

A circular metallic frame with a central rectangular sign. The frame is composed of two concentric rings, with the outer ring being a darker blue and the inner ring being a lighter, brushed metal. The sign is a dark grey rectangle with a thin metallic border. The text on the sign is in a stylized, white, serif font. The background is a solid blue color.

NOW SHOWING
Video on Demand
PRESENTATION

Multi-Protocol Video on Demand System for Distance Education with Pedagogical Enhancements

Thesis Presentation

21/01/2004

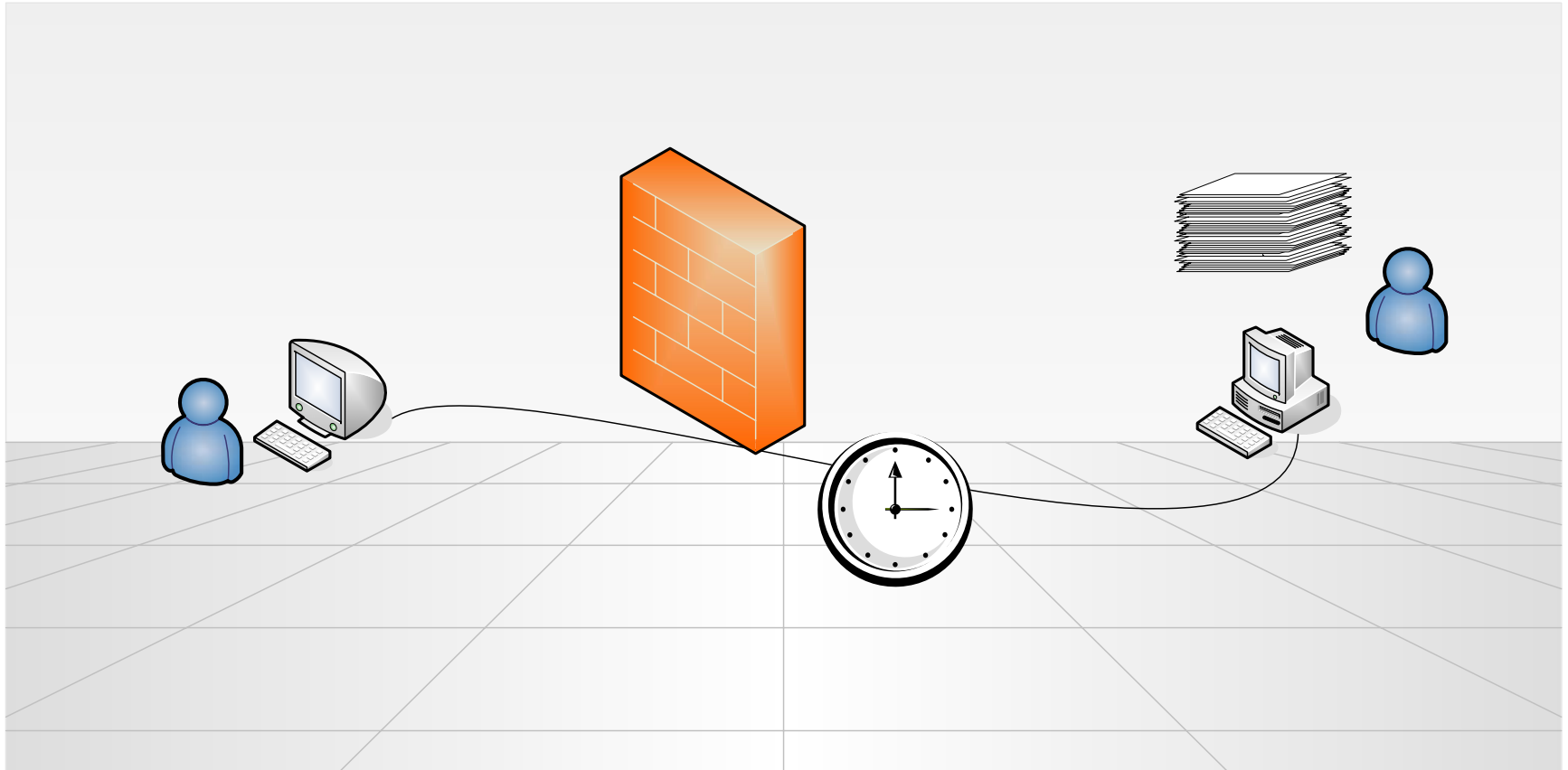
Cem KARACA

Supervisor: Assoc. Prof. Dr. Derviş Z. DENİZ

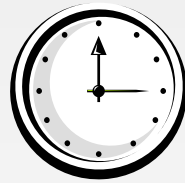
Outline

- Distance Education
- Video on Demand (VoD) Systems
- Pedagogical Enhancements on VoD Systems
- Networking Technologies for VoD Systems
- Buffering
- The Interfaces
- Conclusions
- Questions

