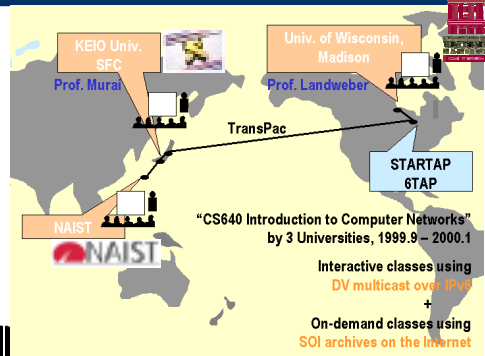


## Global collaboration for the joint University course on the next generation Internet



SOI WG: WIDE Project  
University of Wisconsin

## Project at a glance



## Today's Agenda

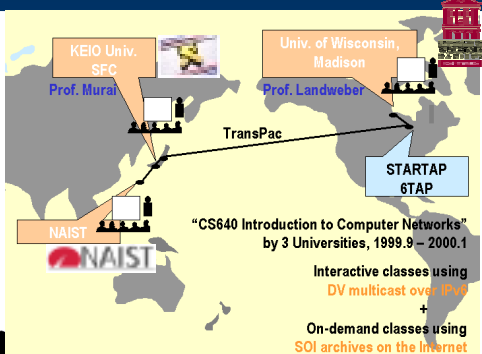
- Background
- What is the project
- How it went
- What we learned
- Progress and Future directions

Course Design
System/Applications
Networks
Operations

## School of Internet Project

- Since 1997
- Learning environment for individuals
  - Anytime/Anywhere
    - Plan your learning time anytime in your life
    - Plan your learning time anytime during a day
  - University can help this by providing
    - on-demand lectures to the home
    - realtime lectures to the home
- Learning environment for classrooms
  - Meet the best teacher in particular areas
  - Study together with same interests in the world
  - Universities can help this by collaborating with each other to provide classrooms connecting to anywhere in the world

## Project at a glance



## Course design : goal

1. Provide the "CS640 Introduction to Computer Networks" course by Professor Lawrence H. Landweber given at the University of Wisconsin(WISC), to students at both KEIO University(KEIO) and NARA Institute of Science and Technology, both in Japan(NAIST).
2. Give opportunity for students in University of Wisconsin to take lectures from Professor Jun Murai in the area of his particular specialty.
3. Students can be accredited in both universities in Japan by taking this course

## Challenges

- **Time** differences between Wisconsin and Japan
  - 15 hours in winter, 14 hours in summer
- **School term** schedule difference among 3 universities
  - WISC: Early Sept ~ Mid December
  - KEIO: Late Sept ~ Late January
  - NAIST: Early October ~ Early December
- **Student background** differences

## “Introduction to Computer Networks” Courses at 3 universities

- **University of Wisconsin**
  - Term : 9/3/99 - 12/6/99
  - Time : Monday, Wednesday, Friday 8:25am - 11:40am
  - Students : graduate school students and 4th grade of undergrads of Computer science
- **KEIO University**
  - Term : 9/28/99 - 1/25/2000
  - Time : Tuesday 9:30am - 11:00am
  - Students : graduate school students of Media and Governance
- **NARA Institute of Science and Technology**
  - Term : 10/7/99 - 11/25/99
  - Time : Thursday 9:20am - 12:30pm
  - Students : graduate school students only

## Solutions

- Combination of realtime lectures and archived lectures.
- Realtime lecture for Japanese students at least once per topic (each chapter in the textbook).
- Archive all the lectures for Japanese students to learn by themselves according to their own speed.
- Evaluation by its own faculty staff

