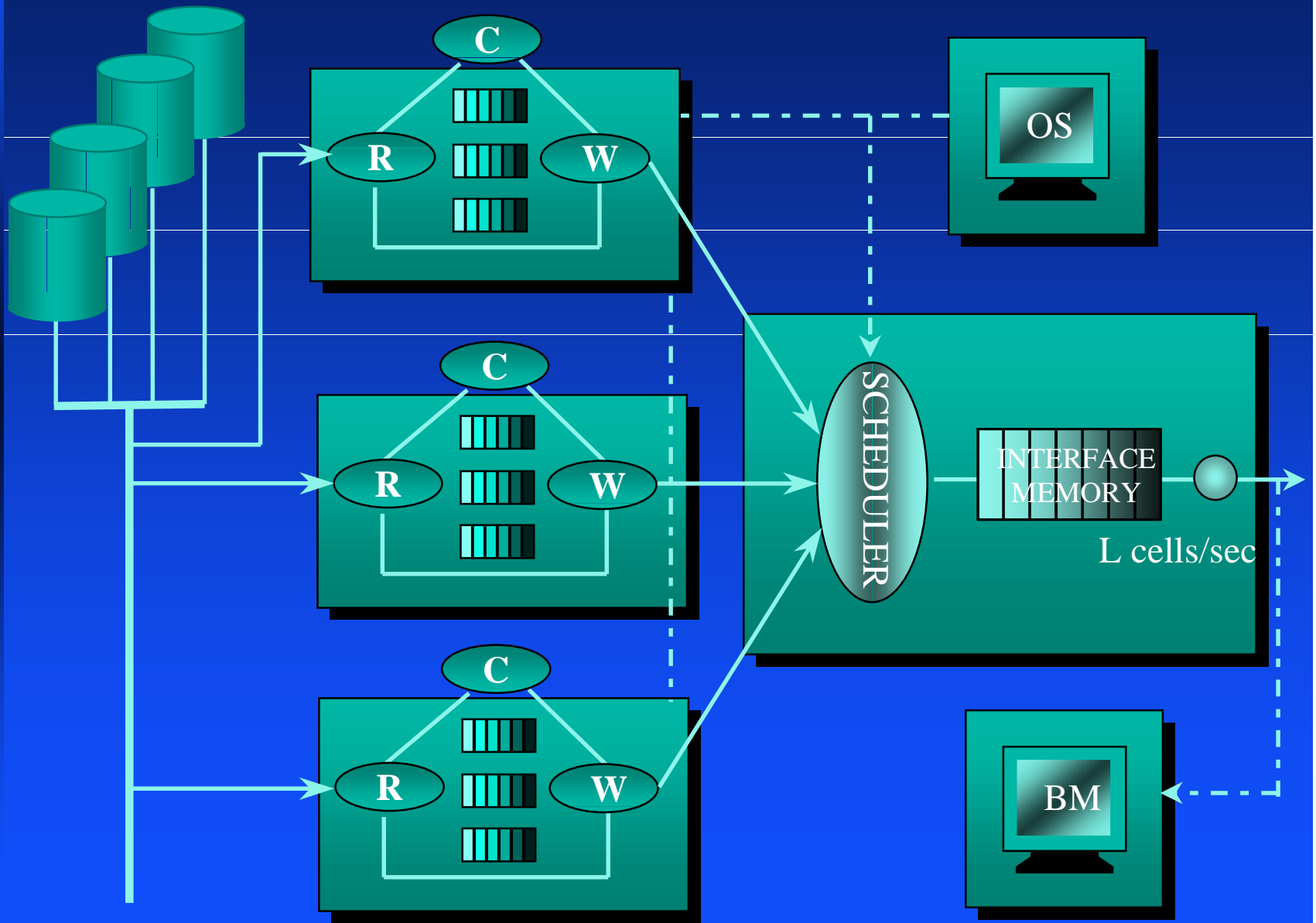
# Video on Demand

## VoD Performance in ATM-WAN



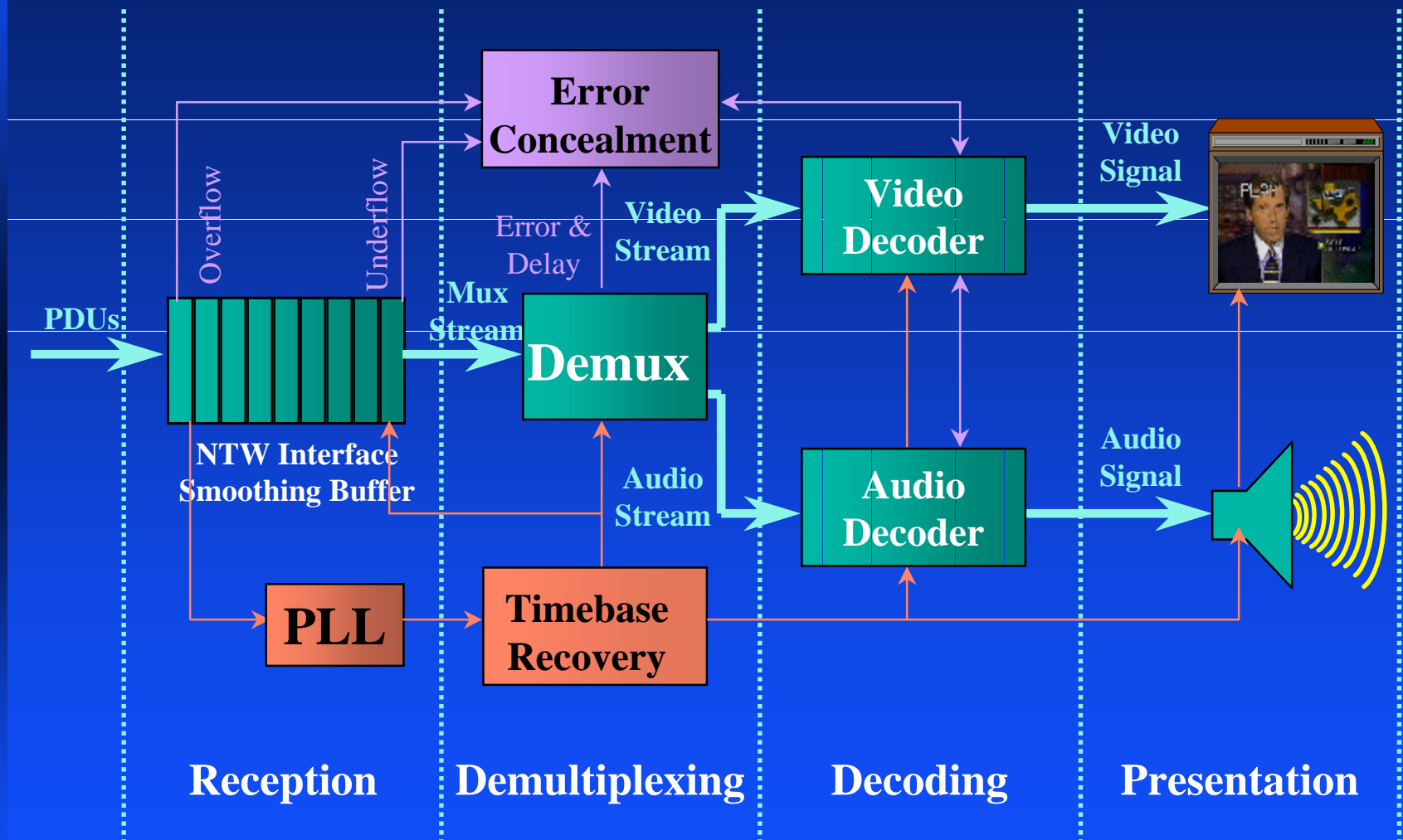
# Video on Demand

## Video Server Model



# Video on Demand

