Abstract - Distance learning is a brand-new pedagogy which the government is energetically popularizing right now. Different from the traditional teaching modes which need students gathering in class, distance learning is a pedagogy using multimedia and network service to eliminate the limitations of time and space. Furthermore, distance learning uses the network digital system to send messages point-to-point or point-to-multipoint. This paper experimentalizes the operation of P2P Live Media Stream, a distance video system based on P2P structure. In addition, we also compare it with Co-Life Video Conferencing System and Marratech Online Video Conferencing System. The comparisons focus on the smoothness of video signals, stability, connect recovery and transmission situations. We prove that P2P Live Media Stream is an ideal and feasible system which can be used in campuses. Furthermore, it combines all kinds of video teaching modes and benefits the teaching diversity in campuses.

Keywords - Multimedia; Peer-To-Peer (P2P); Live Media Stream (LMS); Distance Learning; Video Conferencing Systems

I. INTRODUCTION

As the scientific technology quickly develops, computers and network have gained important positions in our daily lives. For example, most of us use Microsoft Word when dealing with document processing. Furthermore, computers and network are definitely needed while sending e-mail, programming and watching entertainment videos. Lives and works today without computers and network could be very inconvenient. So, it is obvious to see that computers and network are very indispensable nowadays.

P2P (peer-to-peer) system is the most popular point-to-point online transmission system. Most downloading and sharing programs use P2P system to deliver and receive information such as BitTorrent (BT), FOXY, eMule and eDonkey. They all support the transmissions of multi-people and multi-cable at the same time. Online video-sharing mode is mainly divided into two ways. One is the videos will be watched on computer after downloading. The other one is that videos are watched online. However, watching videos online often faces the problem of sudden stops and lags. The reasons of these stops and lags may be insufficient bandwidth (server-end or client-end), too much online users (different watching timing causes reading busy of server) and the packet loss during transmission. Thus, watching videos online is not an ideal mode. For example, when we watch videos on YouTube, often it takes long time of waiting, and the qualities of videos is not very good as well.

But now, video-sharing mode has significant changes. Seeing that P2P system works outstandingly, we combine P2P system and video-sharing mode together. This paper uses P2P Live Media Stream (LMS) [3, 4, 5, 6, 8, 9, 10] on distance learning, delivering the videos by P2P system. The server-end sends out only one information group, peers will share with each others. It is a brand new way of online video-watching, the smoothness and qualities will make great progress, sudden stops and lags happen not as often as before. The use of P2P LMS is chiefly separated into three parts: (1) online distance learning; (2) online television station (it can be used as video on-demand, the displaying of videos can be scheduled in advance); (3) broadcasting TV programs by installing TV-card.

The P2P LMS in this paper is a distance video system based on P2P system structure. It is compared here with Co-Life (Collaborative Life) system which is developed by NCHC (National Center for High-Performance Computing) and Marratech which is developed by a subsidiary company of Google. The comparison will focus on image quality, video smoothness, practicability and transmission efficiency. This paper intends to prove that P2P LMS is an ideal and feasible system that can be used in campuses.

II. RELATED WORKS

For the time being, there are many different online video systems; the most common ones used by Internet users are SKYPE, MSN (Microsoft Network) and Yahoo Messenger. But these three systems belong to point-to-point structure and allows only two people connect to each other at a time which do not fulfill our request. The distance video learning studied in this paper should have two characteristics: (1) images can be played in full-screen mode; (2) systems support point-to-multipoint or multipoint-to-multipoint webcam so that it can easily support plenty users of distance video learning at a time. Besides to P2P LMS, this paper also discusses two often-used multi-people distance video learning system, Co-Life Video Conferencing System and Marratech Net Video Conferencing System. Next, this paper will introduce the functions of these two video conferencing systems.

A. Co-Life Video Conferencing System

Co-Life [30] is a system which focuses on distance desktop-sharing, electronic whiteboard, and words and video communication. It is a multi-people, multi-function online video conferencing system which combines calendar, conference function and community function together; it can simultaneously provide more than twenty-nine video images
during net conference. In the cause of getting the best quality during multi-point connection, the NCHC sets the video servers in three different places (north, central and south) by using TWAREN (Taiwan Advanced Research and Education Network). Every unit only needs to connect to the nearest server then video streaming from different places (servers) will be received. It makes distance courses more sustainable and the connection becomes smoother and stronger. [2]

B. Marratech Online Video Conferencing System

Marratech [27, 31] is also a video conferencing system which is similar to Co-Life in user interface. It provides video communication, word chat, Internet phone and electronic whiteboard. After the purchase, Marratech is mainly used by Google’s employees for cross-country communication. But it still release trial version for people or can be purchased by companies. Marratech uses client-server framework, users can interact with remote users through Internet. The operation is quite simple; it is easy to learn and use.

