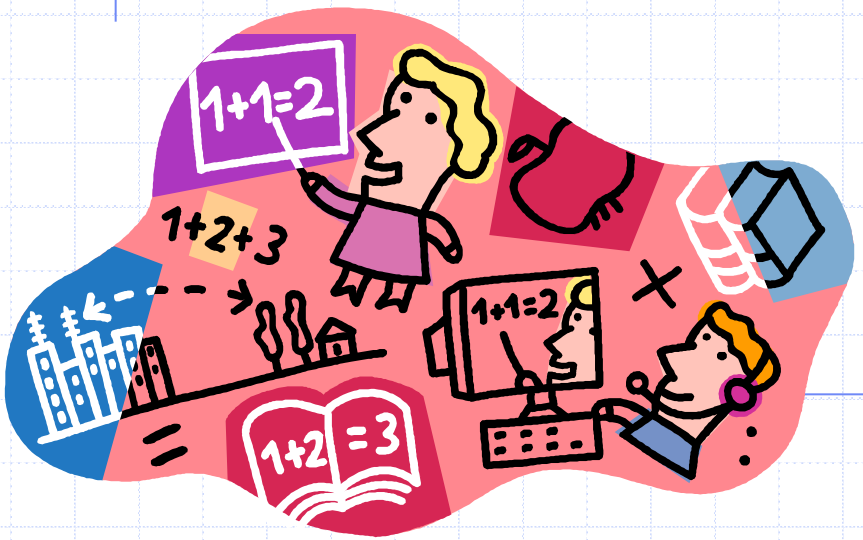
THE DEPARTMENT OF COMPUTER SCIENCE
計算機科學系 HKUST

SIG in Technology/Learning Tools

Cyber-Classroom :

An Interactive Large-scale Distance Learning Application



Gary Chan
Assistant Professor
Department of Computer Science
May 17, 2004

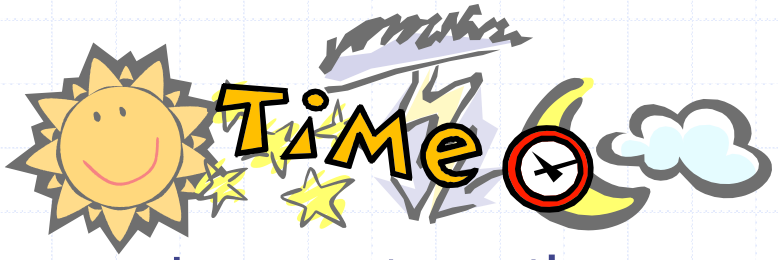
Agenda

- Overview of the Cyber-Classroom
- Introduction of Implementation
  - Network Structure
  - Audio Compression
  - Video Compression
  - Other Features
- A trial run
- Q & A

Traditional Classroom

- Transportation cost and time
- Classroom capacity
- Students with access difficulty

Cyber-Classroom



Learn at anytime, anywhere

Internet

HKUST香港科技大學
Hong Kong University of Science & Technolo

The University of Hong Kong

香 港 中 文 大 學
The Chinese University of Hong Kong

Strengths of Cyber-Classroom

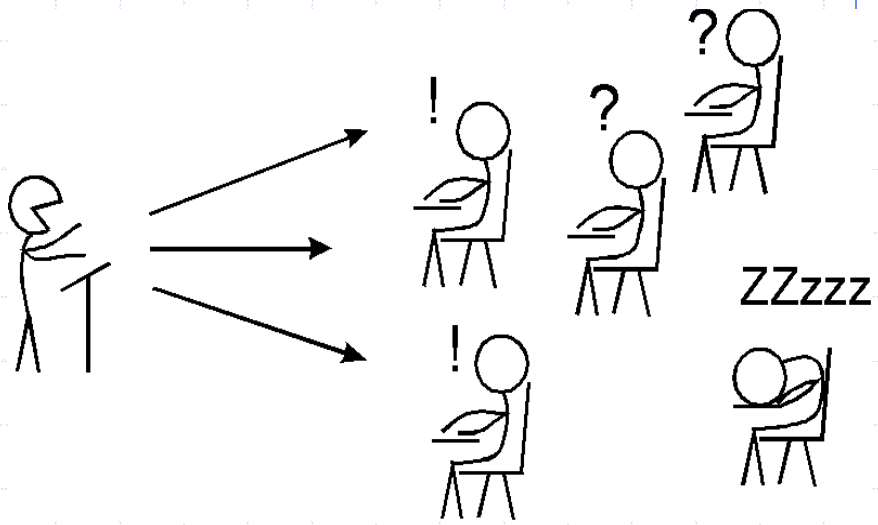
- Save time and cost
  - E.g. Traveling
  - Learn anytime, even traveling
- Multimedia interactivity
  - Powerpoint, chatroom, audio, video, polling, whiteboard, etc.
- Flexible learning schedule
  - Learn at own pace via save-and-playback
- Study schedule need not be disrupted due to suspension of classes
    - Typhoons, SARS, etc.

