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Classroom Shared Whiteboard System using Multicast Protocol

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ABSTRACT
Multiple hosts wish to receive the same data from one or more senders. Multicast routing defines extensions to IP routers to support broadcasting data in IP networks. Multicast data is sent and received at a multicast address which defines a group. Data is sent and received in multicast groups via routing trees from sender(s) to receivers. Demonstrative lectures require to share the computer screen of the lecturer to the students as well as to make discussion with the students. The Multicast protocol is the most suitable method because of its capability in speed and better synchronized process. The word "multicast" is typically used to refer to IP multicast which is often employed for streaming media, and Internet television applications.

KEYWORDS: *Reliable multicast transport protocol, multicast classroom, IP routing, multicast lecturing*

INTRODUCTION
Multicast conferencing is a rapidly-growing area of Internet use. Nowadays, most presentations in meetings, conferences and workshop seminars are using Power Point presentation software magnified by LCD projectors for efficiency and attraction. Similarly, demonstrative lectures require the same capability in the classroom. When demonstrating lecture (like running a program), the classroom require more than just presentation. This kind of application is known as "shared whiteboard". The screen of the lecturer's computer, is distributed to the classroom PCs. By using multicast algorithms, it minimizes the amount of traffic sent over the network.

Active services running in the network mediate between the clients (the student) and server (the lecturer). This paper provides an overview of the mechanisms used to support classroom shared whiteboard data transfer with multicast message conferencing capability. This system is used to advertise and invite individuals to the lectures, and then communicate among the students and the lecturer.

Related works
SLIM [3, 2] is a network layer single source multicast. As such it is most strongly related other single source multicast protocols, particularly [5] and [4]. The single source network layer multicast is the adequate and appropriate elementary multicast service and sufficient for more elaborate group communication sessions to be built upon. In fact, a multi-sender session can easily be created using our [3] or [5, 4]; SLIM leaves such issues to session management and out of the network layer protocol.

Several multicast transport protocols were proposed to meet the requirements of delay-sensitive, real-time interactive applications, such as RTP/RTCP [12] to support multi-party multimedia conferencing tools, SRM [1] and TRM [10] to support distributed whiteboard tools, etc. These applications can tolerate a certain degree of data loss, but they are sensitive to packet delay variance. On the other hand, other protocols were proposed to meet the requirements of reliable data distribution services, such as multipoint file transfer. These applications are not delay-sensitive, but require that the information is entirely received, or else the transfer fails. The Muse protocol [6] (which was developed to multicast news articles on the MBone), MDP [8] (the evolution of a protocol used in disseminating satellite images over MBone) and MFTP [9], RMTP [7] and TMTP [12] (other protocols for reliable one-to-many data transmission) are examples of this kind of protocols. Most of them are designed to work in the MBone when the number of receivers is too large (thousands of receivers). To reach scalability and, therefore, to solve the feedback implosion problem, some of them define complex hierarchical topologies and they even introduce some non-layer 3 functionality into the network devices.

A. Background theory
Multicast messaging architecture Multicast means that the servers are automatically creating a tree-structure. A number of emerging network applications require the delivery of packets from one or more senders to a group of receivers. These applications include streaming continuous media (for example, the transfer of the audio, video, and text of a live lecture to a set of distributed lecture participants), shared data applications (for example, a whiteboard or teleconferencing application hat is shared among many distributed participants). For each of these applications, multicast is an extremely useful. The sending of a packet from one sender to multiple receivers with a single send operation. Multicast protocols allow a group or channel to be accessed over different networks by multiple stations (clients) for the receipt and transmit of multicast data. The main objective of multicast protocols for transporting real-

time data is to guarantee quality of service by bounding end-to-end delay at the cost of reliability. Multicasting can dramatically reduce the network bandwidth multimedia applications require. Servers do not require hardware upgrades in order to take advantage of multicasting. Clients do not require hardware upgrades in order to take advantage of multicasting. Because routers of recent vintage already support multicasting, enabling multicasting on the network is practical and cost-effective.

Types of reliable multicast protocols

1. Scalable Reliable Multicast (SRM)
2. Multicast Transport Protocol (MTP)
3. Reliable Multicast Transport Protocol (RMTP)
4. Reliable Multicast Distribution Protocol (RMDP)
5. Pretty Good Multicast (PGM)

RMTP (Global cast Communication) Reliable Multicast Transport Protocol (RMTP) organizes all the nodes into a tree structure. The receiving nodes are always at the bottom of the tree. Ideally the senders are at the top. The sender transmits messages using IP multicast, after a message is transmitted the sender will not release the memory until it receives a positive acknowledgement from the group. The receivers do not send acknowledgement directly to the top node (sender), but send hierarchical acknowledgements (HACKs). A receiver transmits a HACK to their parent in the tree structure. The parent gathers all HACKs from its children and sends a HACK to its parent node one step higher in the tree. The HACKS are propagated upward to the top of the tree and the sender is eventually notified. This design allows dissemination of messages to a large number of receivers without causing ACK implosion. RLC and RMDP in Reliable Multicast Data Distribution Protocol (RMDP), the problem of insuring reliable data delivery to large groups, and adaptability to heterogeneous clients is solved by Forward Error Correction (FEC) technique based on erasure codes [11]. The basic principle behind the use of erasure codes is that the original source data, in the form of a sequence of k packets, along with additional n redundant packets, are transmitted by the sender, and the redundant data can be used to recover lost source data at the receivers. A receiver can reconstruct the original source data once it receives a sufficient number of (k out of n) packets. The main benefit of this approach is that different receivers can recover from different lost packets using the same redundant data. In principle, this idea can greatly reduce the number of retransmissions, as a single retransmission of redundant data can potentially benefit many receivers simultaneously.

