Broadcasting over Internet-III

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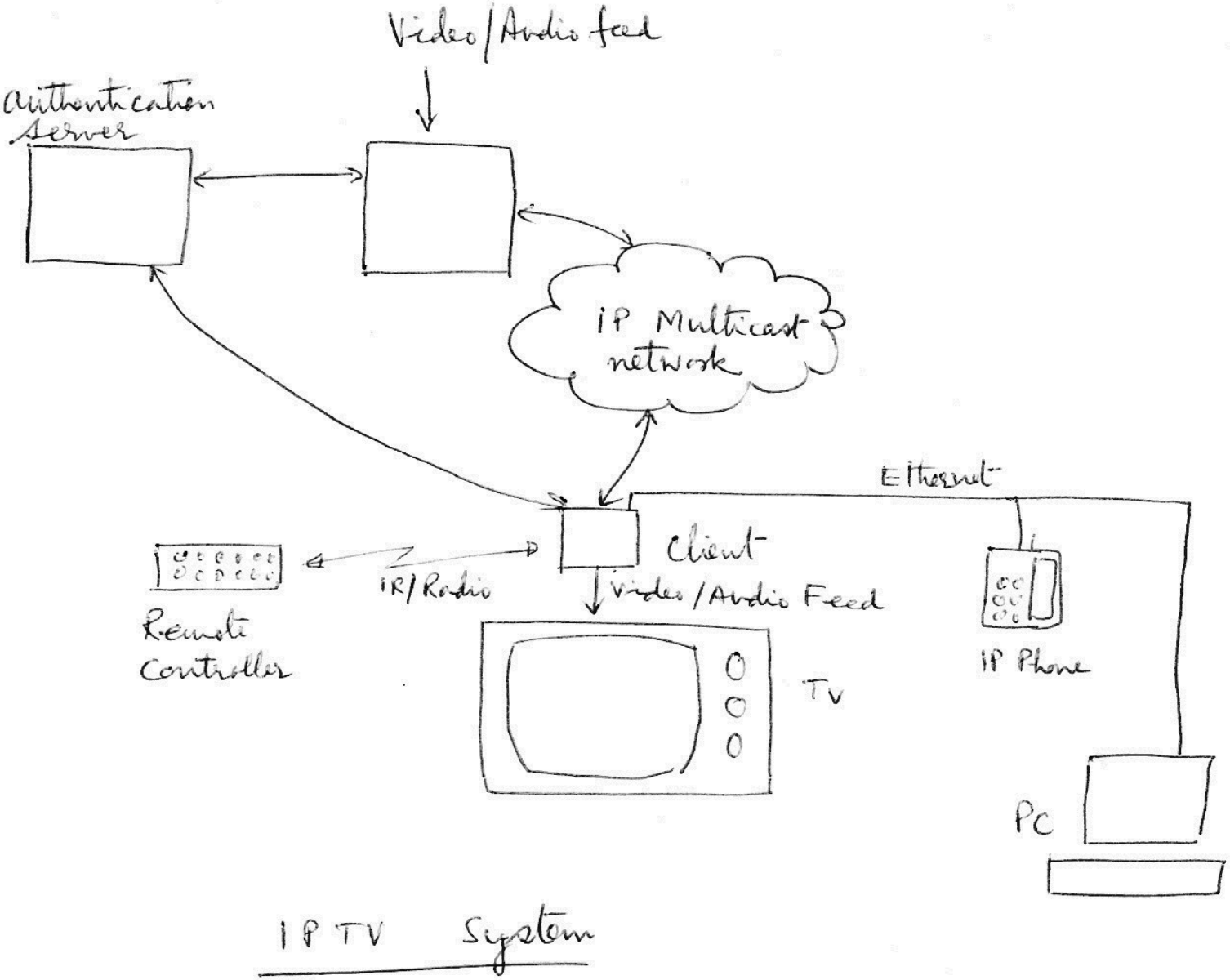
Basic architecture for IPTV system

- Client set top box
  - Connecting to network through ADSL
  - Has built in application to join to IP multicast session for TV channel
  - Application receives the mpeg stream via IP and feeds into hardware to convert it to audio/video signal
  - Audio video signal passed to TV



IP TV System

- Set top box authenticates with IPTV authentication server
- Gets decryption key periodically after authentication
- The IP multicast stream is encrypted by the key

- Whenever the key changes, signal received to discard and use new key already received from server
- Billing done on basis of how many times the key update is taken by client
- per hour basis or per half an hour basis billing can be done.