Networking

Connecting teacher and students

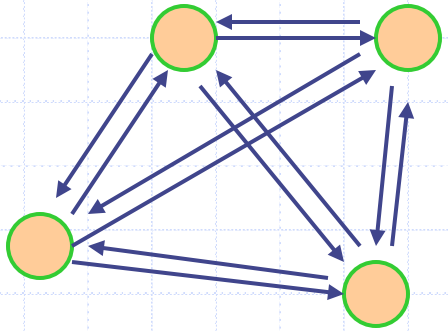
Networking

- Network functionalities:
  - Mainly one-to-many (when teacher is lecturing)
  - Sometimes many-to-many (when there is a group discussion)
  - i.e. need multicast in a classroom
  - Should be able to support hundreds of students

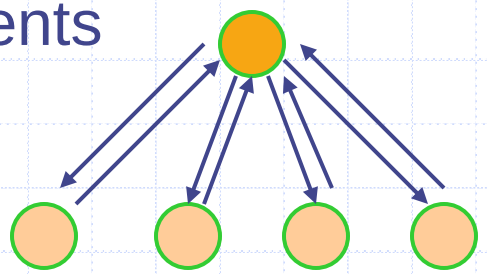


Some possible solutions

- Multiple unicast
  - All nodes are directly connected to each other

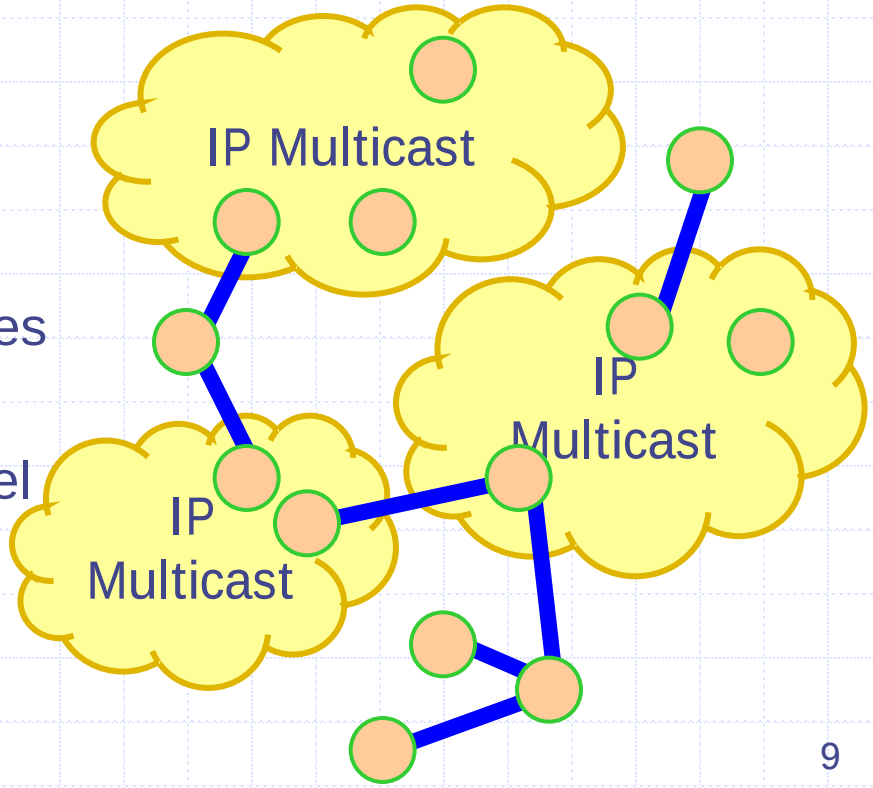


- Pure Client-Server model
  - Like the Web server and clients
  - Use star topology