## Contents

- |                           |                                  |
|---------------------------|----------------------------------|
| 1. Ch1. Intro             | 15. Ch6. Transport Layer         |
| 2. Ch1. Protocol          | 16. Ch6. TCP                     |
| 3. Ch3. Framing           | 17. Ch6. ISO TP4                 |
| 4. Ch3. Error detection   | 18. Ch5. Bridges, Extended LANs  |
| 5. Ch3. Flow control      | 19. Ch5. IPV4/ICMP, ARP          |
| 6. Ch3. HDLC              | 20. Ch5. CIDR, BGP               |
| 7. Ch3. LLC               | 21. Ch5. OSPF                    |
| 8. Ch3. CSMA/CD           | 22. Ch5. IPv6                    |
| 9. Ch3. 802.11            | 23. Ch5. Multicast               |
| 10. Ch3. DSL              | 24. Ch5. DNS                     |
| 11. Ch4. Switching Method | 25. Distance Learning            |
| 12. Ch4. Routing          | 26. Ch8. Congestion Control      |
| 13. Ch4. Routing          | 27. Ch8. Congestion Avoidance    |
| 14. Ch4. ATM              | 28. Ch8. Differentiated Services |

## Courses at 3 universities

- **Students in WISCONSIN**
  - 23 lectures by Prof. Landweber (local)
  - 5 lectures by Prof. Murai (4 remote, 1 local)
  - All lectures are archived on the Internet
- **Students in Japan (KEIO and NAIST)**
  - 5 lectures by Prof. Landweber (remote)
  - 3 lectures by both professors (remote/local)
  - 1 lecture by Prof. Kato (remote)
  - 5 lectures by Prof. Murai (local)
  - Students takes online lectures by Prof. Landweber for some topics (on-demand)

## Classes at both sites



<http://www soi wide ad jp/class/99006/>  
<http://www soi wide ad jp/class/99007/>

## System requirements

- **Interactive lectures over the Internet**
  1. Contents and Quality
    - Good enough **audio** and video **quality** for 1.5 hour length lectures
    - Consisting of **all the media** (face, whiteboard, materials etc)
  2. Interactivity
    - **Multipoint**, multi-directional
    - Low propagation delay for **discussion**
- **Archived lectures on the Internet**
  1. Consisting of video, audio and materials
  2. Accessible from home

## Internet Environment

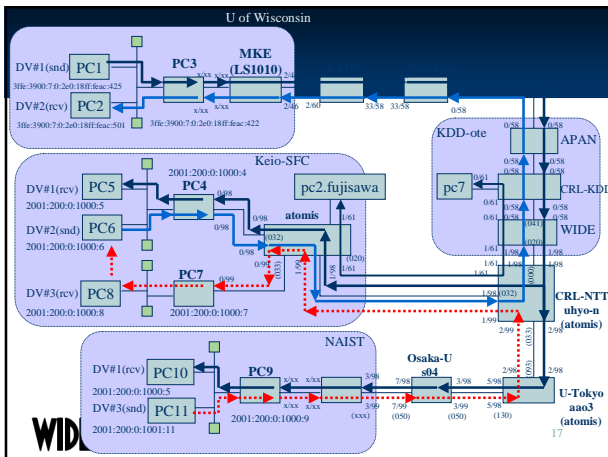
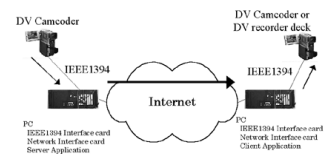
- **WIDE/JB – High performance R&D network infrastructure in Japan**
  - WIDE Backbone
  - Japan Gigabit Network (JGN)
- **APAN/TransPAC – 70Mbytes ATM link between US and Japan**
- **High performance Intranet within three campuses.**

## Applications

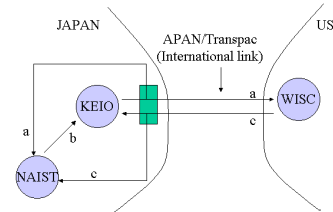
- **Interactive lectures over the Internet**
  - **DVTS** as a Video Conferencing System
    - High quality Audio & Video transmission
    - Requires about 40Mbps bandwidth
  - **RPT** as a material synchronization
- **Archived lectures on the Internet**
  - SOI Archive system
    - RealVideo and HTML