III. PEER-TO-PEER LIVE MULTI-MEDIA STREAMING SYSTEM

A. The Basic Structure of P2P LMS

Peer-to-peer network topology is mainly divided into three ways: a) Tree-based topology [21]; b) Mesh-based topology [4]; c) Gossip-based topology [8, 13, 22, 24]. The algorithm of tree-based topology is very efficient; however, it has a critical problem. The P2P system allows users to leave at any time; but as long as the node which is quite near the server leaves, it may cause system crash. As shown in Fig. 4, when node A leaves, fourteen nodes lower than node A disconnect with the server and cause system crash. Mesh-based topology is constructed based on tree-based topology. It hugely reduces the problem happened when nodes disconnect to the server. Nevertheless, it cannot thoroughly solve the problem for it is still based on tree-based topology. Gossip-topology is a node that connects nodes in random selection. It uses push-and-pull technique so that speed of sending data is much faster. Gossip-topology does not choose neighbor node, instead, it considers global scope for the optimization of choosing nodes, avoiding the wastes of bandwidth. As shown in Fig. 5, node S choose the more ideal nodes W, X, Y and Z to connect to instead of neighbor nodes P, Q and R. Nowadays, P2P LMS mostly uses gossip-topology such as CoolStream [8, 24], GridMedia [13] and Chunkyspread [22]; they all belong to large-scale video streaming. GridMedia emphasizes the preservation between nodes and optimizes the push-and-pull technique for a better efficiency. Chunkyspread pays attention to the structure between parent-node and child-node for the sake of the smoothness of video transmission. Furthermore, Chunkyspread will set up connection limit according to the bandwidth of nodes to avoid the system crash. The P2P LMS discussed in this paper uses CoolStream as main framework. We can conclude from [8, 24] that the basic framework of CoolStream can be divided into: a) Basic Components; b) Multiple Substreams; c) Buffering; d) Overlay Construction; e) Content Delivery.

1) Basic Components:

The formation of CoolStream [8, 24] system is represented in Figure 6; it contains three basic modules, a) membership manager: to preserve the member in net; b) partnership manager: to establish and preserve the TCP connections between partners, also delivering some information by buffer map (BP); c) stream manager: the core of information transmission.

2) Multiple Substreams:

Before the video is delivered, it would be cut into some equal blocks. A sequence number is attached on each block for the convenience of assembling and recording after receiving. This sequence number is equal to timestamp and will be delivering through TCP (Transmission Control Protocol). After the video is cut into blocks, some substreams will reform. When one video is cut into several substreams, one node can ask for different substreams from other nodes. For example, node A wants substream $S_1$ from node B, then node B delivers $S_1$ to node A; meanwhile, node A wants substream $S_2$ from node C, then node C delivers $S_2$ to node A. In CoolStream system, there is an important differentiation – the differences between parent-children relationship and partnership (as shown in Fig. 6). Partnership means two nodes exchange useable blocks through the connection of TCP. Parent-children relationship means one child node completely receives the video streams from another parent node. At the same time, a parent node should deliver all substreams to the child node. Fig. 1 is the diagram of how a video is cut into four substreams. If the original image has thirteen blocks, the system would re-arrange it into four substreams \{ $S_1$, $S_2$, $S_3$, $S_4$ \} and sent it out. Nodes will reform the original image according to the sequence number after the receiving.

![Image](image)

Fig. 1 The diagram of the dissolution and reforming of video streams

3) Buffering:

As shown in Fig. 7, buffer map (BM) represents the received newest block of different substreams. In BM, partners will exchange information for acquiring their needed substreams. Basically, BM is formed of continuous
2K byte; K means the number of cut substreams. The first continuous K byte records the sequence numbers received by substreams. For instance, video is cut into K substreams \{S_1, S_2, ..., S_k\}, the last received blocks are \{2K+1, 3K+2, ..., 4K\}. Then “2K+1” means \(S_1\) receives the 2K+1 block; “3K+2” means \(S_2\) receives the 3K+2 block and so on. The second continuous K byte means the substreams it asks for from the partners. For example, node A does not receive Blocks 1 and 2 well, then node A will ask its partner, node B, for Blocks 1 and 2. Later node A sends message \{1, 1, 0, 0 ..., 0\}, which represents the request of Blocks 1 and 2, to node B.