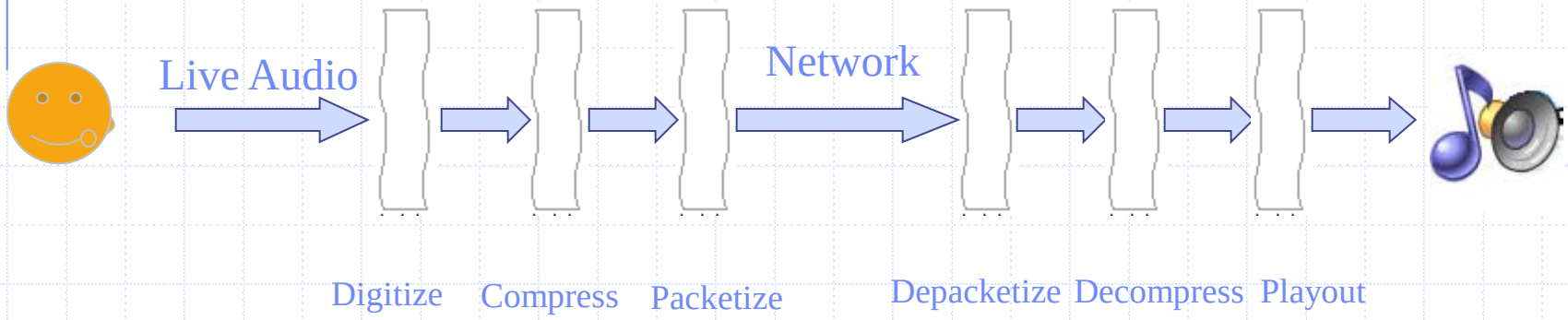


Our solution: Application Layer Multicast

- We use “Island Multicast” which is a kind of ALM
- Students and teacher are connected in a “tree” topology
- Data is disseminated along the overlay topology
- Advantages:
  - Can support large number of nodes
  - Higher throughput
  - Adopt to the current Internet model
  - More reliable and stable



Audio Streaming



Audio compression

- 8kHz X 16 Bit = 128kbps without compression
- Compression algorithm :G.723.1
  - Big compression rate
  - less loss
- After compression
- 128kbps → 12.8kbps

Before compression

After compression

Compare the before and after compression quality

Video Compression

Live Interactivity

H.264 Video Codec

Advantage

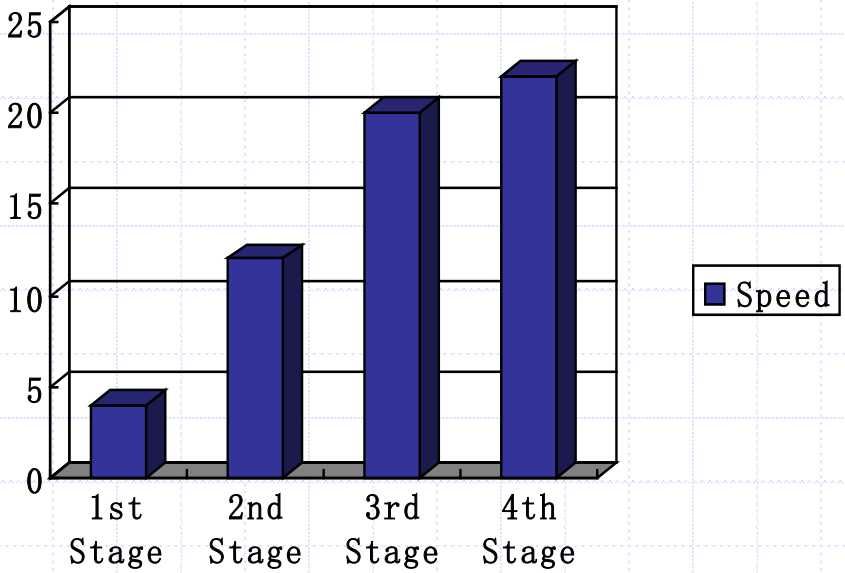
- Higher compression rate
  - 50% higher than H.263 theoretically
- Better Video quality
  - Improved by 15%~40% compared to H.263