## Video Conferencing System

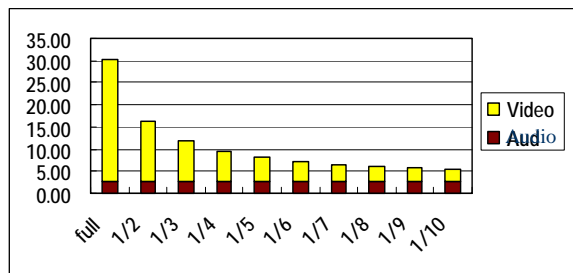
- **Requirements**
  1. high quality
  2. Small delay
  3. Low cost
  4. Internet friendly
- **DVTS**
  - DV over IP
  - DV over IPv6



## Communication among 3 points



## Frame rate and required Bandwidth



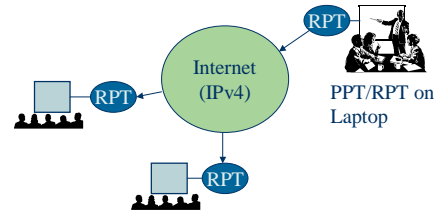
Full Rate Audio : 2.64 MBps  
Full Rate Video : 27.58 MBps

WIDE School of Internet

19

## Sharing Materials

- RPT (Remote Presentation Tool)