B. Applying multicast protocol

Messaging structure of multicast classroom

The network layout of the classroom as shown in Figures 1 and 2, all the classroom PCs are connected through a network switch. For extensive usage that is if there are more than one classroom, PCs in each class are connected to a network switch, and all the switches of the classrooms are connected to a router.

The request from the students' PC are transmitted to the server PC of the lecturer and by acceptance of the request, the multicast transmission occurs.

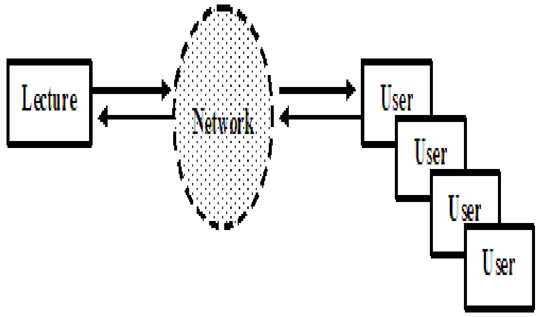

Figure1. Network relation in a multicast classroom

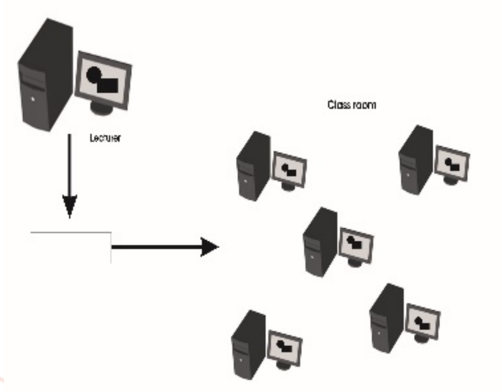

Figure2. Network layout for classroom lecturing

System flow diagram

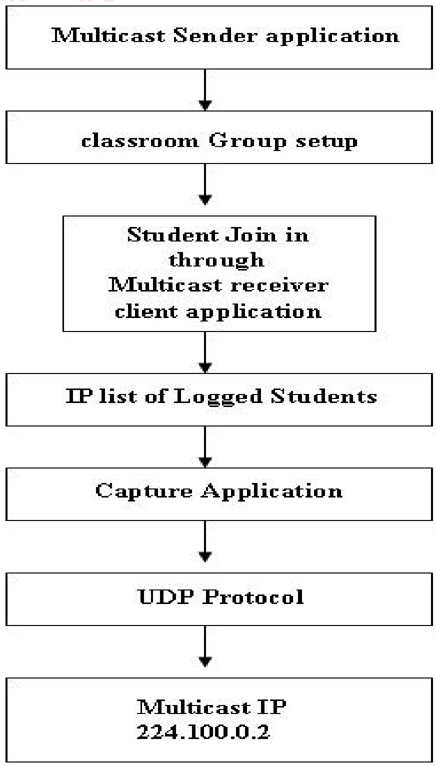

Figure3. Multicast classroom application system flow diagram

Multicasting algorithm

Server algorithm

1. Start the SendTimer
2. When the SendTimer is expired, Capture the Current Screen and save as Memory Image.
3. Change the Image to Byte array and send to Multicaster_IP (224.100.0.1)
4. Wait for the next expire of SendTimer.

Client algorithm

1. Start the RecvTimer
2. When the RecvTimer is expired, receive the byte array and save as Memory Image.
3. Show the image
4. Wait for the next expire of RecvTimer.

Multicast process

Server side (Lecturer's computer)

The server side main control will be displayed. There will be 2 options.

Figure4. Start the classroom lecturing from server side

If "Screen Sharing" is selected, the following menu will appear.

Figure5. Start the screen sharing

If "Start" is selected, the teacher (server) screen will be shown to all connected clients (students).

If "Stop" is selected, the screen sharing process will terminate

The following text message screen will appear when "Text Messaging" is selected. The lecturer can send Instant messages to the students.

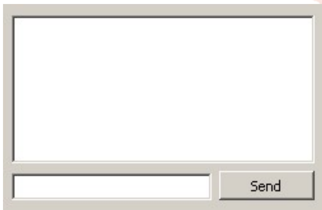

Figure6. Start text messaging

Client side (student) Client side menu will be shown as follows

Figure7. Start lecturing from client side

"View screen Sharing" option will let the students join the classroom. The server screen (lecturer's screen) will be shared to the student's computer. When teacher send messages, the clients can see the messages from their computers.

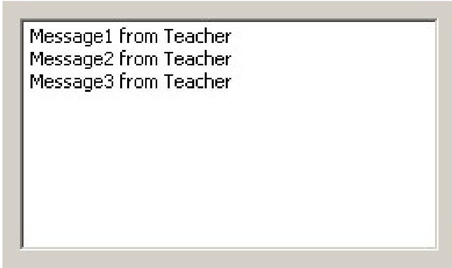

Figure8. Receive messaging from server side

"Text Messaging" option will let the students see the messages sent by their lecturer.

C. Conclusion

The aim of this system is using Multicast protocol for class room lecturing with lecture demonstration screen sharing and classroom discussion. In practice, the use of shared computer screen and multicast messaging is an applicable system. This system can also assist distance learning on the internet infrastructure and benefit students who are in remote area.

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