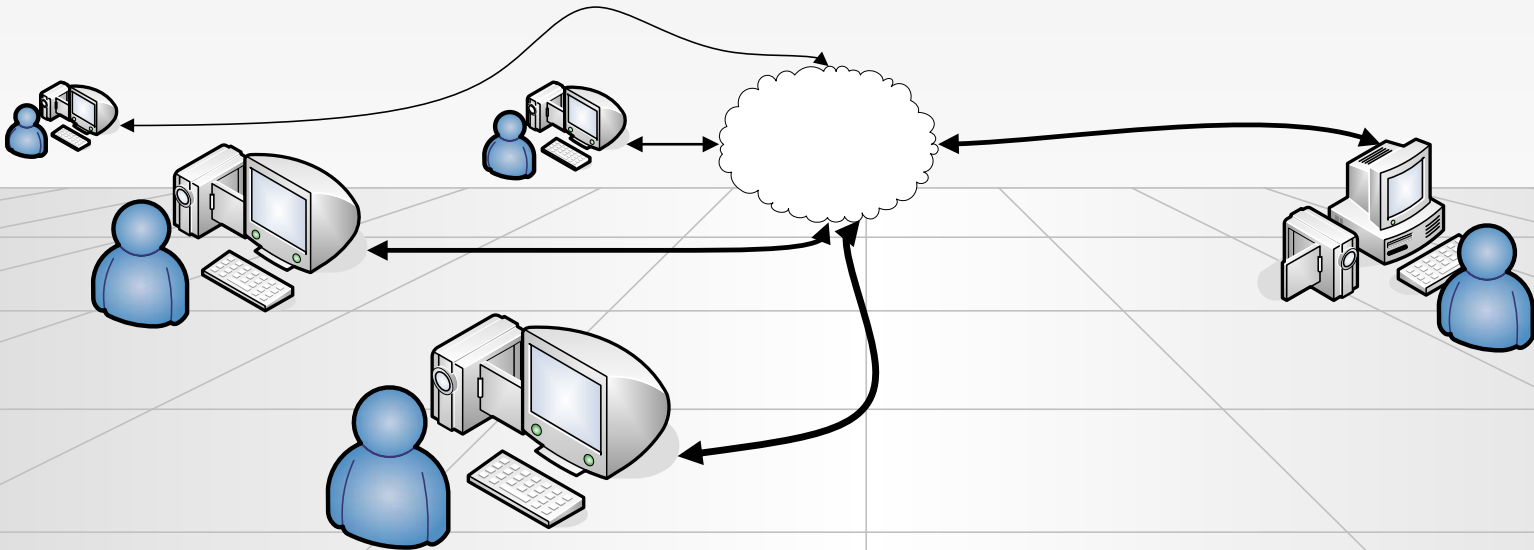
Distance Education (DE)



Synchronous Distance Education (SDE)

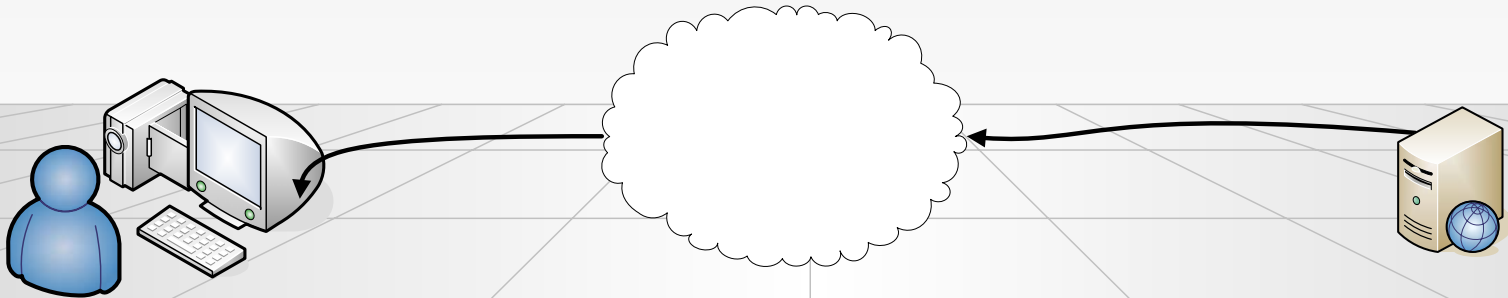


- Must be scheduled
- Multicast

















Asynchronous Distance Education (ADE)

- Peer to peer (Unicast)
- No time limitation
- No interaction



Comparison of SDE and ADE

	SDE	ADE
Orientation	 Classroom	 User or Group
Scheduling	 Required	 Not required
Presentation	 Multicast	 Unicast(peer to peer)
Network Load	 Continuous	 When streaming
Distribution	 WAN	 WAN and Internet
Hardware	 Any compatible	 Mass storage
Interaction		
Broadcast	Real-time	Streaming

The Problems

ASE Systems

- ASE System session quality is dependant on time and place.
- Sessions are non-repeatable

ADE Systems

- Current implementations are not interactive
- The DE content cannot be expandable by the learner
- Mostly web based and multimedia is only used where necessary