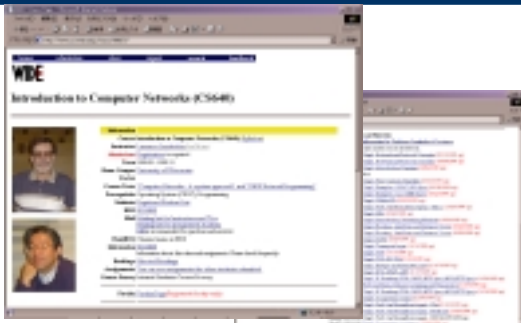


WIDE School of Internet

INET2000 7/19/2000

20

## Archived class

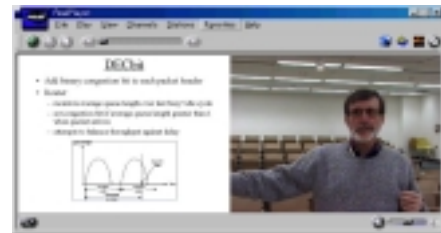


WIDE School of Internet

INET2000

## Archived Lectures

- SOI (School of Internet) archives
  - Video/Audio/Materials synchronized



WIDE School of Internet

INET2000 7/19/2000

22

## Archive Lectures

School on the Internet

Assignment System

Lecture on demand

Survey System

discussion

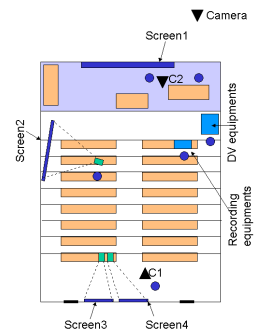
Authentication

7/19/2000

## Classrooms

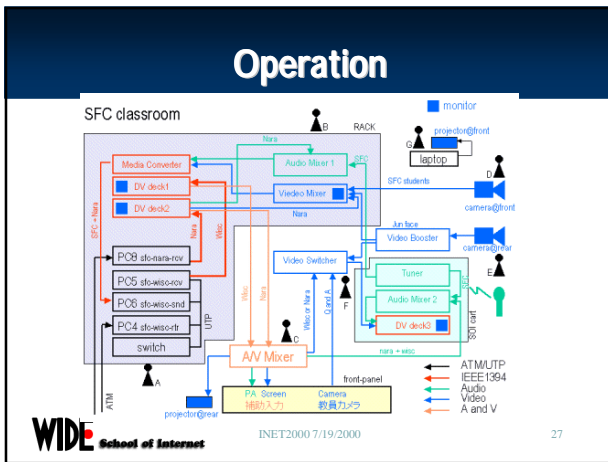
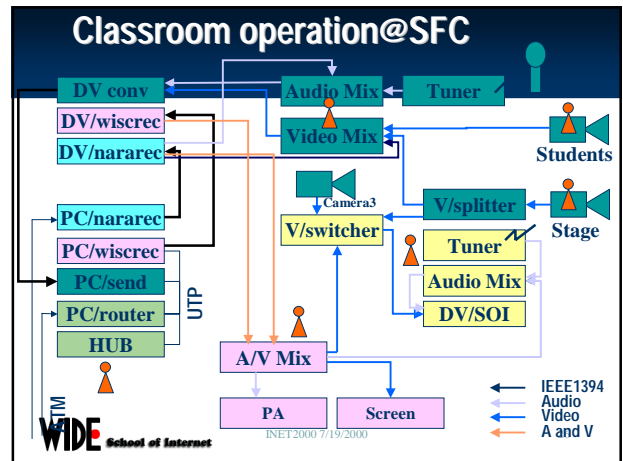
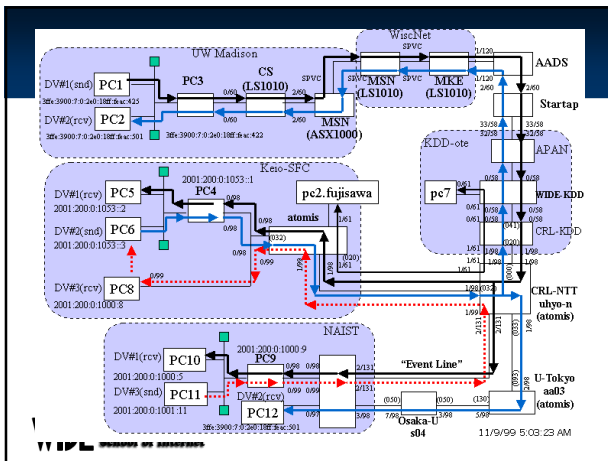
- Requirements

- The local lecturer can face both local students and remote students.
- Students feel the remote lecturer sees them. ( eye-contact )



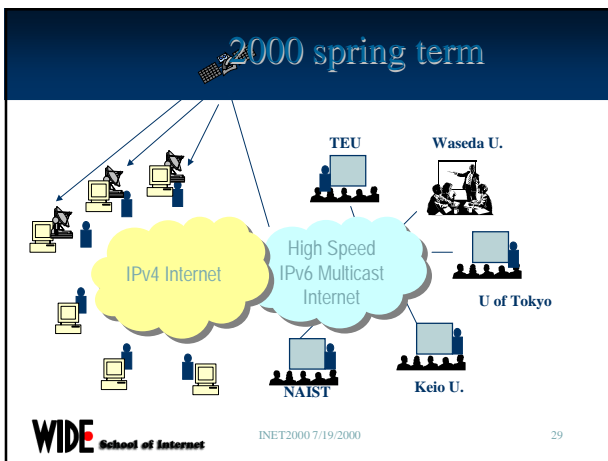
WIDE School of Internet

INET2000 7/1



### Conclusion

- Achieved high quality Interactive lectures over the Internet, throughout the school term.
- Well accepted by students and faculties
- Students obtained credits from their own universities
- Future issues
  - Less overhead for daily operations
  - Stability of the system
  - Manuals and training for autonomous operation by many sites



### 2000 spring term

- Lectures
  - KEIO / WASEDA joining class (Muraoka, Goto, Murai) "Internet Applications"
  - U-Tokyo/ KEIO (Morikawa) "Mobile and Wireless"
  - TEU / KEIO (Aiso) "Media"
  - NAIST / KEIO (Chihara) "Information Sensoring"
  - KEIO (Tokuda, Murai) "Autonomous System"
  - KEIO (Murai) Introduction to computer

## Future Plans

- Corporation with Asian countries via AI3 (Satellite based Internet among 11 countries in Asia)
- Collecting more lectures about “Internet Technology”.