Every node has its own buffer area (the structure is shown in Fig. 2); it consists of synchronization buffer and cache buffer. Synchronization buffer puts the received substreams to the right places and sends it to cache buffer for combination. During the combination, the sequence number will be the basis. The combination will immediately stop when it meets blocks have not been received. The combination will resume after the missing block is received. As shown in Fig. 8, the video is cut into d blocks; but Blocks 8 and 9 are not received yet. So, Blocks 1 to 7 will reform the video stream first. After receiving Block 8, it will make a combination with Block 8.

![Fig. 2](image)

**Fig. 2** The structure of node buffering area and the example of block-receiving

4) Overlay Construction:

In overlay construction, one membership manager is needed for preserving the nodes. Each node has a unique ID and preserves its own membership cache (mCache) to record the active nodes. Nodes also use mCache to set up the connection with TCP. mCache system consists of three parts: a). Source nodes: to provide the nodes of video; b). Boot-strap nodes: to serve the newly joint node; c). Member nodes: all nodes in the system.

The TCP is mainly used in overlay construction; this technique is widely applied in BitTorrent (BT) and other P2P systems \(^{[1, 5]}\) to solve the random error and disperse the operations. In CoolStream system, a newly joint node will first contact with boot-strap nodes and ask for a node list to save in its mCache. In boot-strap nodes, there are two chief operations: a). to randomly provide the nearest active node for new joint nodes; b). to renew the nodes in mCache as often as possible and add new nodes. After receiving the node list, the newly joint nodes will randomly set up TCP connection to the nodes in the list and it is called partnership. When two nodes establish partnership, they will exchange their node information in the mCache. It happens only at the initial stage and will not last long. The maximum argument M is decided by the system. M is the upper bound of partnership; but the size of mCache is limited. Thus, mCache needs to remove the inactive nodes and update the nodes frequently so that the nodes in mCache are all the newest and most active for sure.

5) Content Delivery:

During the delivery of video streams, CoolStream uses “push and pull” mixed mode. When one partner sends out request, another partner will keep providing the needed blocks. As a parent node, it will unconditionally send video streams to child node constantly. The decision is made by the child node for it can determine to have a parent reselection or not.

By the information exchanging of BM, the newly joint nodes can get their needed blocks from the parent node. Before receiving the blocks, new nodes need to decide which block they want to start with. Now the sequence number of existing blocks is from n to m (n is the smallest number, m is the biggest number), if the new node directly asks for block m, this request may not be fulfilled for every node is asking for downloading block m. If the new node starts the download from block n, it may cause two problems: a). block n may have been played and abandoned, so the download will be invalid; b). even the download starts, the video would be over when the download finishes. In consideration of these problems, CoolStream uses a simpler way to solve them. The new node examines partners’ BM, if one partner has finished download, then it will ask the partner for downloading the block. Once the first block is decided, the node will keep on examining partner nodes’ BM. Furthermore, the new node will see them as parent node and acquire video streams from them.

B. System Dynamics

CoolStream system’s operation can be separated into two parts: a). peer adaptation; b). peer dynamics. The arguments and the explanations are represented in Table 1.

<table>
<thead>
<tr>
<th>Argument</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>The source of video streams</td>
</tr>
<tr>
<td>R</td>
<td>The bit rate of video streams</td>
</tr>
<tr>
<td>K</td>
<td>The number of cut substreams</td>
</tr>
<tr>
<td>B</td>
<td>The length of node buffer area in a given time</td>
</tr>
<tr>
<td>V</td>
<td>The maximum difference between substreams</td>
</tr>
<tr>
<td>W</td>
<td>The maximum difference of substreams between partner and parent node</td>
</tr>
<tr>
<td>U</td>
<td>Presently the nearest block in the buffer area</td>
</tr>
<tr>
<td>T</td>
<td>The cycle that one node takes for parent reselection</td>
</tr>
<tr>
<td>M</td>
<td>The Maximum number of partner</td>
</tr>
</tbody>
</table>

