

# A Joint Online Transcoding and Delivery Approach for Dynamic Adaptive Streaming

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## BACKGROUND

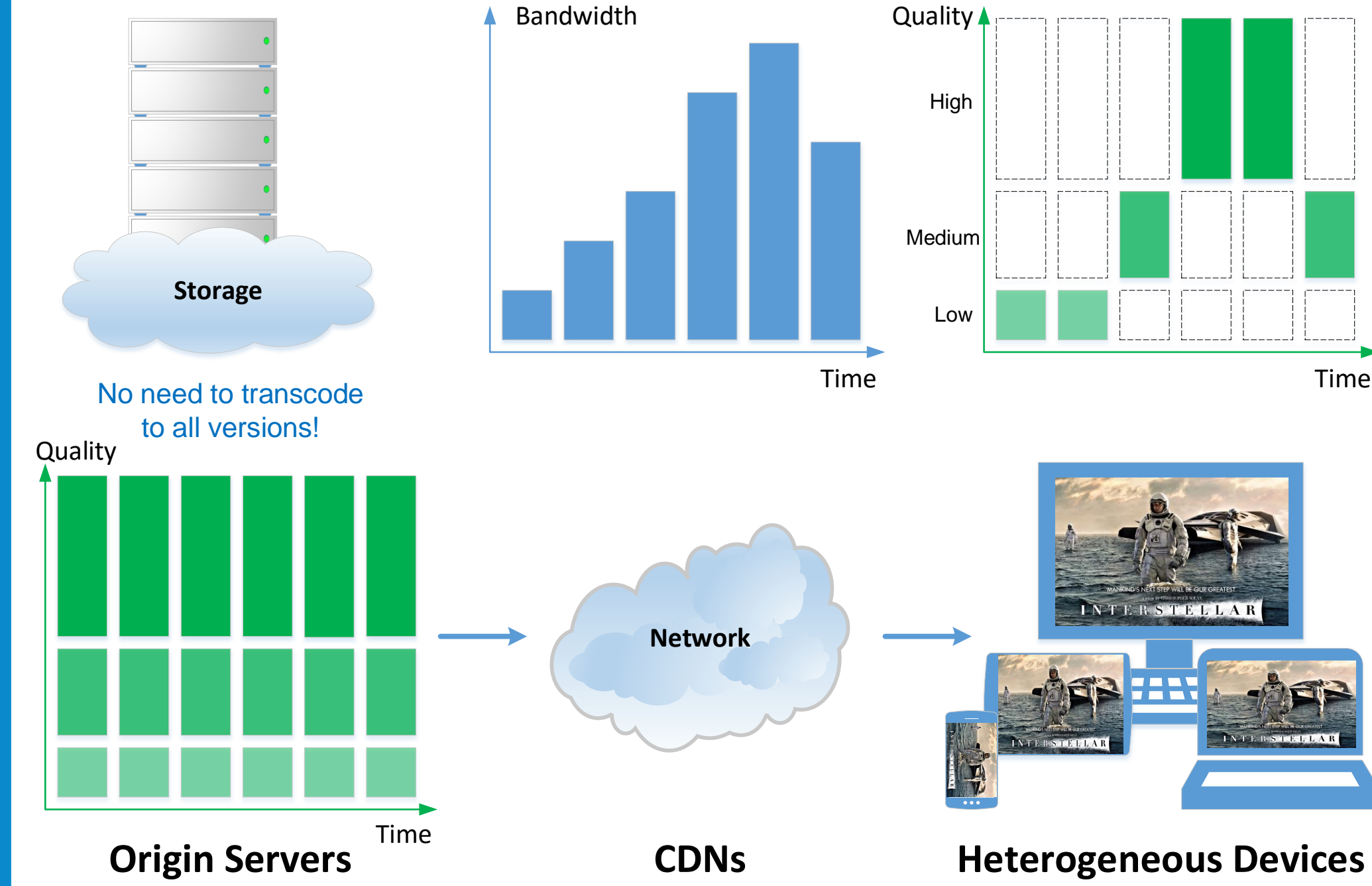
Popular online video sites



transcode their videos to multiple versions

$$\rightarrow \{mp4, [H.264, AAC]\} \begin{cases} version_1 & (x_1 \text{ kbps}) \\ version_2 & (x_2 \text{ kbps}) \\ \vdots & \vdots \\ version_n & (x_n \text{ kbps}) \end{cases}$$

and then stream them through the network,



so that users can enjoy a better watching experience according to their current bandwidths and device decoding abilities.

