Brihaspati_sync: A tool for interactive classroom over multicast network

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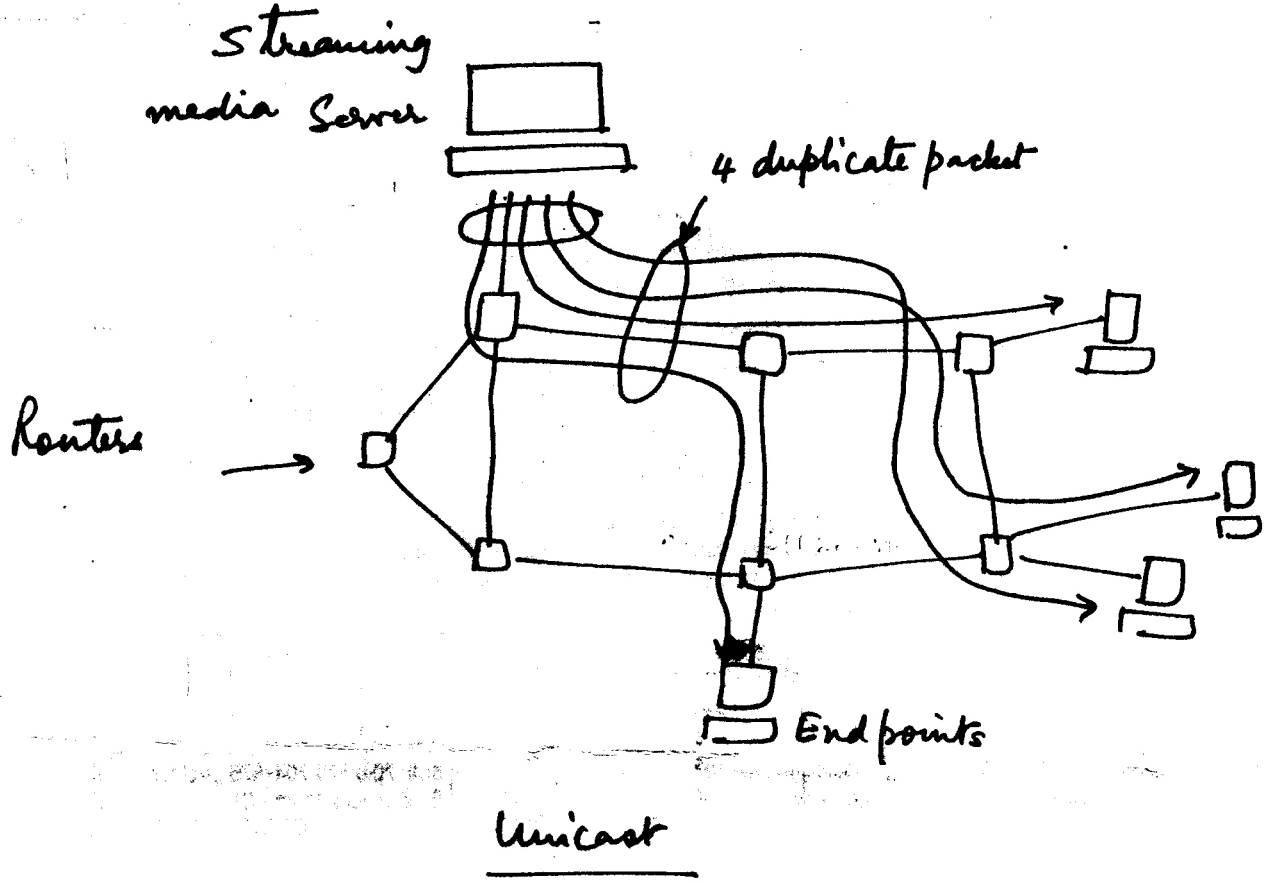
Purpose

- Holding live lecture
- PCs with multimedia support
- Multicast connectivity
- Application architecture?