1) Peer Adaptation:

Congestions often occur on the Internet. When congestions happen, nodes are hard to receive streaming so the problem of peer adaptation appears. Each node should keep monitoring the condition of receiving substreams. If the request cannot be fulfilled, the parent reselection happens to satisfy the need.
In [8], two thresholds \{V, W\} are set up to monitor the insufficiency of bandwidth. V represents the block number’s maximum difference of the substream received by one node. W stands for the maximum difference of block number between a node’s partner and the parent node. Here we make \(H_{S_i}, A\) represent the serial number of the substream \(S_i\) which received by node A. Then we compare it to parent node P’s substream \(S_j\), two formulas will appear:

\[
\max \{H_{S_i}, A - H_{S_j}, p : i \leq K\} < V \tag{1}
\]

\[
\max \{H_{S_i}, q : i \leq K, q \in \text{partners}\} - H_{S_j}, p < W \tag{2}
\]

Inequality (1) is used to monitor the condition of substream in buffer area of node A. If the inequality does not sustain, it means one video streaming delays and it is lower than the threshold V. Also it shows that the bandwidth narrows so that peer adaptation occurs for substreams are not sufficiently received. Inequality (2) mainly monitors node A’s parent node. Node A compares the serial number received from the nearest block of parent node with the partners. If the inequality does not sustain, it means the parent node is far behind its partners. For this reason, it no longer qualifies for being the parent node of node A. Again, peer adaptation occurs and node A will have a parent reselection from its partners.

When a new parent node is chosen, it must sustain these two inequalities. If two or more partners qualify the conditions of being the parent node, it will be decided randomly. As a parent node, it never rejects what its child node’s requests. Moreover, the parent node constantly sends the streaming it has to the child node. Obviously, the happening of peer adaptation may cause the overlay topology instability or crash. So we induct a new argument “T” to be a cool-down timer. T means the longest time of parent reselection when peer adaptation happens.

Before the partner argument M of one parent node is full, it should always accept the requests from the child node. One parent node may contain many child nodes at a time; these child nodes shares one parent node’s bandwidth. However, the bandwidth cannot always satisfy the request from the child nodes. At this moment, peer competition occurs. Later it may cause one or more nodes which are not satisfied with their needs from the parent node. This condition leads to the chain reaction of peer adaptations. During the chain reaction, two inequalities can be violated. At this time, many temporary parent nodes would occur. The status returns to normal till a stable and capable parent node is selected.

2) Peer Dynamics:

The peer adaptation mentioned above is mainly used to deal with the congestions of network and nodes. So, the argument development and collision inside the system should be considered. Referring to [8], considering one parent node P delivers information to child node Q, the average bit rate of every substream is \(R/K\).

Hypothesis 1: Node P has enough bandwidth for delivering streaming to node Q, the upload bit rate of node P \(r_{up} > R/K\).

In this hypothesis, node Q fully keeps up with the transmission condition of node P, including the time of getting back the missing blocks. This is called “catch up process.” If there are \(l\) blocks missing in transmission (compared to the blocks that node Q has received to node P), the catch up time is \(t_{up}\); then, according to [8], the transmission equation is:

\[
r_{up} \cdot t_{up} = R/K \cdot t_{up} + l \tag{3}
\]

\(t_{up}\) can be figured out

\[
t_{up} = \frac{l}{R/K - r_{up}} \tag{4}
\]

The formula above appears under normal condition when bandwidth is enough and the information transmission is balanced. Next the discussion will focus on the happening of peer adaptation.

Hypothesis 2: Node P failed from peer competition and cannot obtain enough blocks from parent node. The average download bit rate is \(r_{down} < R/K\). Now chain reaction could happen on node P. If P could not find a new parent node in a time, then the child node, Q, of node P will also fall behind. Given \(t_{down}\) to represent the time that node Q needs to find a new parent node after abandoning node P. In other words, if node P can find a new parent node in \(t_{down}\), then peer adaptation will never happen, nor does the chain action. So, we can know the transmission equation according to [8]:

\[
t_{down} \cdot r_{down} + l = t_{down} \cdot R/K \tag{5}
\]

\(t_{down}\) can be figured out

\[
\Rightarrow t_{down} = \frac{l}{R/K - r_{down}} \tag{6}
\]