- Client set top box
  - Also acts as NATing router
  - Connection to VOIP phone
  - Optionally can act as media gateway device connecting to ordinary phone
    - Visible to outside world as IP phone
  - Interface to connect PC for Internet browsing

Video on demand

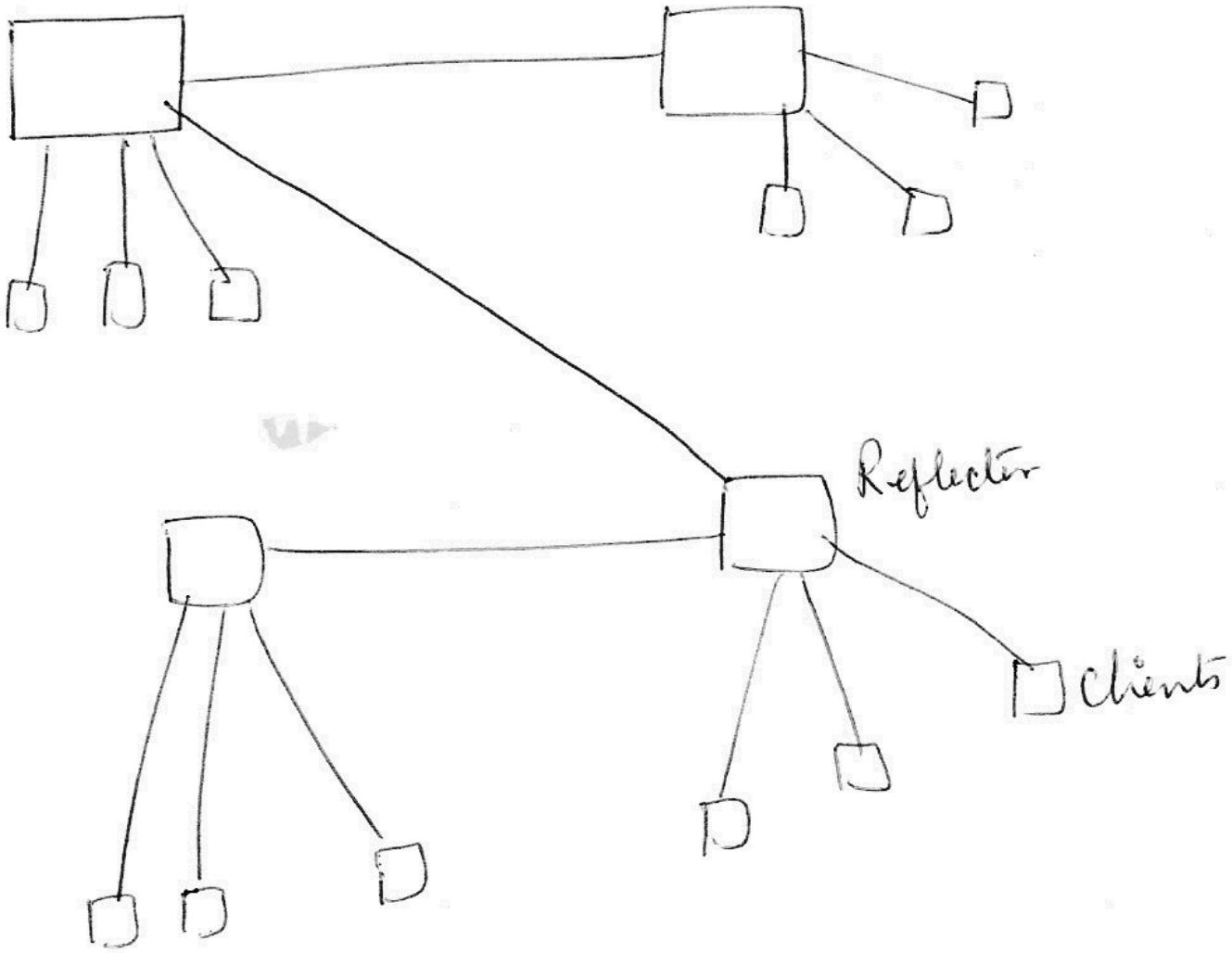
- Set top box can connect authentication server
- fetches the key to access the video on demand server
- Video on demand server load increases with number of access

Video on demand (contd.)