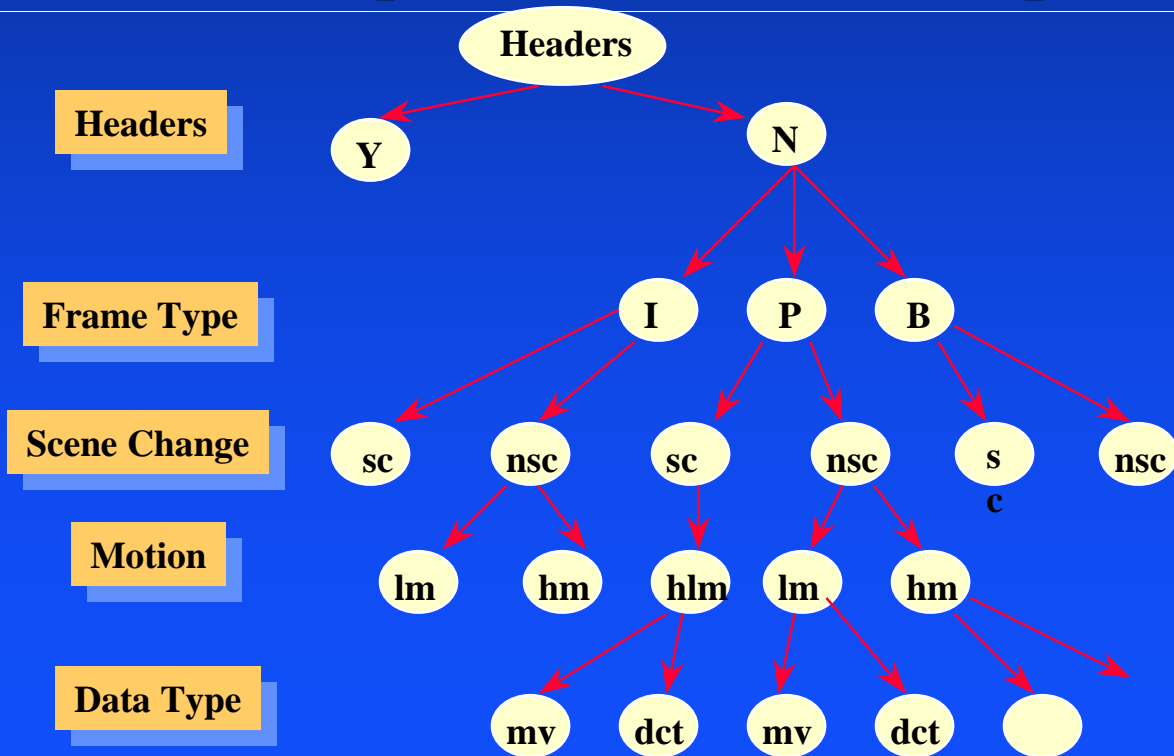
## Video Client Model





# Ongoing Research

- Wireless Video Transmission
  - ◆ Content-dependent FEC
  - ◆ Content-dependent ARQ + multiple copies