Let \(D_p\) be the node P’s speed of substreams transmission. P originally satisfies all child nodes’ transmission bandwidth. But when new node Q asks for being P’s child node, the bandwidth of sending substreams to each child node would be lower because P’s bandwidth is fixed. The bandwidth goes down from \(R/K\) to \(r_{down}\). It is written as:

\[
r_{down} = \frac{D_p}{D_p + 1} \cdot R/K \tag{7}
\]

If one node violates inequality (1) and lost peer competition after a time \(t_{late}\), the blocks in buffer area is \(U\) to \(V\) away from its partners. The result of competition would appear in the buffer area since the beginning of this competition. According to [8], the transmission equation can be written as:

\[
\frac{R/K \cdot t_{late} - D_p}{D_p + 1} = \frac{V - U}{R/K \cdot t_{late}} = (V-U) \tag{8}
\]

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\[ R / K \cdot t_{\text{lose}} \] is the amount that are supposed to transmit. After the minus of the amount after the joining of node Q, \[ \frac{D_v}{D_v + 1} \cdot R / K \cdot t_{\text{lose}} \], it equals to the difference of blocks when peer adaptation happens.

\[ t_{\text{lose}} = \frac{(D_v + 1)(V - U)}{R / K} \quad (9) \]

We have mentioned above that peer adaptation should be done in a time \( T \) or the blocks in buffer area would be insufficient to play. So \( t_{\text{lose}} \) must be shorter than \( T \). By this, we can figure out the probability of the happening of peer adaptation:

\[ P(t_{\text{lose}} \leq T) = P \left( \frac{(D_v + 1)(V - U)}{R / K} \leq T \right) = P \left( U \geq V - T \cdot R / K \right) \]

\[ \left( \frac{D_v + 1}{D_v + 1} \right) \times (10) \]

IV. EXPERIMENT RESULTS

In order to understand the operation of P2P LMS system and compare it to Co-Life Video Conferencing System and Marratech Online Video Conferencing System, this paper plans four scenarios: In LAN, Local Area Network, we mainly use the network in campuses for we have to experiment video teachings in campuses. In WLAN, we mainly use the wireless network in campuses to experiment the wireless online videos and to know the quality of wireless online videos. In MAN, we focus on the Center of Information Education & Networking, experimenting distance learning with schools from different levels to reach the goal of mutual help education. We experiment the distance learning by using ADSL, Cable Modem and FTTx to connect to the Internet.

The pre-setting is set at high-quality output. The settings of Co-life and Marratech are not adjustable for they are determined by systems. The output mode of P2P LMS is adjustable; the settings of in-line mode are 1000 Kbps output for throughput and 30 fps for frame rate. The settings of non-synchronous mode are 1128 Kbps for throughput and 30 fps for frame rate. The experiment is long-time filming; we record the data every fifteen seconds, four times a minute. We put all data in order every ten minutes. The total filming time is one hundred minutes.

A. The Experiment in LAN

The performance of frame rate is shown in Fig. 3. We can see that Marratech has better performance on frame rate with an average of 22 fps for the server is set in the campus. Co-life has an average of 16 fps and P2P LMS has 14 fps in average. From the perspective of standard deviation, P2P LMS is the most stable system in ten experiments, the standard deviation is 0. The second is Co-life with 0.46, while the standard deviation of Marratech is 1.1, the worst. As for throughput (shown in Fig. 4), P2P LMS has the best performance with 972 Kbps, Co-Life with 602 Kbps, Marratech with 413 Kbps (all in average). P2P LMS also stands out with the standard deviation lower than 10 in ten experiments. The worst performance is Marratech with the standard deviation of 6.267. From the performance of throughput, we know that Marratech abandons more video qualities in order to gain the good smoothness. Though P2P LMS does not perform well at frame rate, the video quality is the best. It means that the image has better dpi and is suitable for students to watch.

Fig. 3 The accumulated chart of frame rate in LAN

Fig. 4 The accumulated chart of throughput in LAN

B. The Experiment in MAN

From Fig. 5, the frame rate performance, we can see that even Marratech has a better average of 16 fps, the standard deviation of 2.41 shows the insufficient stability. Co-life has the worst performance of 10 fps and the standard deviation is 1.0 which shows the wave motion is also high. Only P2P LMS has an average of 13 fps and steady performance with the 0 standard deviation.