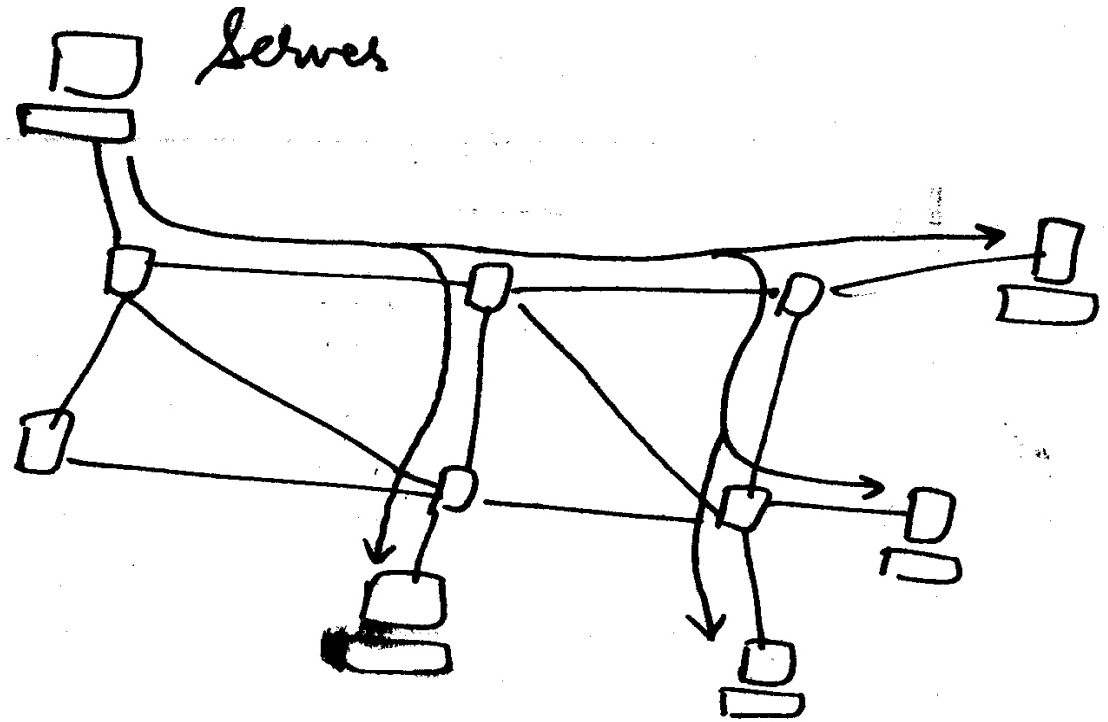
Unicast network



Unicast network

- Wastage of bandwidth
- Not scalable to large numbers
- More computing resources at server

Multicast



Multicast

- Additional protocols
- No wastage of bandwidth
- Efficient and scalable compated to unicast
- Synchronous tool – based on multicast due to better scalability
- Unicast-multicast gateways, end system multicast

Multicast (contd.)

- For multicast the destination address is a group address.
- All tx to group address (cannot use TCP, have use UDP)
- Receivers takes group membership to receive the media transmission.

knowing the group address?

- Well known group address for announcement.
- Each tx puts the announcement periodically.
- Rx listens to announcements on this well known group address.
- Rx now knows
  - about what all session will be there
  - at what time and
  - at what group address.

Group address?

- How to make sure? – no two transmission uses the same group address.
- (Source address, group address) pair – unique
  - Used for session identification.
- Different media types use different ports. (UDP port)