The Solution

Need for a Complete DE System

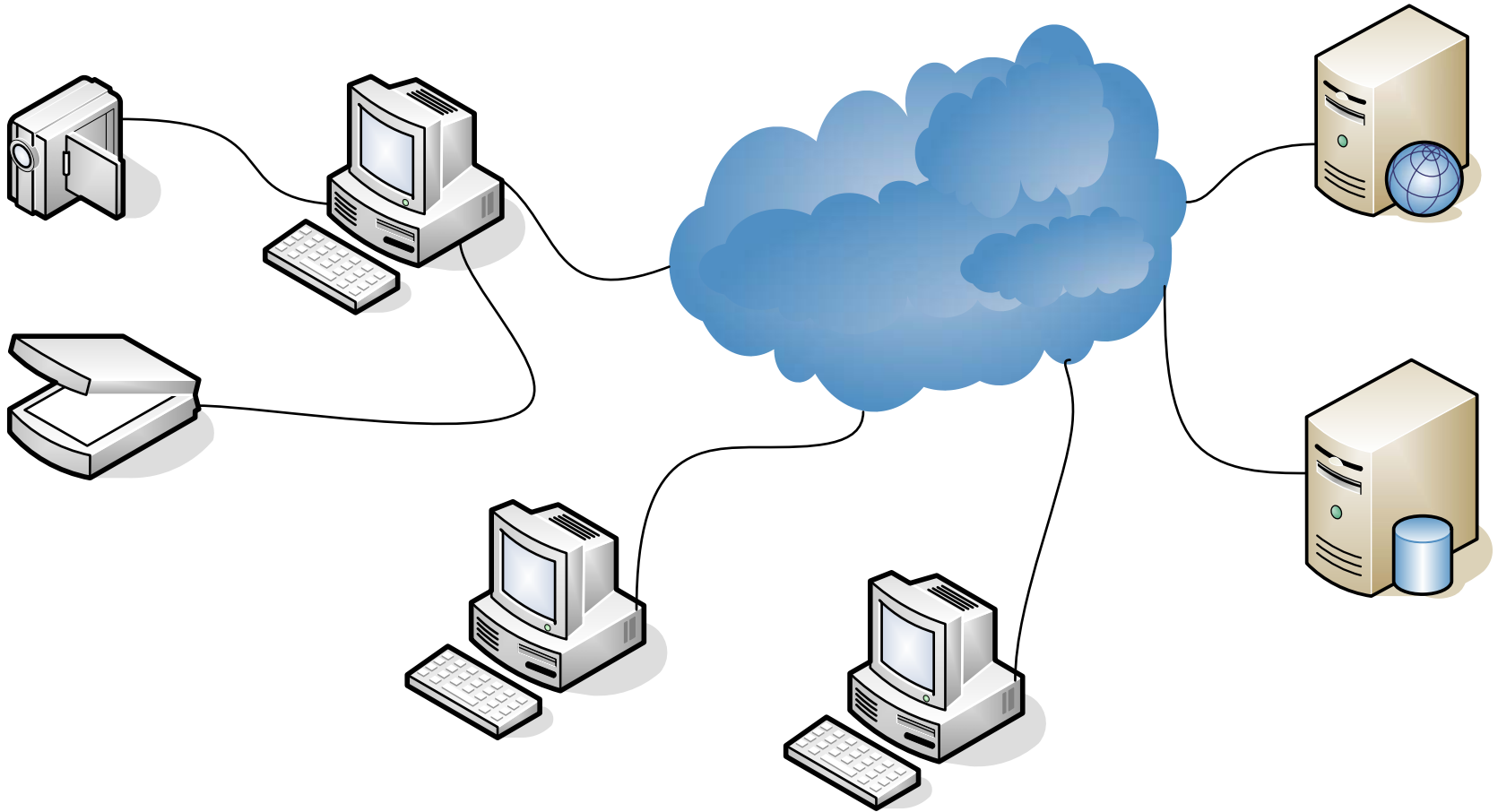
- Learner oriented,
- That will be accessed on demand over the WAN or the Internet,
- It will also include course content related knowledge base.
- It will allow learner interaction to the knowledge base.

The VoD System

Pedagogically Enhanced Video on Demand (VoD) System for ADE

- Streaming on demand video,
- VCR Capabilities,
- Applicable over the Internet
- The network and storage load could be distributed.

The DoD System Infrastructure



Servers

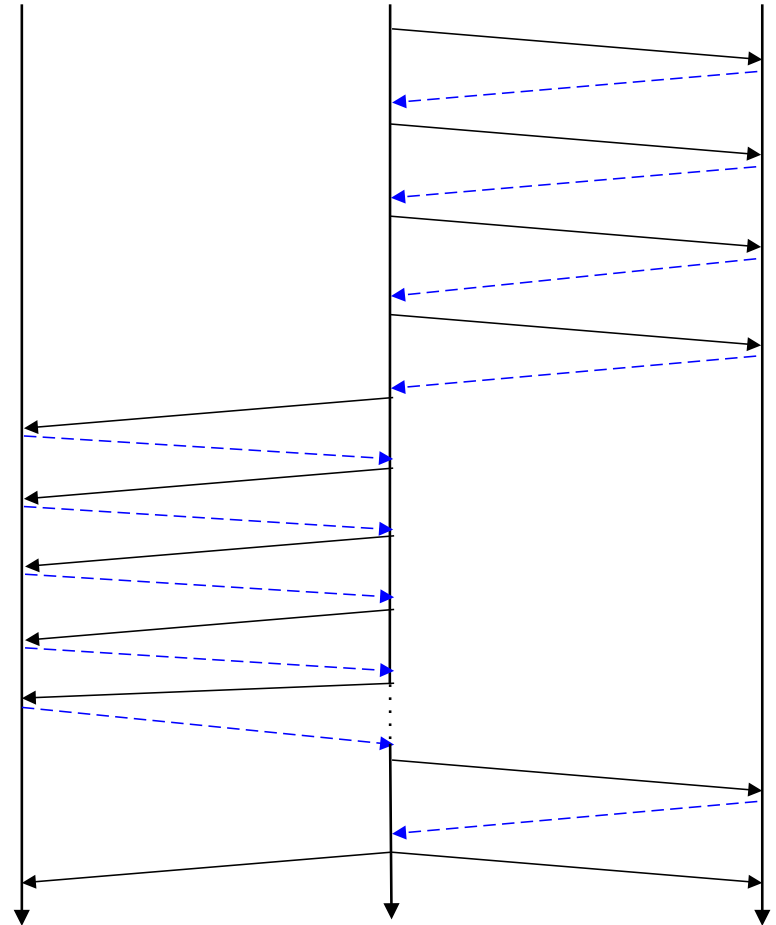
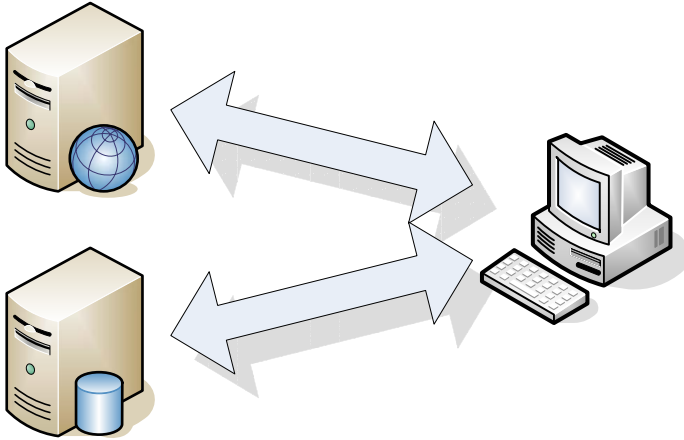
Mediation Server