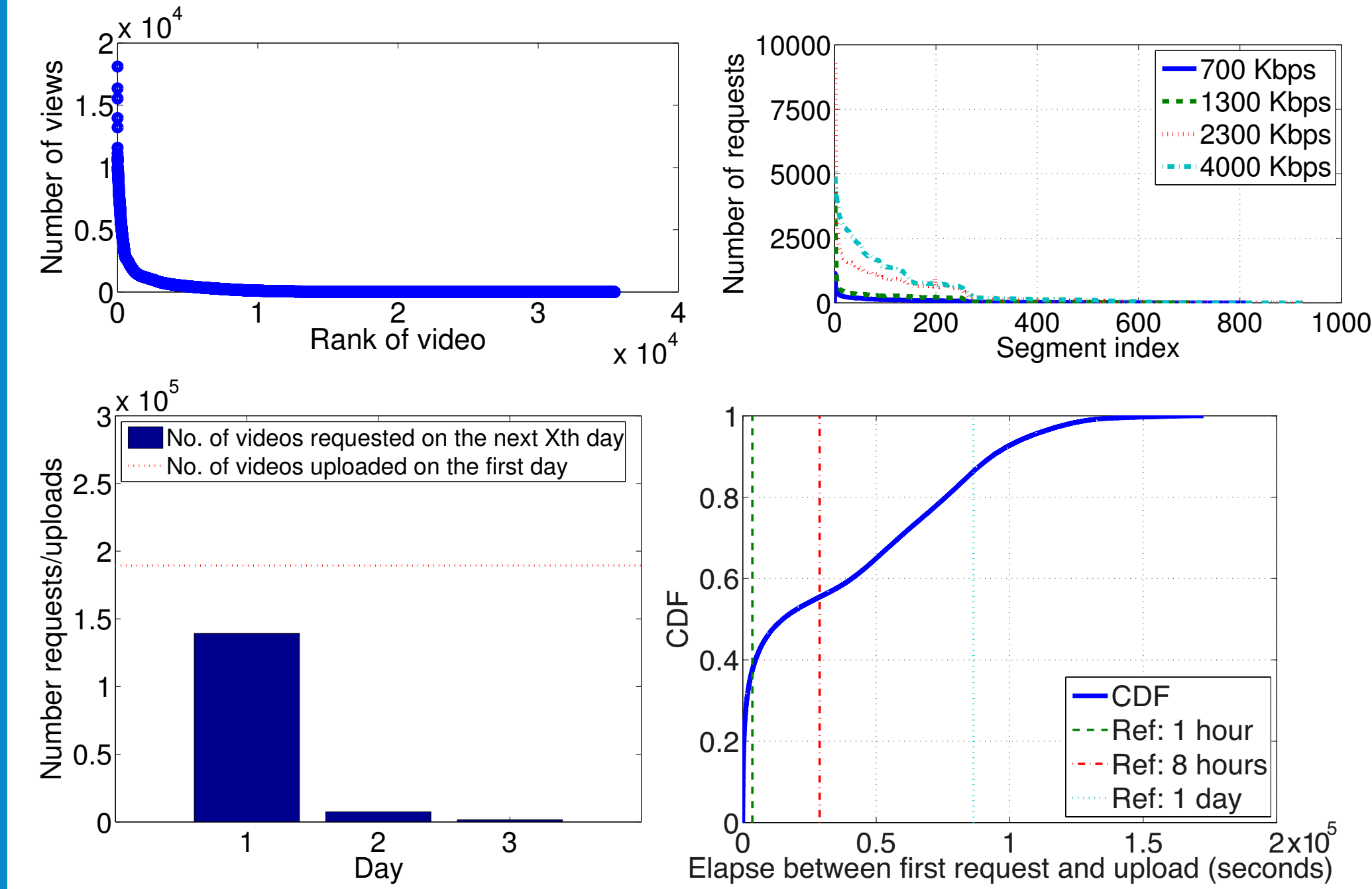
## PROBLEM

They all transcode origin videos to all versions. In such scheme,

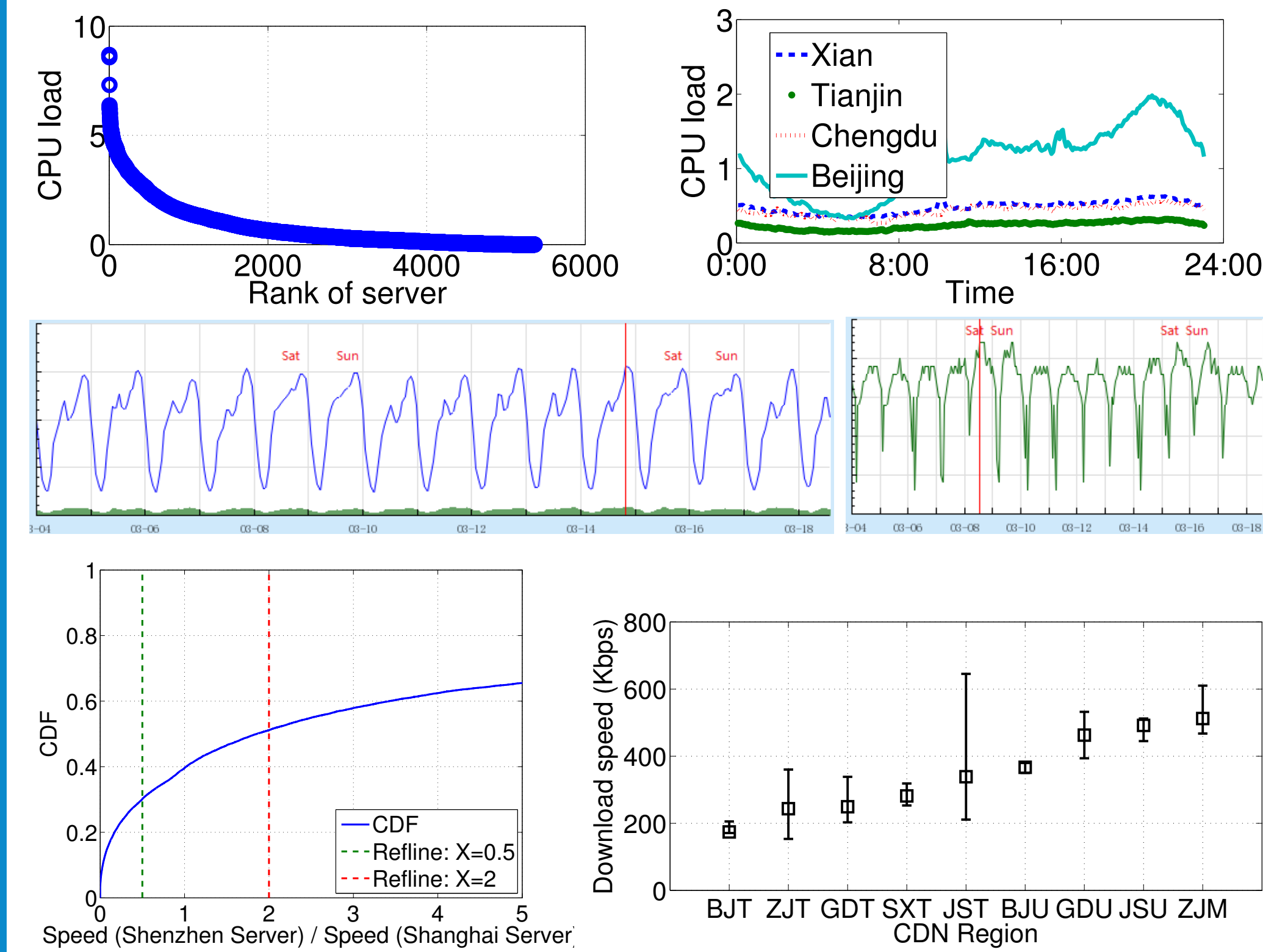
- only a small set of candidate bitrates to manually choose from; cannot effectively adapt to the changing network conditions
- huge computing resource consumption
  - H.264: 1/3 to 2/3 of playback time
  - H.265: 30+ times of playback time
  - 1 CPU: 1-2 concurrent coding tasks
- oblivious of users' preferences of different peering servers