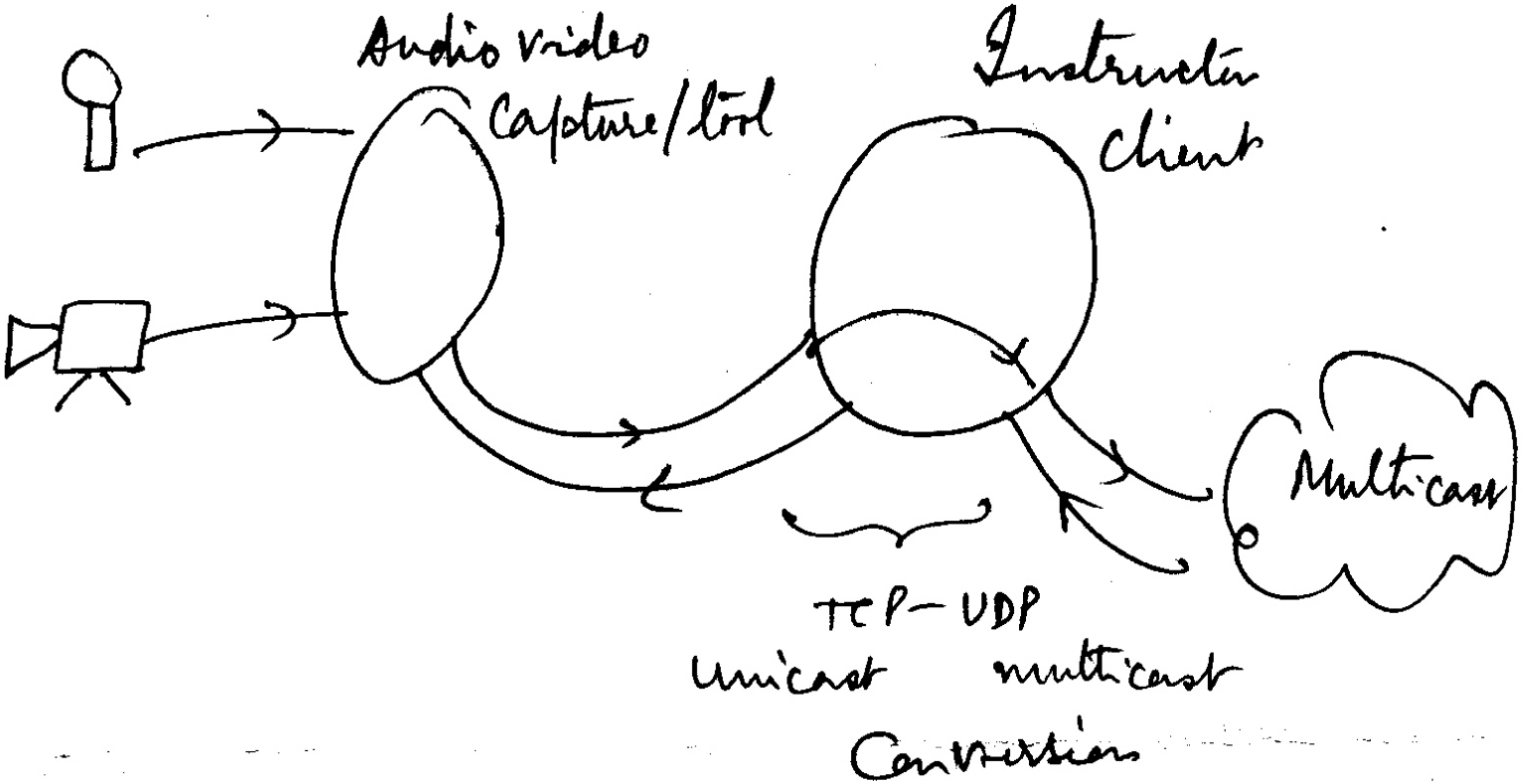
Knowing group address (contd.)

- How students (their part of software) of class will know – groups address.
- LMS (learning management system) will be used additionally to disseminate lecture notes, slides, discussion group etc asynchronously. (Brihaspati or Brihaspati-2)
- Same database can be used by synchronous tool

Steps for instructor

- Client authentication
- User-group-role (instructor, student)
- Allocation of group addresses
- Control of various media types
- Encryption and decryption for secrecy after authentication

Audio/video capture tool



Audio/video capture mechanism

- Possibility of classroom scenario
- Separate capture tool
- Capture tool – instructor client – multicast to students.
- Capture tool and student cleint of same machine.

Problem of layering

- Why?
  - Heterogenous network
  - For only video transmission – connection breaks if congesion occurs in some links.
  - Network usually will have dynamic bandwidth conditions.
- Use QoS support – costly
- Use video transmission in multiple layers.

Video layering

- Video -> L1 +L2 +L3 +L4
- L1 is good enough for poort quality video.
- L1+L2 gives improved performance
- L1, L2, L3 and L4 on separate multicast group.
- Drop in order L4, L3, L2 and L1 if congesion occurs
- Smooth degration

Layering in our tool

- All media types are prioritized
- Each one is send in separate layer (separate group address)
- Each session requires more number of mutlicast groups addresses – routing table resources in routers are consumed.
- Depending on bandwidth estimate, only layers with higher priority are subscribed.