- Authentication
- Storing important databases
- Mediates between client side applications and Content Servers

Content Servers

- Storing lecture videos
- Content materials and their bounded objects
- Serving VoD DE projects with the transport/application protocols such as TCP, FTP, UDP and RUDP.

System Architecture



Pedagogical Enhancements on VoD System

- VoD Player is the only required tool for viewing VoD Projects.
- VoD Player is a video based system application, that is able to view content related supporting materials as “html” pages.
- VoD Player allows the learners to make their own additions.
- VoD Project Editor is the only tool for creating VoD DE projects.
- VoD Project Editor supports “html” creation, edition and synchronization to course videos.

System Applications

	Client-Server Applications	Software Component
Client Side	Student/Learner Client	VoD Player
	Project Editor/Instructor	VoD Project Editor
	Database and Content Admin	Web access to server resources
Server Side	VoD Mediation Server	User and password database, Video Project database, Content server IP database.
	VoD Content Server	TCP, UDP, RUDP and FTP Servers, Video Library, Supporting materials.

The VoD Player

VoD Player - Project: Stability

Main video screen

Buffered video amount

Supporting material window. "html" browser

Progress Bar

Linear region

The screenshot displays a VoD Player window titled "VoD Player - Project: Stability". The main video screen shows a green chalkboard with the equations $x = Ax + Bu$ and $y = Cx + Du$, and a block diagram of a control system. The diagram includes blocks labeled B, 1/s I, C, A, and D, with input u and output y. Below the video player is a progress bar with a green indicator and a "Buffered video amount" label. To the right is a "Supporting material window. 'html' browser". Below the progress bar is a graph with a red line and a lightbulb icon, labeled "Linear region".