From the comparison of throughput in Fig. 6, we can conclude that P2P LMS still works outstandingly. It is two times higher than Co-Life and four times higher than Marratech which represents that P2P LMS performs better in image quality. We can see in the chart that the last four times throughput of Marratech is considerably low. It is because students are out for other classes at those times. But P2P LMS and Co-life keep the same throughput as average; only Marratech will be affected. In standard deviation, P2P LMS still leads by the value of 12.06 while Co-Life gets 61.53 and Marratech has the worst performance of 147.31. As a result, P2P LMS still has the best stability. Since the experiments are operated in office hours, the network is hugely used by users. By this situation, we can know how each system react to different bandwidths. When the bandwidth is enough, frame rate and throughput are on a high level; on the contrary, frame rate and throughput performance badly when the bandwidth is insufficient. Nevertheless, P2P LMS does not affected by the bandwidth for it will download the image in advance when the bandwidth is enough in order to respond to the bandwidth-insufficient situation.
C. The Experiment in WAN

Fig. 7 is the average frame rates of each system. Due to the high and stable bandwidth, the frame rates are all stable without wave motion. Among them, Marratech has an outstanding average of 24 fps; meanwhile, Co-Life has the average of 16 fps and P2P LMS get 14 fps. We can conclude that three systems are very stable for the standard deviations are all 0. But when we take a look at Fig. 8, the throughput of each system in WAN shows totally different results. As mentioned in the experiments in WLAN, Marratech will turn down the throughput to the bottom in order to get the best performance in frame rate when the motions are fewer. Thus, the images will be displayed in a lower quality for the throughput has been abandoned. The situation is not what this research wants to see. At the same time, P2P LMS still have the same outstanding quality, having an average of 1000 Kbps which is better than Co-Life’s 402 Kbps and Marratech’s 82 Kbps. P2P LMS is the best distance learning system for it displays the best image quality. From the perspective of standard deviation, P2P LMS still leads at 1.83 while Marratech and Co-life’s standard deviations are 4.01 and 36.48.

V. CONCLUSIONS

We can conclude the advantages of P2P LMS from Table 2: (a) The throughput of P2P LMS stands out in every kind of network service which represents that P2P LMS has good quality in video output; (b) P2P LMS is very stable in each network service for it always remains the output of around 1000 Kbps; (c) P2P LMS performs well in connection recovery. In the best condition, it can keep the video playing after network disconnection of 10 seconds.

<table>
<thead>
<tr>
<th>Network Type</th>
<th>P2PLM S-non-syn</th>
<th>P2PLM S-syn</th>
<th>Co-Life</th>
<th>Marratech inside</th>
<th>Marratech outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame rate</td>
<td>Excellent</td>
<td>Normal</td>
<td>Good</td>
<td>Excellent</td>
<td>Normal</td>
</tr>
<tr>
<td>Stability</td>
<td>Excellent</td>
<td>Normal</td>
<td>Good</td>
<td>Excellent</td>
<td>Normal</td>
</tr>
</tbody>
</table>

Maybe the P2P LMS does not work well on frame rate; but it is much more stable than Co-Life and Marratech in every kind of network service. Especially in the video quality, P2P LMS far exceeds Co-Life and Marratech. P2P LMS system is even more outstanding in playing teaching videos. It transcends in every parts – frame rate, throughput and stability. From the results, it is better to use P2P LMS in distance video learning than using Co-Life and Marratech. The high image quality provided by P2P LMS allows less shape-changing and distortion of images when playing in full-screen mode; also, the video will also be clearer through projectors. Co-Life and Marratech have worse image qualities. Images may look good on a small screen; but after being enlarged, images squares may occur and it is not easy to watch.

From the perspective of connection recovery, P2P LMS keeps playing for seconds after the disconnection owing to its operation system. P2P LMS saves images of a few seconds in the user-ends in advance in order to respond to the possible stops caused by the network problem. It is indeed a very outstanding mechanism. The education in the future will be focused on a multi-dimension education. The cooperation of distance learning is also an important tendency for it has great potential. In addition to distance video live broadcasting, P2P LMS can be used in the cycle-playing of teaching videos. As a result, P2P LMS is indeed very practicable and helpful for schools which want to develop the distance video learning and e-learning.

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