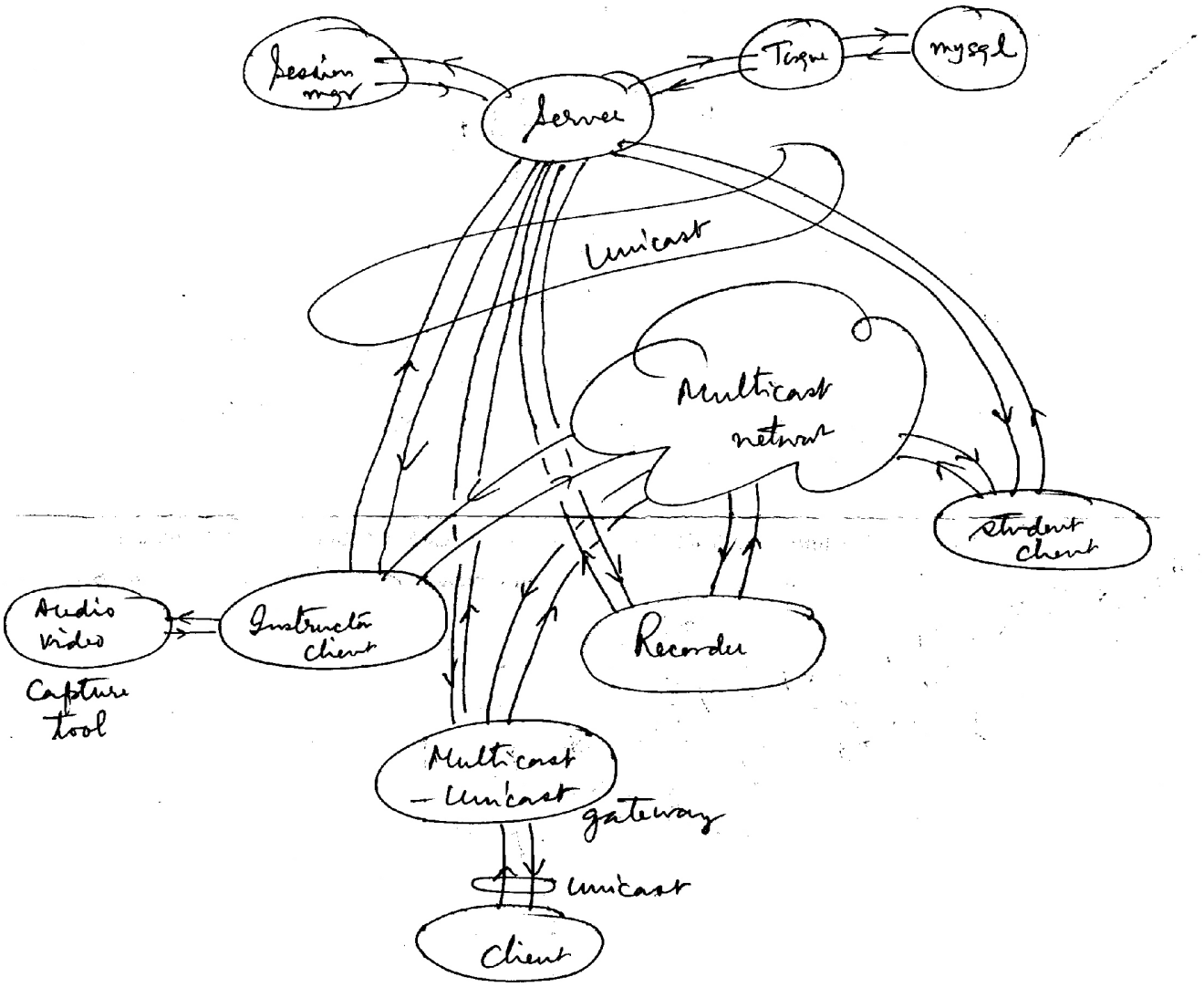
Advantages

- Bandwith estimation in realtime.
- Join and leave decisions as a result of estimation.
- Different students will get different quality of classroom.
  - Will be able to attend the class always even if small bandwidth is available.

Other client end features

- Handraising
  - Permission for audio/video transfer
  - One or more than one.
- Chat
- Whiteboard
- Screen capture

System architecture



Problem yet to be resolved

- Bandwidth estimator
- Layered audio, video codec in Open Domain (Brihaspati_sync is opensource freeware)
- Unicast-multicast gateways
- Peformance enhancements.
- Better security features.

URL regarding this project

- http://brihaspati.sourceforge.net/
- http://sourceforge.net/projects/brihaspati
- brihaspati_iitk group at yahoogroups.com

Future targets

- Brihaspati-2 release for users in August 2005
- Brihapati_sync – basic release for users in August 2005.