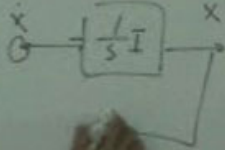
The VoD Player Plus

VoD Player - Project: Stability

4 Stability of State Variable Systems

Syst. $\dot{x} = Ax + Bu$
 $y = Cx + Du$

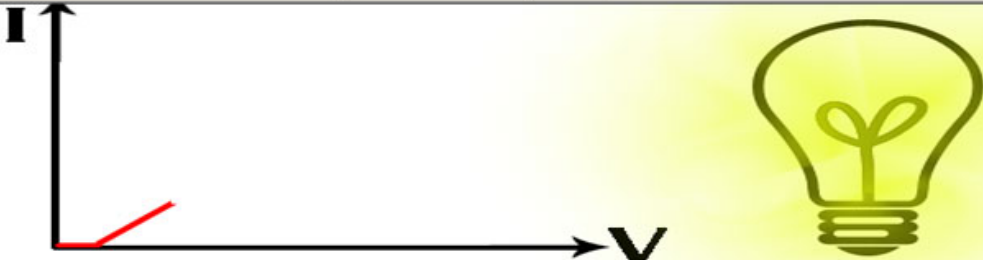
Block Diagram



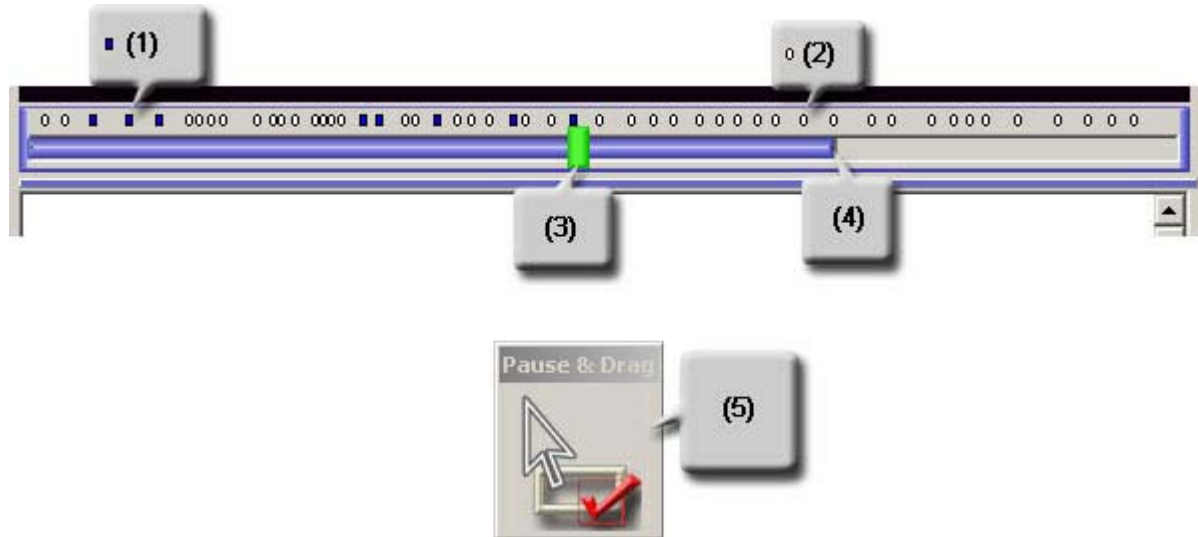
Project Name: Stability
Subject: Linear Systems
[Open Stability forum](#)
Logged as Student
Active Users:
Std: Cem KARACA
Inst: Ahmet Turhaner
Std: Emre Öktem
Std: Gökhan NAS
Adm: INTERDEC
VoD Admin

Send

aturhaner: Now the system in the figure below is in its stable region and when flame burns the system will go in an unstable condition.
cem: Ok
aturhaner: Now, move your slider to 30th second



Content Synchronization



1) Learner additions

2) Standard content material

3) Video Slider

4) Buffer progress

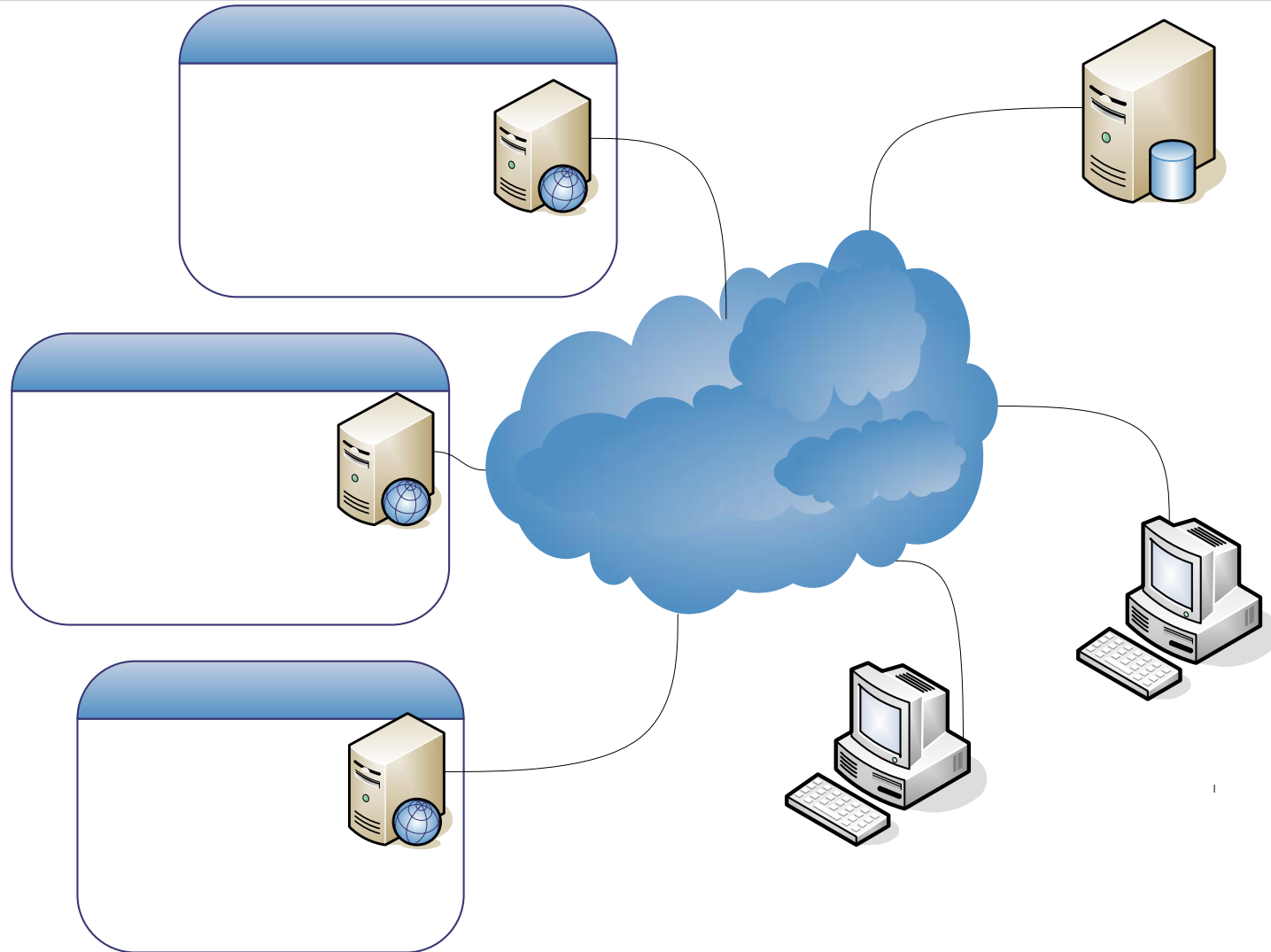
5) Content addition window for the use of learners