- One hour programme
  - Can be transmitted as twenty separate multicasts with starting staggered by five minutes
- Depending on time of joining of VOD, multicast address is informed
- Worst delay after initiating the VOD, five minutes

Reflector technology

- Unavailability of multicast network
- All users connecting to central server
  - Not efficient
- Have multiple servers

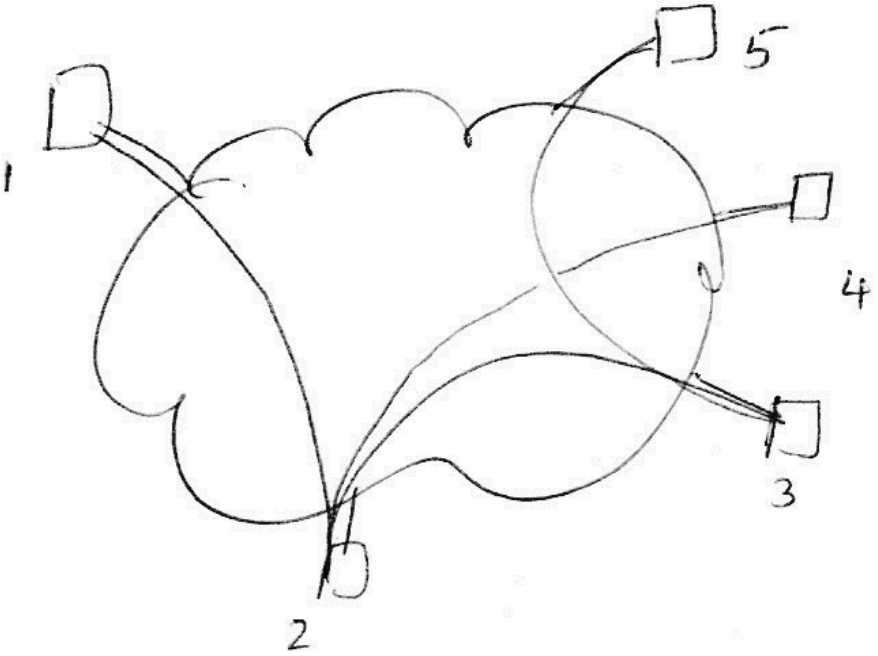


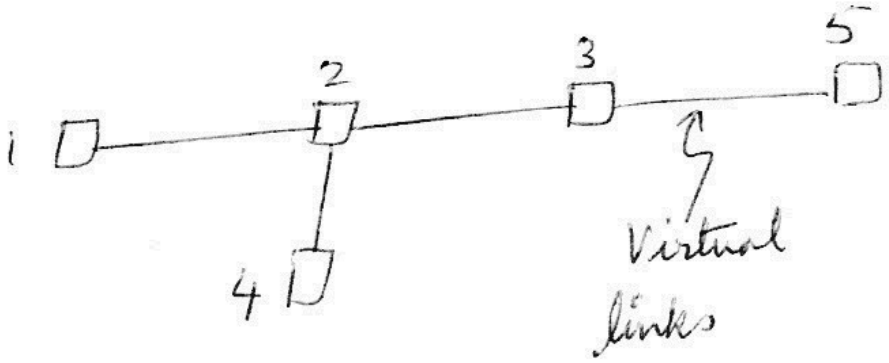
Reflector based System

- The transmission is passed from one server to another
- Clients connect to least loaded server
- Some clients can act servers, if permitted by master server.

Overlaid multicast

- If all clients can act as server – overlaid multicast
- Client act as router – virtual multicast tree creation



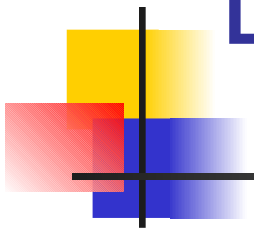


- For each session one single virtual multicast tree
- Clients are connected by virtual links (UDP/TCP tunnels)

Congestion control

- Congestion control – not present for UDP
- Congestion control – reduce the traffic injection rate on detection of congestion
- In case of congestion
  - TCP transmit window reduces
  - UDP – no transmit window

Layered media transmission



- All the transmission divided in layers
- Each layer transmitted on separate multicast group
  - If congestion control is not required, all layers can be transmitted on same group with different UDP ports
- Base layer – control layer
- Other layers (in a possible order) – signaling, audio, video.

