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

School of Internet Project
- Since 1997
- Learning environment for individuals
  - Anytime/Anywhere
  - Plan your learning time anytime in your life
  - 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 the world

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 (NAIST), both in Japan.
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**
  - Time: Monday, Wednesday, Friday 8:25am - 11:40am
  - Students: graduate school students and 4th grade of undergrads of Computer science
- **KEIO University**
  - 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**

### Courses at 3 universities

- **Students in Wisconsin**
  - 23 lectures by Prof. Landweber (local)
  - 5 lectures by Prof. Murai (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 take online lectures by Prof. Landweber for some topics (on-demand)

### Contents

1. Ch1. Intro
2. Ch1. Protocol
3. Ch3. Framing
4. Ch3. Error detection
5. Ch3. Flow control
6. Ch3. HDLC
7. Ch3. LLC
8. Ch3. CSMA/CD
9. Ch3. 802.11
10. Ch3. DSL
11. Ch4. Switching Method
12. Ch4. Routing
13. Ch4. ATM
15. C6. TCP
16. C6. ISO TP4
17. C6. Bridges, Extended LANs
18. C5. IPv4/ICMP, ARP
19. C5. CBR, BGP
20. C5. OSPF
21. C5. IPv6
22. C5. Multicast
23. C5. DNS
24. Distance Learning
25. C4. Congestion Control
27. C4. Differentiated Services

### 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/J B – 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

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Full Rate Audio : 2.64 Mbps
Full Rate Video : 27.58Mbps

Sharing Materials

- RPT (Remote Presentation Tool)

Archived class

Archived Lectures

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

Classrooms

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

Classroom operation@SFC

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 Sensing”
- 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”.