The VoD Project Editor

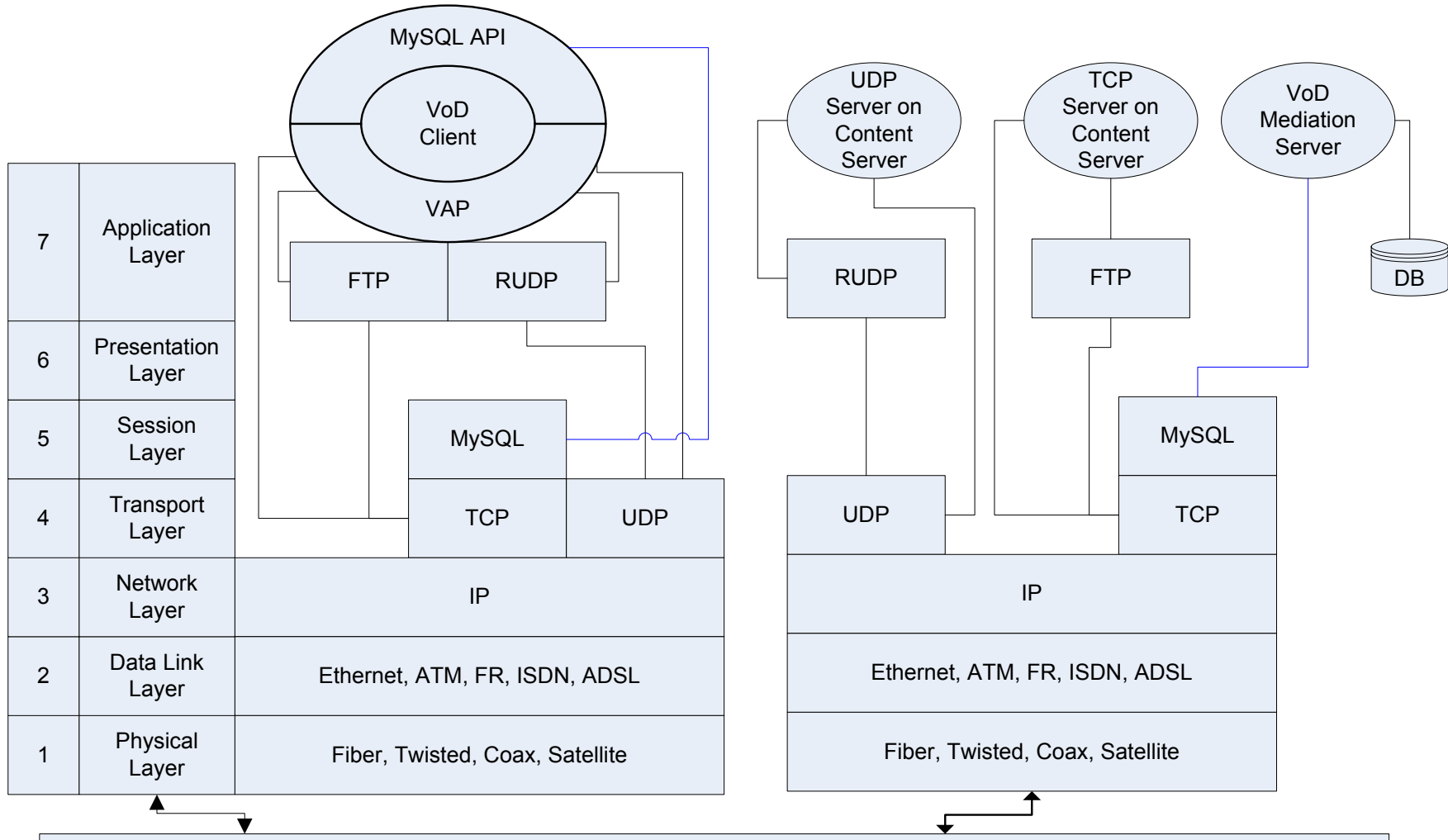
- 1.) Video Preview Screen
- 2.) Project tree
- 3.) Content addition ruler
- 4.) "html" editing screen



Distributed Server Architecture for VoD System

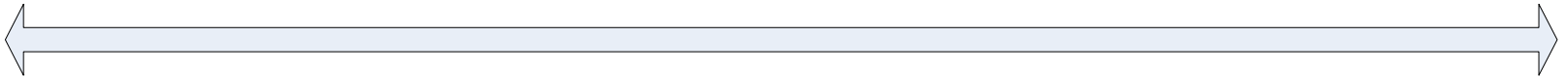


OSI and VoD



Supported Protocols for Video Streaming

- Transport Control Protocol (TCP)
- User Datagram Protocol (UDP)
- File Transfer Protocol (FTP)
- Reliable User Datagram Protocol (R-UDP)