## OBSERVATIONS & INSIGHTS

Video Viewing Patterns (Pro. & UGC)



CDN Patterns (CPU load & bandwidth)

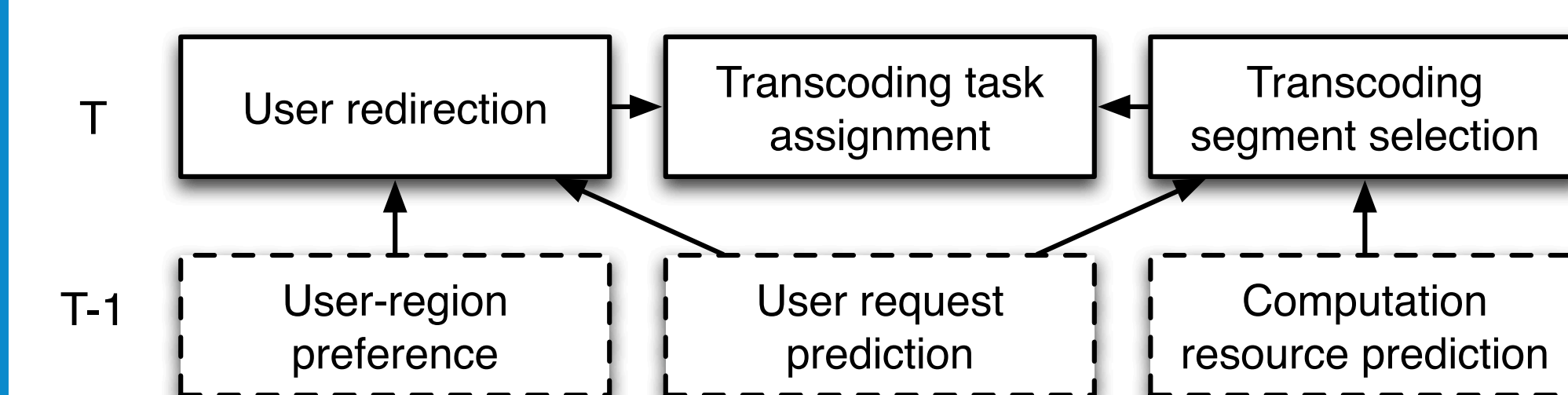


Insights:

- § No necessary to pre-transcode/store all
- § Most backend servers in CDNs are pre-dictably(stably) idle
- Can be scheduled for transcoding?
- § users have preferences in CDN regions
- § regions have preferences in media versions