Implementation

- Implementation based on JM
  - Developed by ITU and various companies
- Optimized by PMVFAST and MMX
  - Speed up time-consuming calculations

Performance

- Stage 1: Original
- Stage 2: Configuration Modification
- Stage 3: PMVFAST
- Stage 4: PMVFAST with MMX



Samples

Features

Installation

Web-interface

Save and playback

Installation Steps

Problems in the past:

- Platform dependence, that is we must compile our source code on every machine to ‘install’ the software.
- Confusing in settings, IP addresses, port numbers need to be set by users.
- Code sharing and Software requirement

Tools:

- Microsoft Installer (MSI) service
- Installshield Express Installshield

Installation Steps

Our Solution:

- Single executable file that ready to install for each part which handled the software dependence in advance.
- Settings of the software such as IP address and port number were given by default values

Web Interface

Homepage of Cyber-Classroom

- Implemented by Macromedia Dreamweaver
- Maintaining all project related information.

Video & Audio

- Windows Media Encoder 9.0
- Easily decoded by Windows Media Player

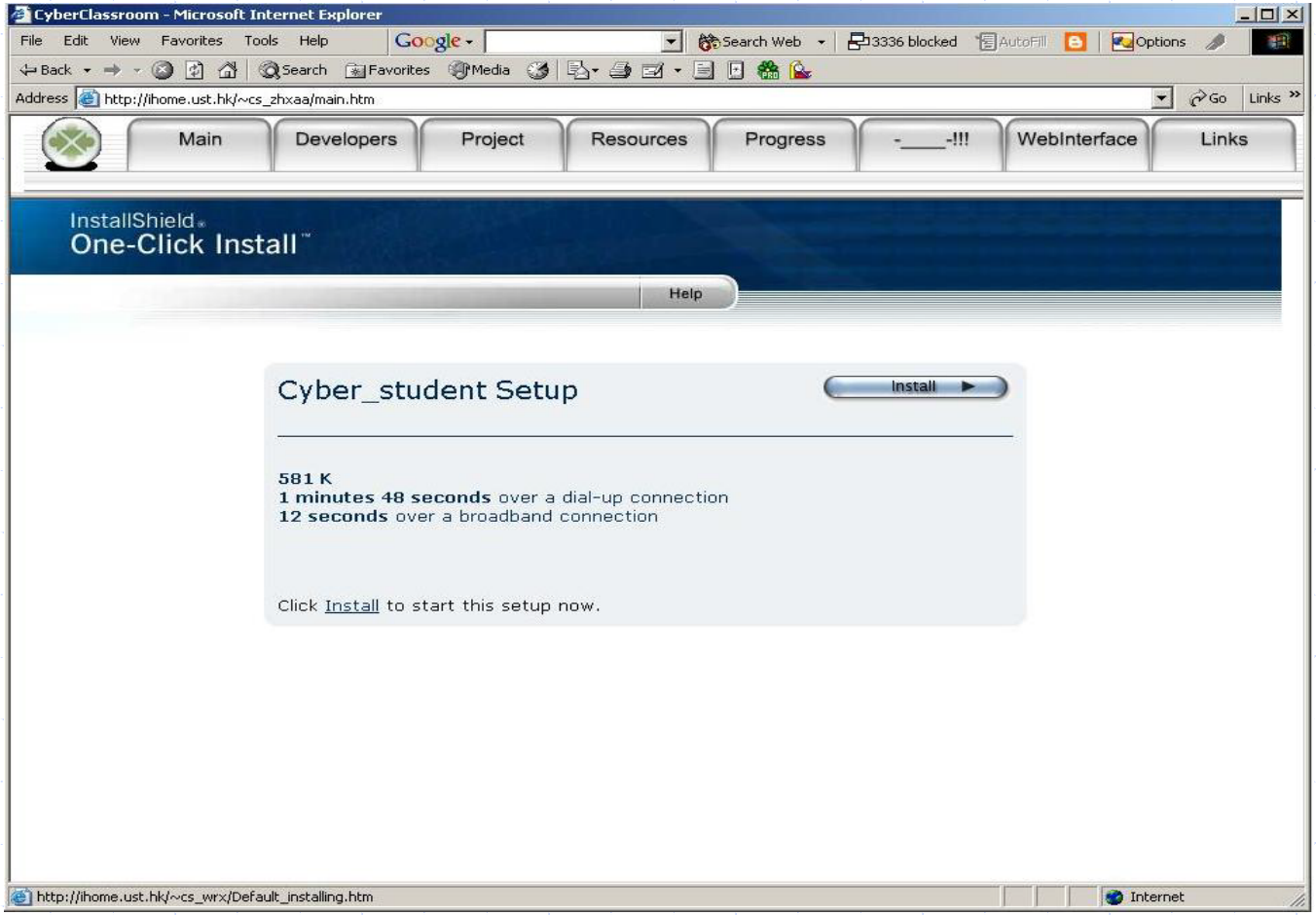
Web-based chatting system

- ASP programming
- widely used in the Internet to make online discussions

Web installation

- New feature by Installshield software

Web Installation

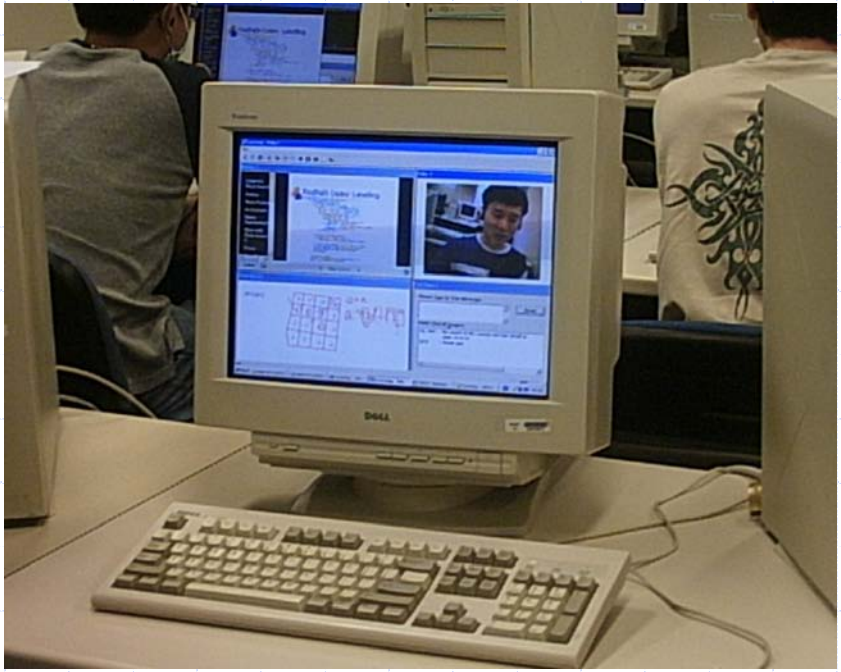


Save and Playback

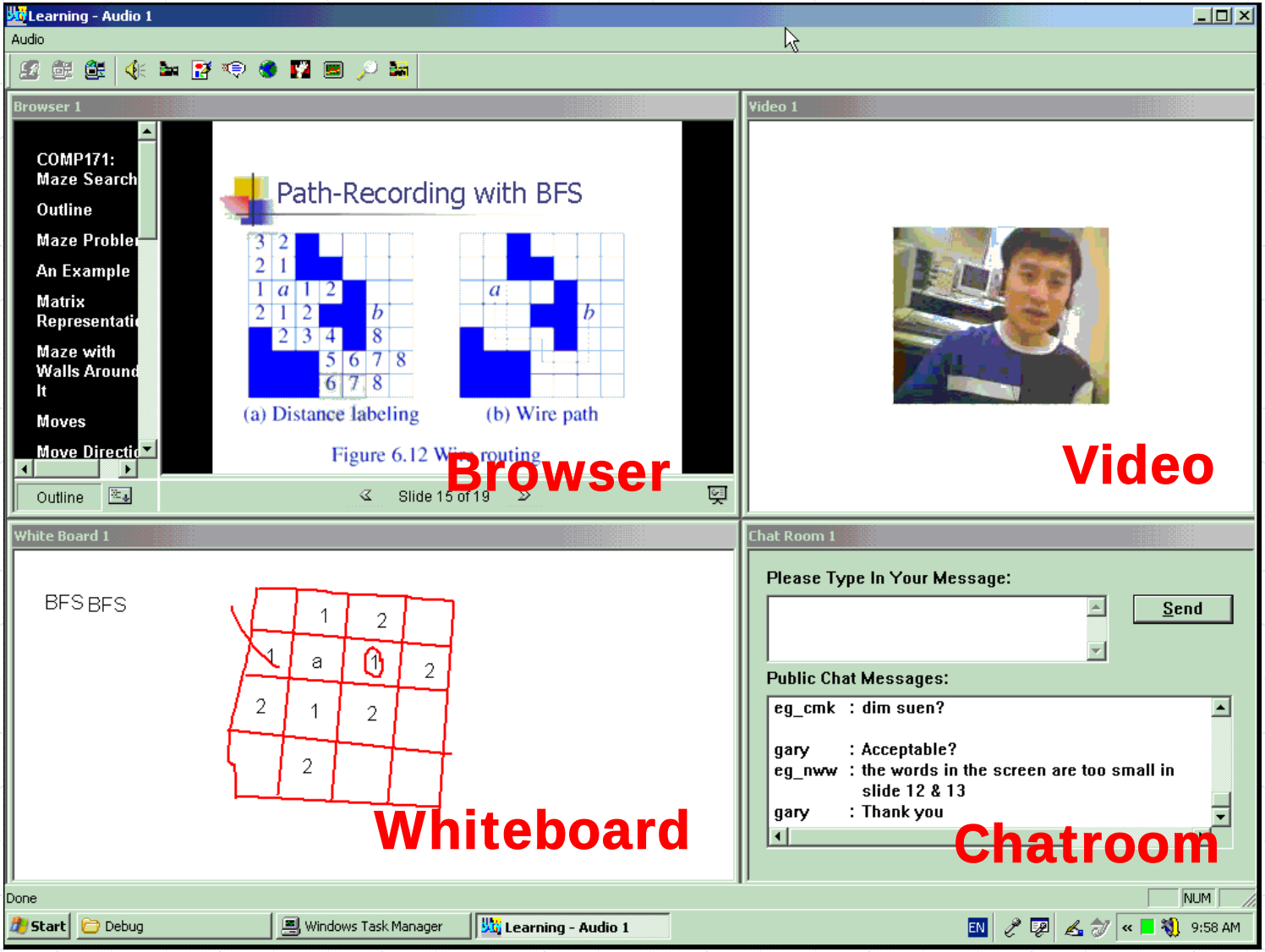
- Save lecture for revisions
- Learn at your own pace
- Save
  - Screen capturing at Student's machine
- Playback
  - Microsoft® Windows Media® Player

A Trial Run

- Thursday, May 8, 2003
- 9-10:30am
- COMP171 (Data structures and algorithms)
  - 108 students, 37+ students attended



User Interface



A Survey

- 15+ responded to questionnaire
- Cyber-Classroom helps me to engage better in discussion and learn better
  - 64% agreed
  - 29% strongly agreed
- I feel more comfortable in expressing myself
  - 71% agreed
  - 29% strongly agreed
- Classroom format
  - 63% prefers traditional classroom
  - 25% prefers Cyberclassroom

Q & A:

Any Questions?

Playback File Performance

- Performance
  - Video : Smooth
  - Browser, Whiteboard: Clear
- Encoding profile :
  - Frame per Second: 4
  - Video Bit Rate: 150Kbps
  - Audio Bit Rate: 16Kbps
  - Sampling Frequency: 22KHz
  - Audio Channel: Mono CBR
  - Target Bit Rate: 173.02Kbps