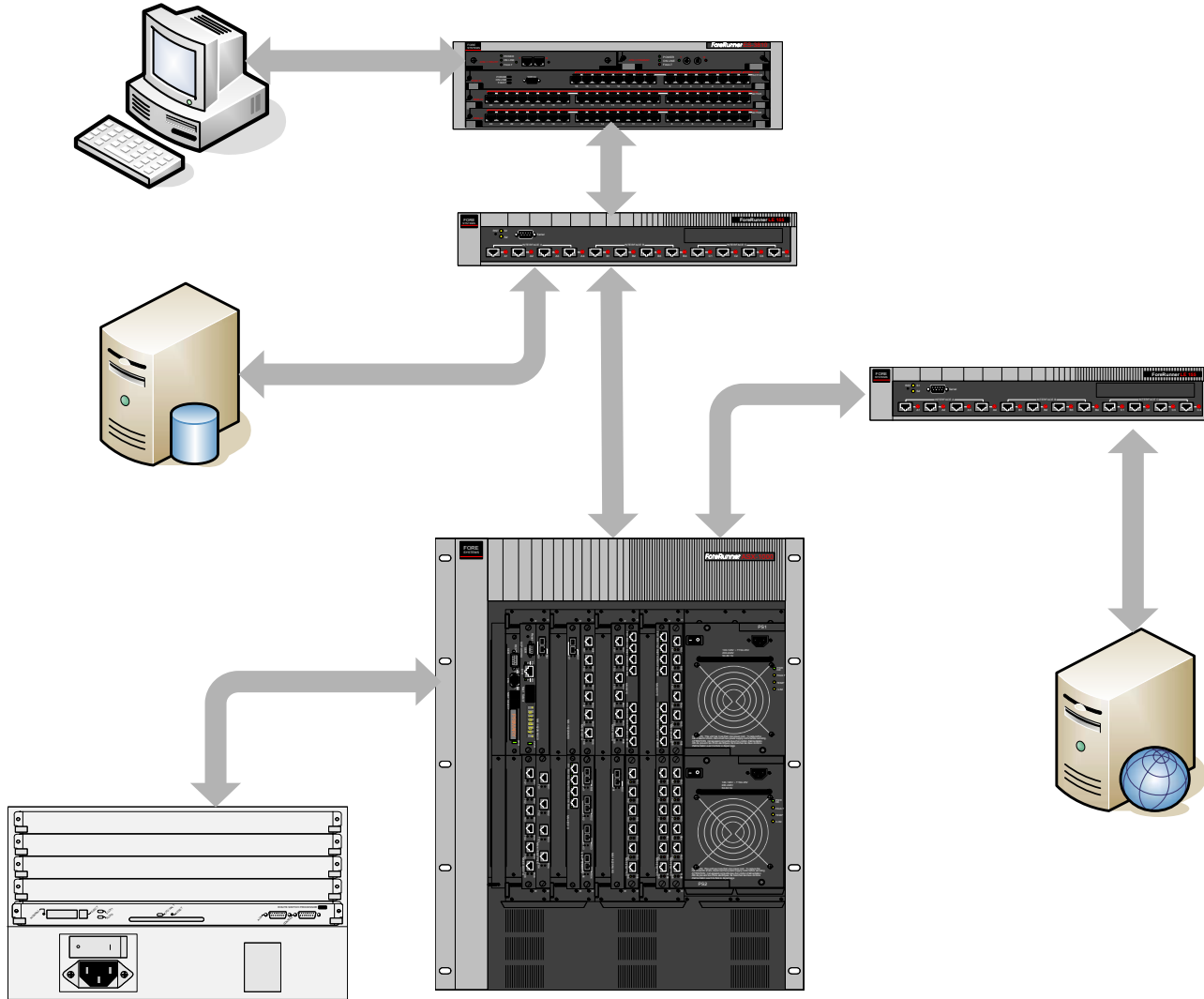
* In ideal cases

Reliable UDP

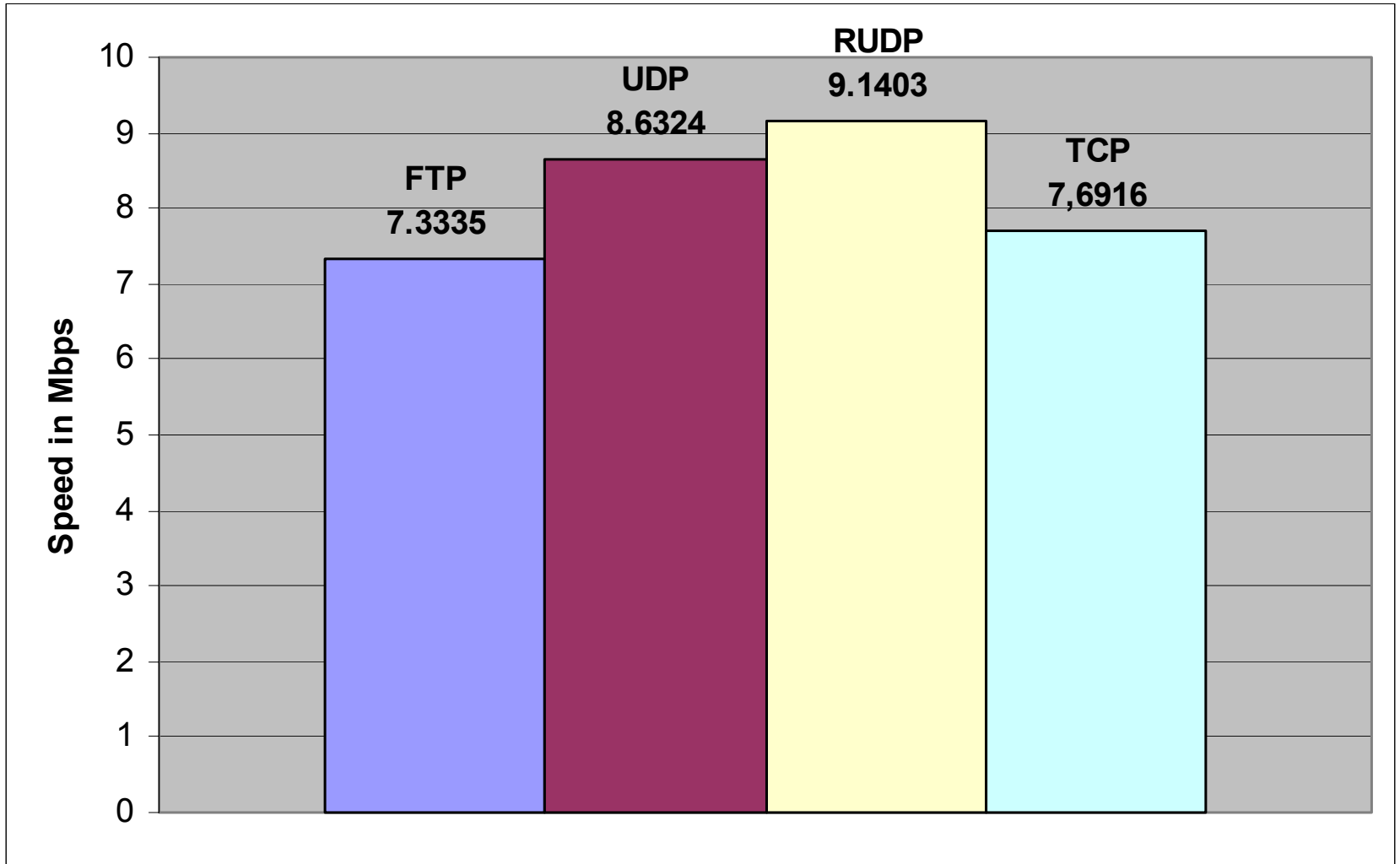
- Connection Oriented
- Error control with 32 bit CRC
- Packet Recovery
- Less overhead
- Fast
- Designed for video transportation