Bandwidth estimation

- Source periodically transmits probe packets (a packet pair) on Base layer.
- Each receiver receives them
- The time gap between them and round trip delay estimate – can give available BW estimate

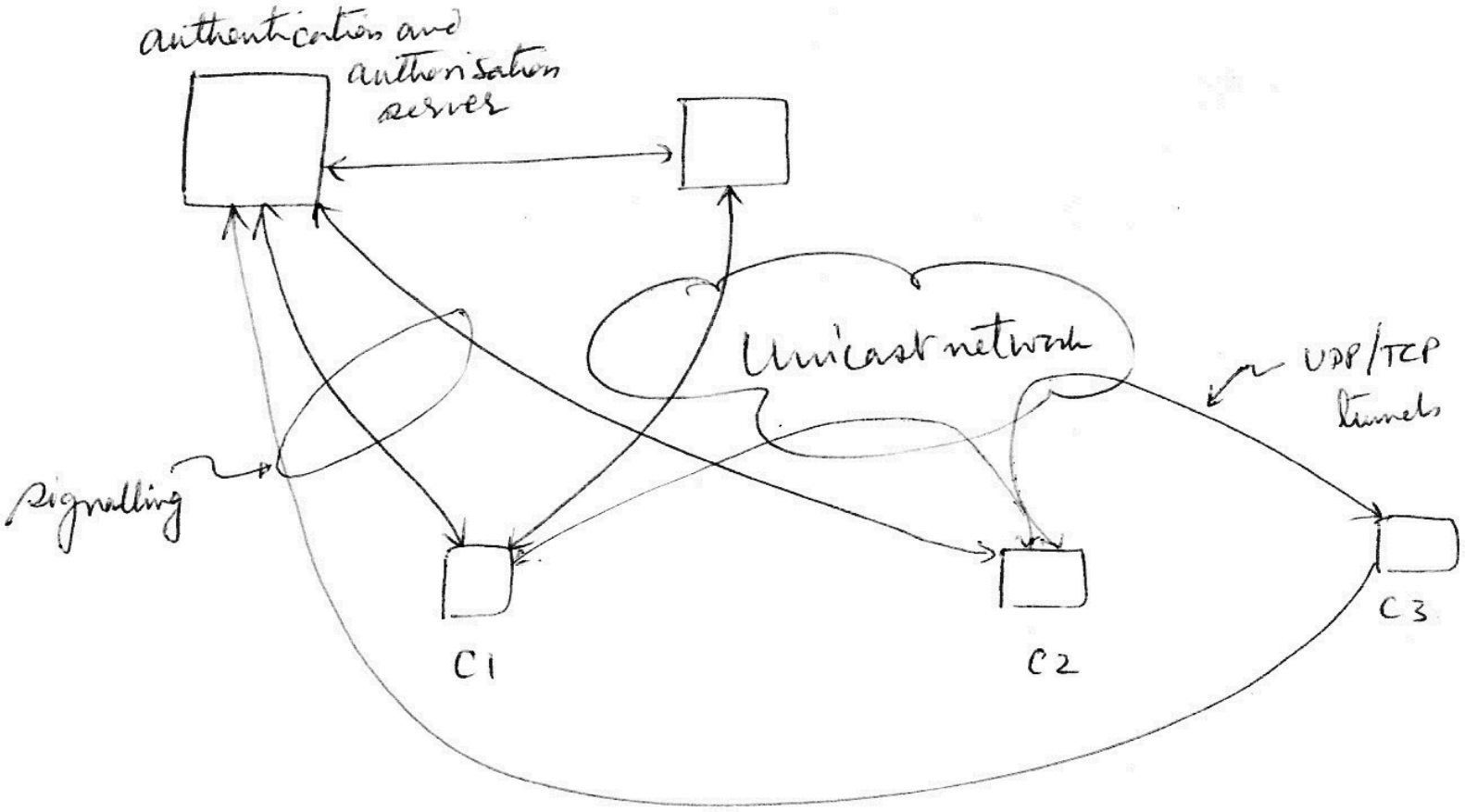
Leave, join of media layers

- If estimated available bandwidth less than required by all the subscriber media layers
  - leave the least important media layer multicast group
- If more
  - If join the media layer multicast group if available, in order

Layered video

- Video can be layered
- Base layer only – poor quality video
- More layers one gets – better quality video
- Synchronization – important
- Each video layer – on separate multicast group

A possible architecture for IPTV using overlaid multicast



Basic architecture of Brihaspati_sync

- Base layer – control layer
- Other layers (in a possible order) – signaling, audio, slides, chat, video.
- Other media types added – screen capture, desktop control, slides, chat, white board

- Transmission can continue even if only audio and slides are there.

Challenges

- Reliability – what happens if a client node fails
- Every nodes maintains the list of all neighbors
- List send to all the neighbors

Challenges (contd.)

- Each neighbor looking at its position in list decides which client to connect in case, the node to which list corresponds, dies.

- What happens if client behind NATing router, behind http proxy
  - Anybody behind NATing router – cannot become forwarding node
  - Behind http proxy – requires http tunneling for media transport
- Clients have been provisioned with http tunneling server

For updates on Brihaspati initiatives

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