Headers

Frame Type

Scene Change

Motion

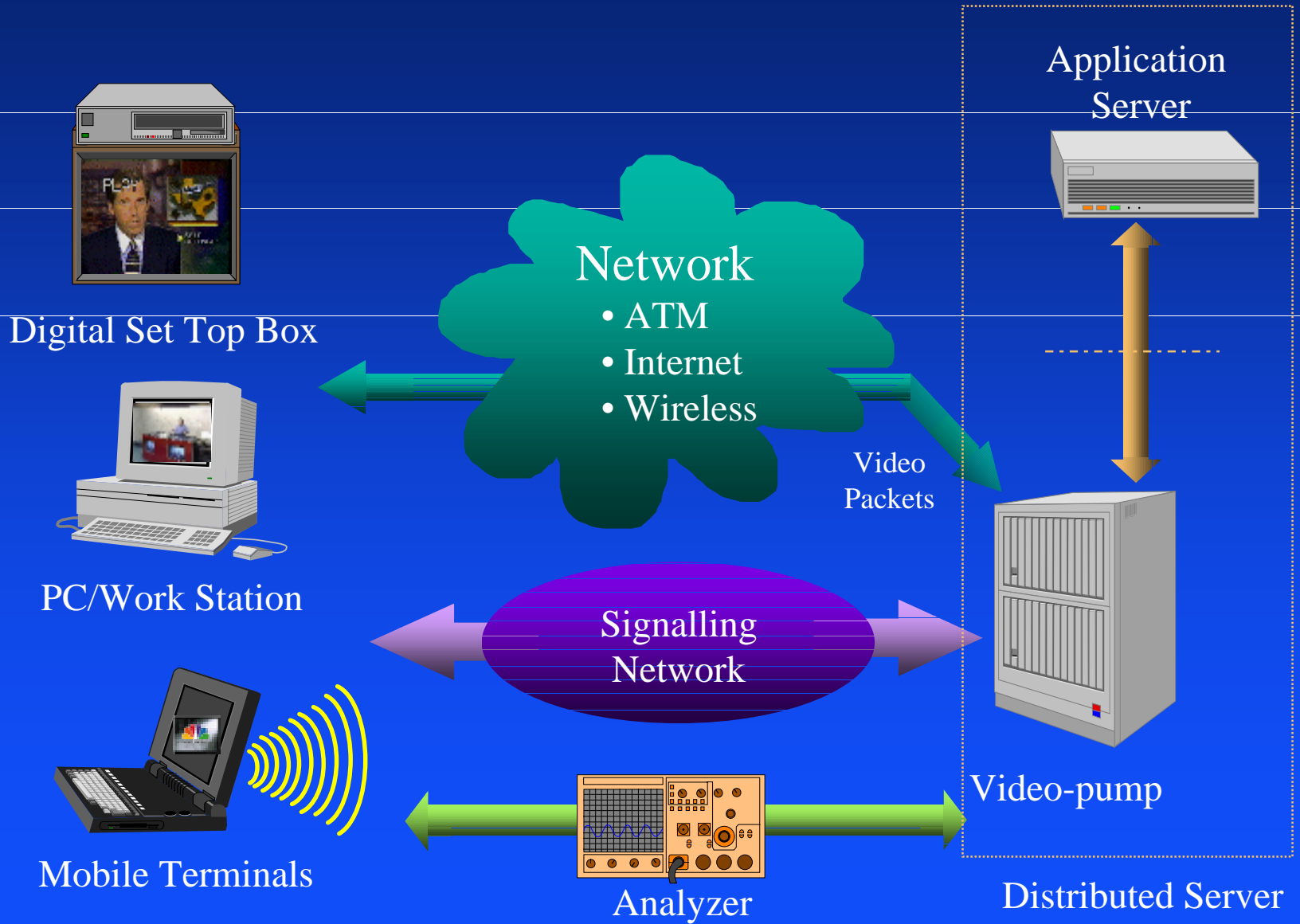
Data Type

## Ongoing Research (2)

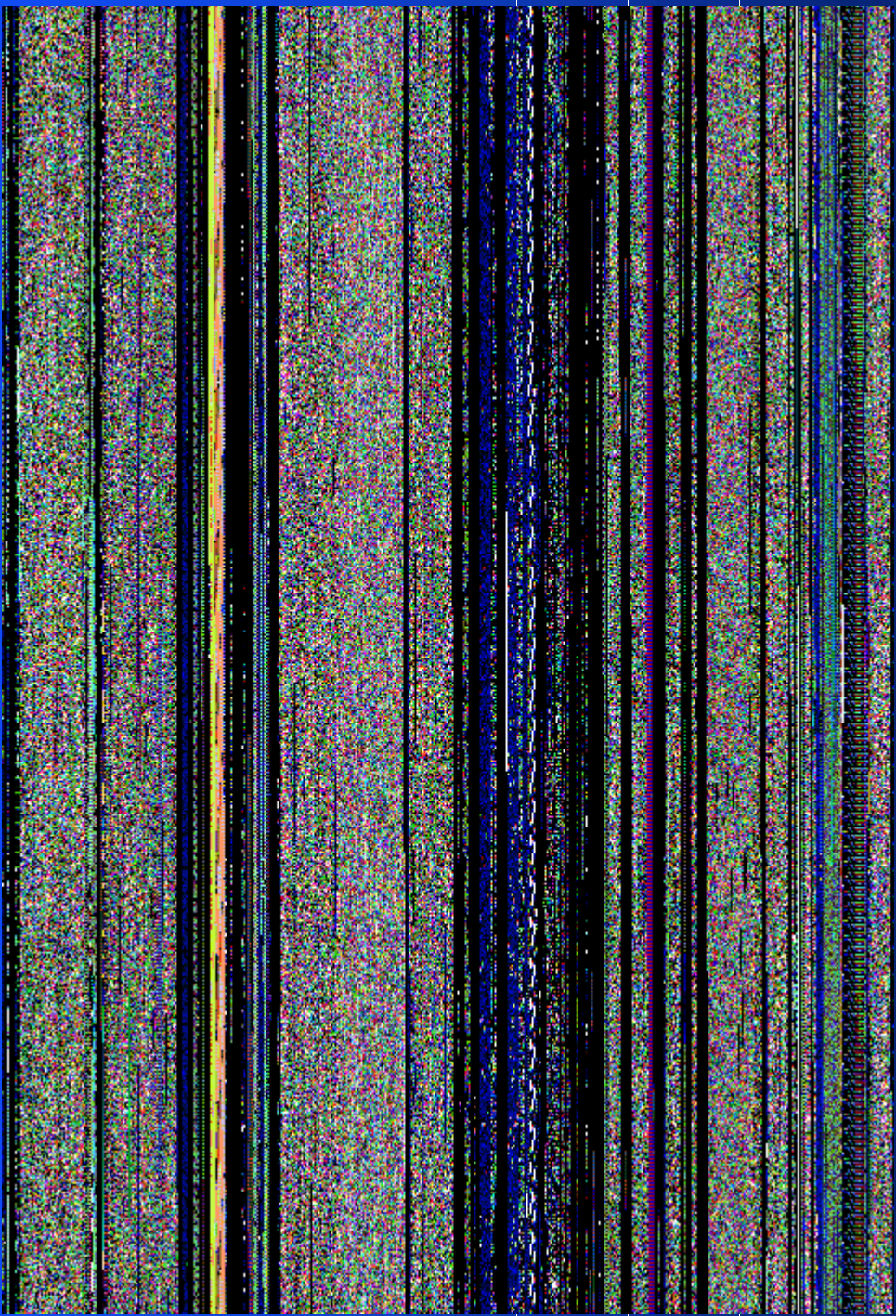
- Video Server Scheduling and Admission Control
- Video over Networks without QoS
  - ◆ Dynamic Rate Shaping
  - ◆ Rate Control using TCP flow control (but not error control)

Video on Demand

# Demonstration Video



# Video on Demand



Demonstration Video



## For More Information

- VoD Team: D. Anastassiou, S.-F. Chang, X. Chen, A. Eleftheriadis, S. Jacobs, H. Kalva, S. Paek, J. Zamora
- For access to papers, the DAVIC Interoperability Experiment Report, etc., visit the ADVENT home page:

<http://www.ee.columbia.edu/advent>