

Maharaja Agrasen Institute of Technology
ETCS 211
Computer Graphics & Multimedia
UNIT 4
Intermedia Synchronization

Overview

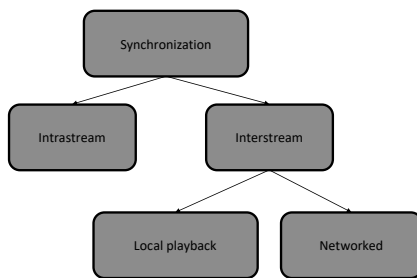
Why we need to sync?
 How close must we sync?
 How to sync?
 How to measure sync?
 Applications

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Problem

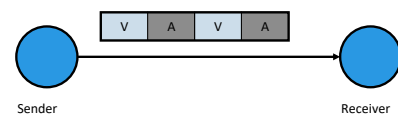
Ensure that audio/video captured at the same instance at the source, are **displayed at the same instance** at the receivers.

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Why we need Synchronization?

Why not Pre-sync?



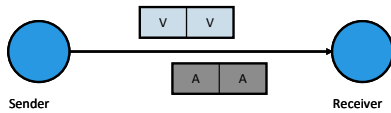
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Seperating A/V Flows

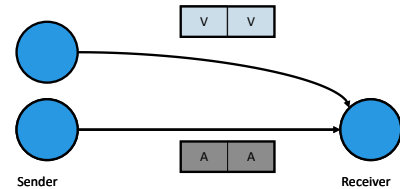


- Can receive audio without video
- Can prioritize audio over video

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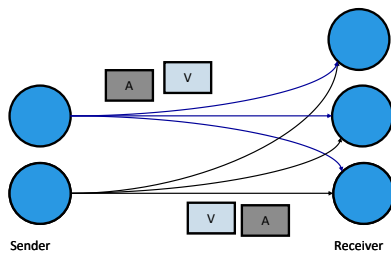
May Come from Different Sources



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or Displayed at Different Sources



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More Complications

- Different decoding time for video and audio
- Network delay and jitter
- Different clocks

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Bottom Line

Must synchronize at the receiver

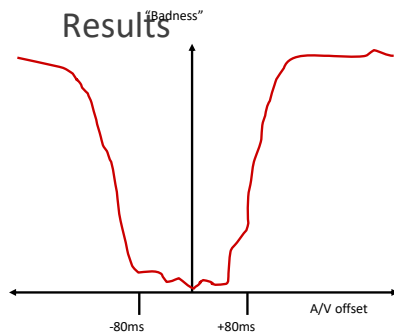
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Synchronization Requirements

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What matters

Video ahead of audio vs. audio ahead of video

Size of head

Occupancy

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What does not matter

Language

Speaking or Singing

Speed

Hobby

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Conclusion

-80ms to +80ms acceptable

-160ms to +240ms noticable but not annoying

– audio > video

+ video > audio

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How to Synchronize?

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Receiver needs

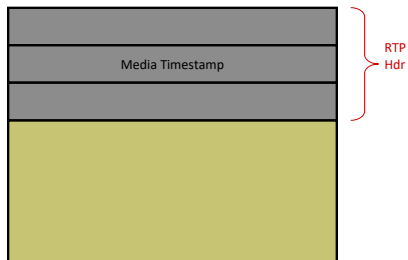
Exact time a sample is generated

Each packet needs a timestamp

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RTP Protocol



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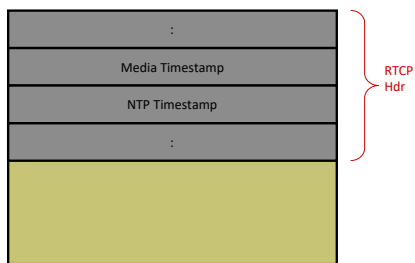
But..

Media timestamp has a random offset

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RTCP Protocol



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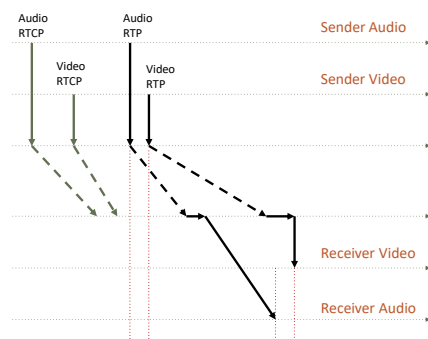
NTP

Network Time Protocol

Synchronize clock up to few milliseconds

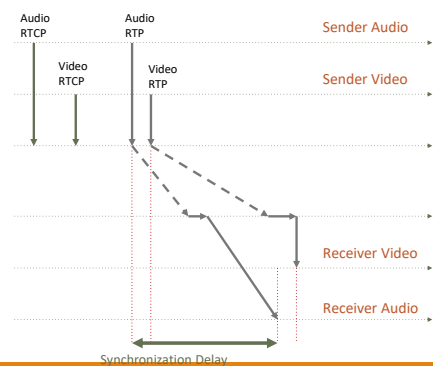
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Multiple Receivers

Everyone must have the same *synchronization delay*

How to set Sync Delay?

Receivers tell each other their network delay

Synchronization Delay =
 $\max \{ \text{Network Delays} \} + \text{Buffer}$

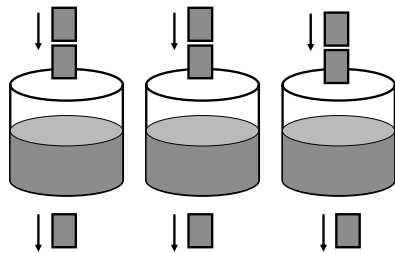
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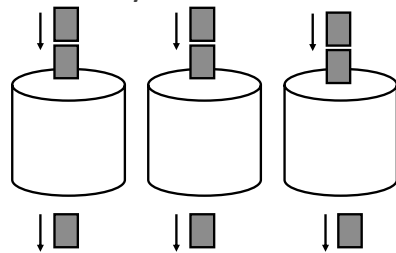
Buffer Control



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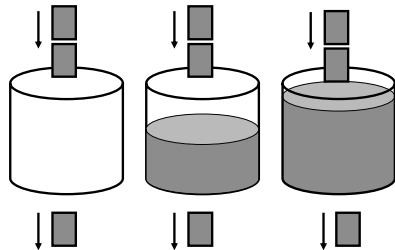
No Delay No Jitter



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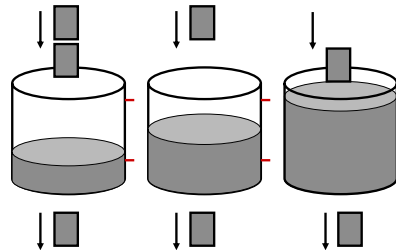
Delay, No Jitter



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Delay, Jitter



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If Buffer too Full/Empty

Send message "Play faster!" or "Play slower!" to other receivers

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Must Synchronize!

Send message "Play faster **at time T!**" or "Play slower **at time T!**" to other receivers

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