Experiences in Distance Education

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Outline

- IITB Distance Education (DEP) network

- Technology R &D:
  - RTAN: Data transfer protocol over DEP
  - MADE: Mobile agents for remote examinations
  - xNet: Demos for learning for networking topics

- Pedagogical Issues:
  - Offering of IIT courses over DEP
DEP: The KReSIT Model

- “Class Room” environment
  - “Interactive” Lectures and Discussions

- “Hub And Spokes” star network
  - IIT Bombay - Remote Centres (RCs)
  - 512 Kbps DAMA channel; 16 kbps TDMA control channel

- Some numbers
  - Infrastructure at IIT Bombay: ~Rs. 1.0 Crore
  - Infrastructure at RCs: ~ Rs. 19 Lakhs
  - Recurring Bandwidth Costs: ~Rs. 37 Lakhs per Year (512 Kbps)
  - Other costs: Staff, dispatch, classroom etc.

- Scaling: 6 RCs today, 25 by Dec 2003, ….
The DEP Network Setup

Central Site - IIT Powai

- Satellite dish
- Viasat HUB
- Comnet Noida

- Remote Site

- Satellite dish
- Control Channel to Comnet Hub
- 16Kbps TDMA Control
- 512 Kbps Simplex Carrier
Data Transfer Requirement

- Reliable file transfer over the DEP network:
  - Large files of the order of 1 GB: videotaped lecture
  - Small files of the order of KBs: tutorials etc.

- The Problem
  - Need to have TCP like reliability
  - The 16 kbps full duplex reliable channel is too small for doing FTP/TCP in reasonable time
  - The 512 kbps DAMA channel is a half duplex multicast channel supporting UDP
RTAN

- Application level UDP based reliable transfer protocol
- Use the 512 kbps half duplex channel for data transfer
- Use the 16 kbps full duplex channel for control

Reliable Transfer over Asymmetric Networks (RTAN)
- The overall transfer consists of many Transfer Cycles
- Each Transfer cycle consists of one Data Cycle and many Recovery Cycles
- A fixed number of packets are sent per Data Cycle to all the clients.
- All the packets dropped by at least one client are remulticast in Recovery Cycles until all the clients have received all the packets sent in the Data Cycle.
Logical TDMA point to point channel
RTAN: Deployment and Experiments

- **Deployment issues:**
  - Router configuration for multicast
  - Time To Live value
  - Link synchronization and Up-Down

- **Field Experiments:**
  - Network MTU found to be ~1400 bytes
  - Error rates observed to be from 0.5% to 5%
  - ~75 Kbps was data rate achieved for reliable transfer
MADE

- Use of Mobile Agents for the various phases of distance examinations

- Examination Process:
  - Exam setting
    - examiners set the question papers
  - Distribution and testing
    - question papers are presented to the students
  - Evaluation and result compilation
    - answers are collected and results compiled
Mobile agents

Programs that can autonomously migrate amongst nodes of a network and perform computations on behalf of a user

Client/server communication

Mobile agent communication
Examination setting: overview

Comprehensive Paper

Paper Assembler

To Distribution Server

PS-1

PS-2

PS-3

PS-4

PS-5

IIT Bombay

PS = Paper Setter

♫ = Mobile Agents
Dynamic Upgrade
Distribution and Testing

1. Single copy of paper
2. List of Students enrolled
3. Each Candidate get a Copy
4. Answered and Returned
5. Each copy returned

Separate Copy per user

IIT Bombay

Distribution Server

Exam Center Distribution Server
Agents collaborate to produce the final result
Student examination system: summary
xNet: eXplaining Networking

- Goal: develop web-based self-learning materials for eXplaining Networking concepts, protocols and technologies
- Several modules, each on one concept/protocol
  - HTML/Java Applet based simulation resources
    - A brief HTML description of the protocol, including links to relevant RFCs and other references
    - Some "default/in-built" Java applet demos of the protocol functioning, in pre-defined network topologies
    - A "custom/user-driven" simulation, wherein the user defines the parameters for the protocol simulation
Pedagogical issues in teaching at IIT v/s DEP

- **Communication medium:**
  - IIT class has “high” bandwidth => Possible to interact freely, get instantaneous visual feedback
  - DEP class has “low” bandwidth => Constrained interaction and that too with non-trivial delays

- **Student’s background:**
  - IIT class has JEE/GATE filtering => Possible to assume minimum level of competence
  - DEP class has minimal filtering => Large variation in background/abilities even after pre-requisites
  - IIT students are mostly full-time
  - DEP students are mostly part-time working professionals

- **Instructor’s skill:**
  - IIT class emphasis is on domain knowledge
  - DEP class requires good teaching skills also
Observations on DEP teaching

- Many standard assumptions about giving a course within IIT do not hold for DEP
  - Extensive domain knowledge alone is not sufficient
  - Visual feedback about student’s understanding is inadequate
  - Being a “good” teacher within IIT does not imply that the same material and delivery style will be good for DEP students

- DEP teaching is fun and satisfying if:
  - One likes teaching
  - One is willing to adapt one’s style for the medium
  - One is willing to put in the “extra” effort to prepare detailed course material
Watch out: Pitfalls

- Assuming that customizing one’s course for DEP will not take much time
  - Making slides for DEP usually takes much longer than anticipated

- Assuming that specifying pre-requisites is enough to ensure uniformity
  - DEP students usually meet the pre-requisite only on paper

- Getting carried away in class
  - Not being aware of what is being broadcast

- Handling all floor requests
  - Few clueless/shameless students can upset entire lecture timing

- Attempting a lot of interaction
  - May result in bizzare queries/answers

- Assuming that everything will go fine
  - Murphy’s Laws strike with amazing regularity 😊
Thank You