0	8	16	31
Source Port		Destination Port	
UDP Length		Checksum	
Size			
32 bit CRC			
Packet Number			
Bulk data 65467 bytes			

System Performance Measurements

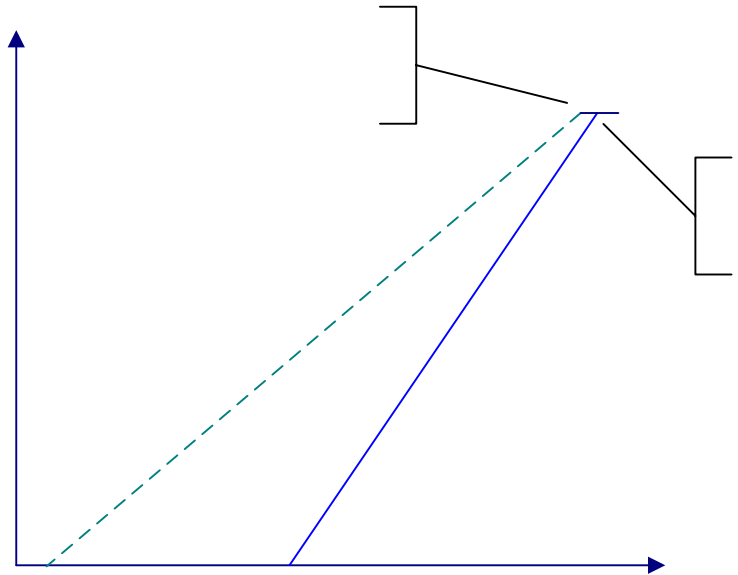
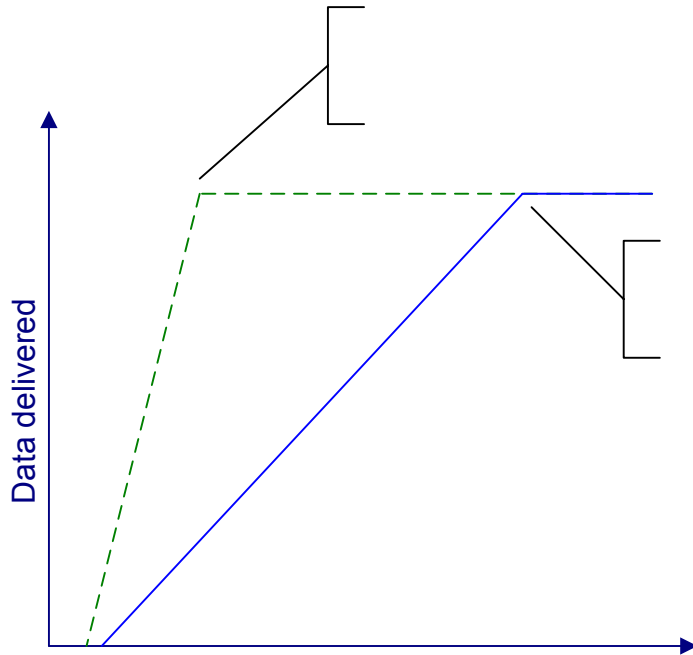


Results



Smooth Buffering

$$t_w = \begin{cases} 0 & : S_p < S_D \\ \frac{t_p * S_p}{S_D} - t_p & : S_p > S_D \end{cases} \Leftrightarrow S_D > 0$$



Conclusions

- A complete ADE system could be implemented
- Pedagogical aspects are developed for VoD systems
- A new streaming protocol R-UDP is developed for low bit error rate networks
- Comparisons of the transport/application protocols are made
- Smooth buffering is developed