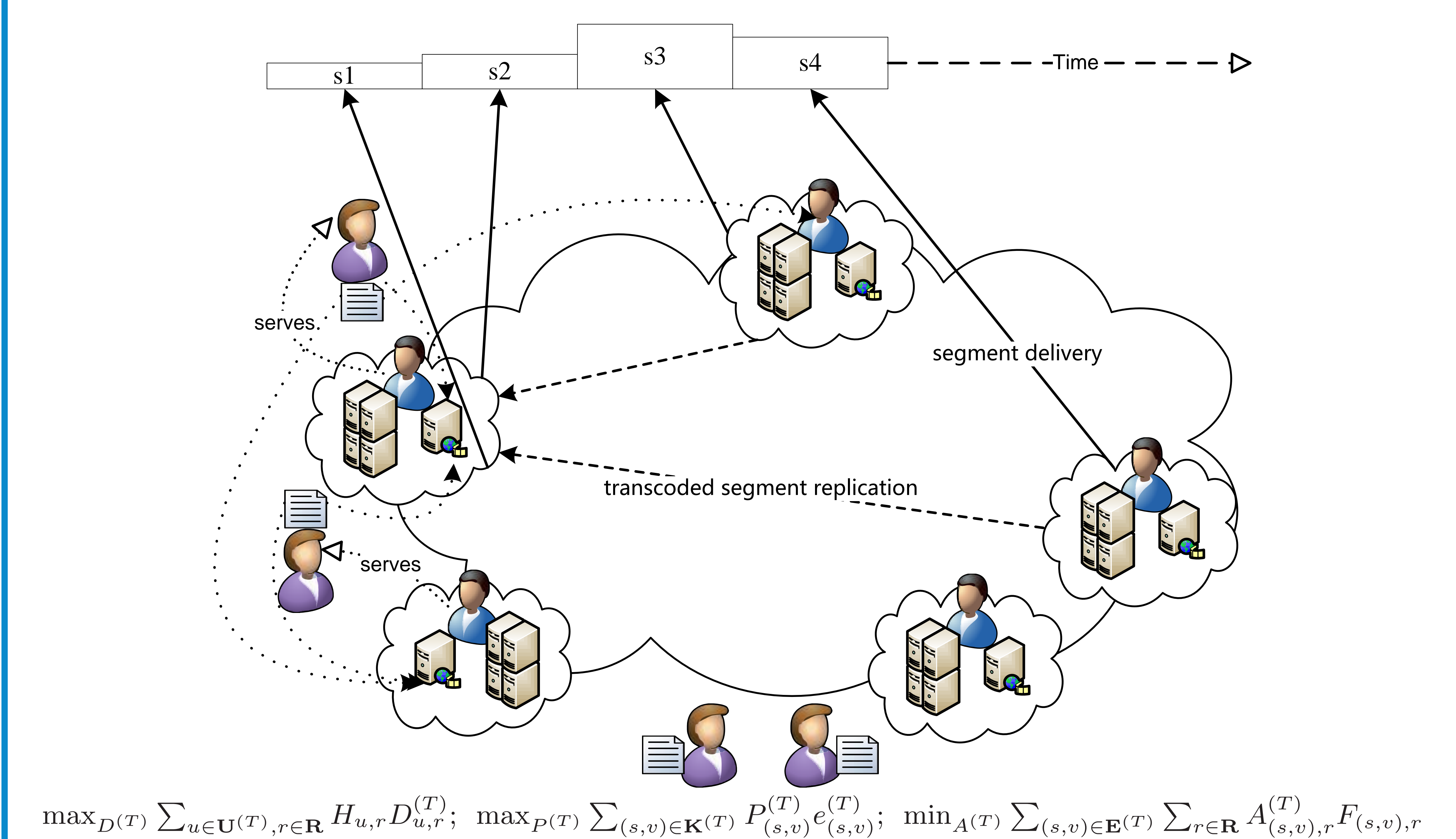
## FRAMEWORK

3 phases joint optimization

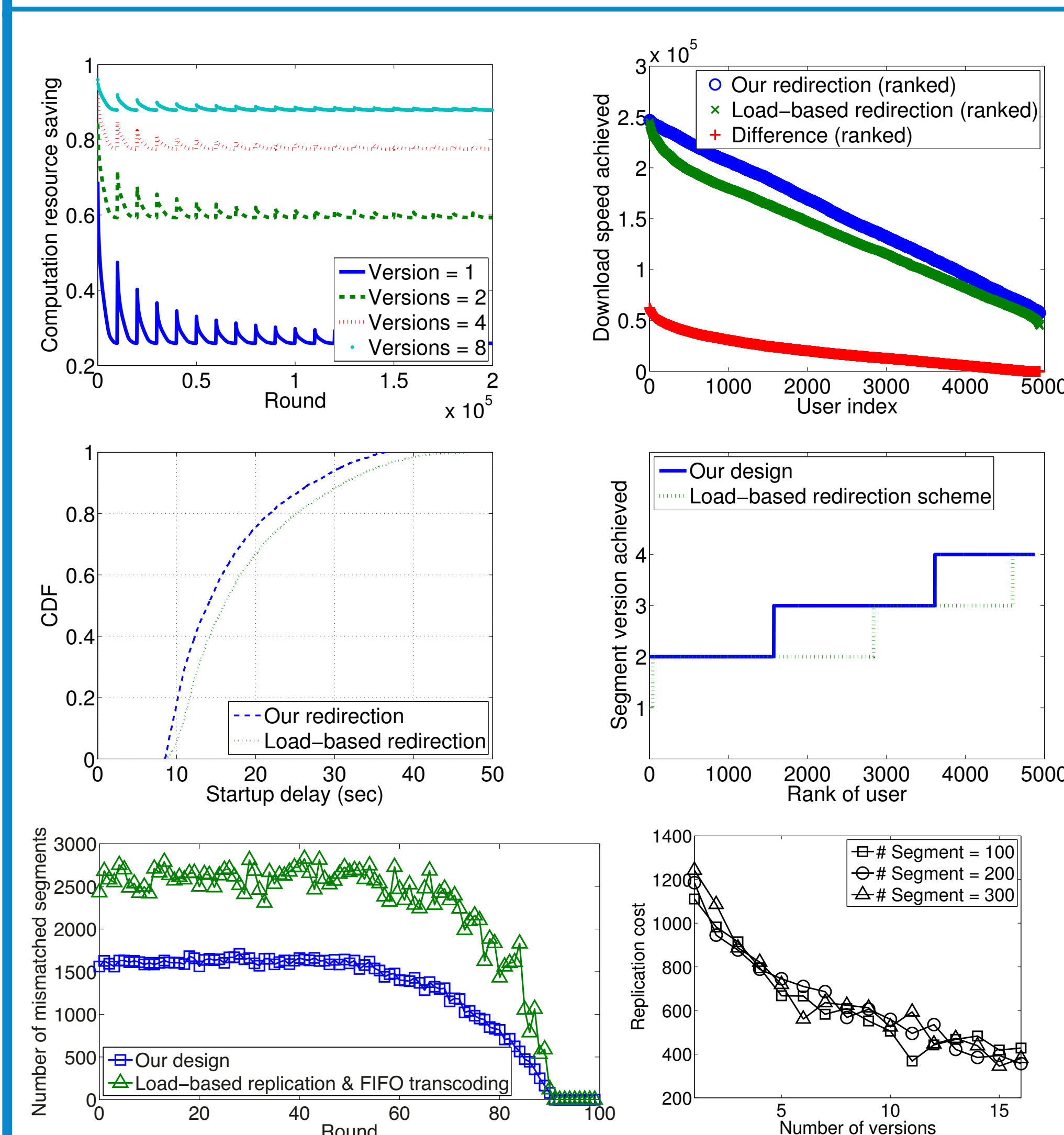


## METHODS

Girls Chasing Boys! (Stable Maching plus Linear Programming)



## RESULTS



## HIGHLIGHTS

- 44.8% users enjoy higher bitrate versions than the load-balanced redirection scheme
- 4.5x users enjoy the highest possible bitrate
- Mismatch rate reduced by over 42.2%
- ~ 80% computing resource saved when the number of versions is 4. The higher the number is, the more resource our approach saves.

## AFTERWORD

Transcoding and delivery can, and should be considered & done jointly.  
§ A joint work with THU, HKU, Tencent.  
§ Appeared in IEEE TMM 2015.  
§ In serving WeChat video clip, QZone video...