Low-cost video transcoding at the wireless edge

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Motivation

- Mobile video streaming is a killer application





- Wireless link is dynamic; link fluctuation, limited bandwidth, long latency, high jitter, prone to being unstable.

stall



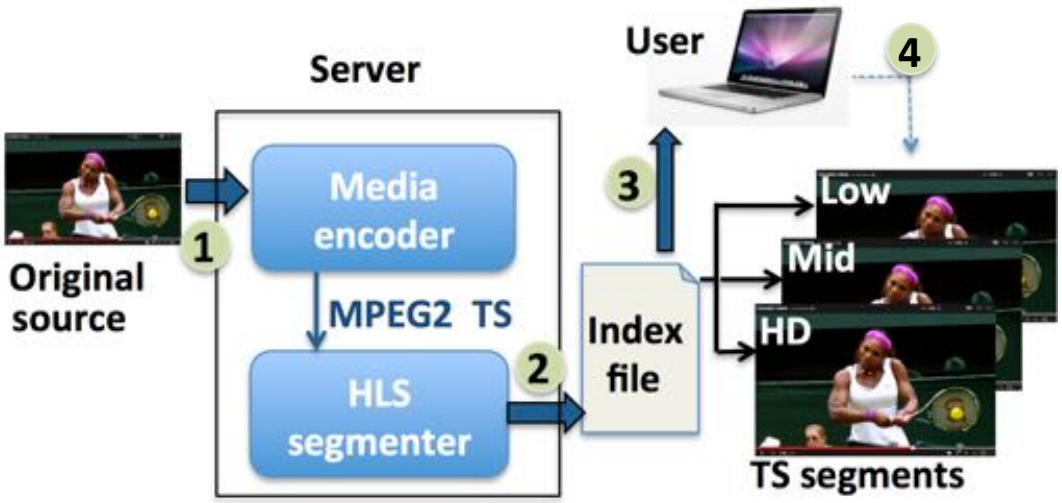
glitch



- Hard to provide satisfactory video streaming quality to mobile users.

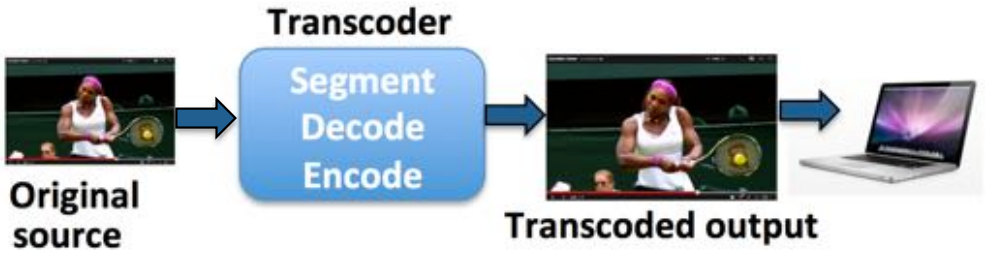
Solutions

Adaptive bitrate streaming



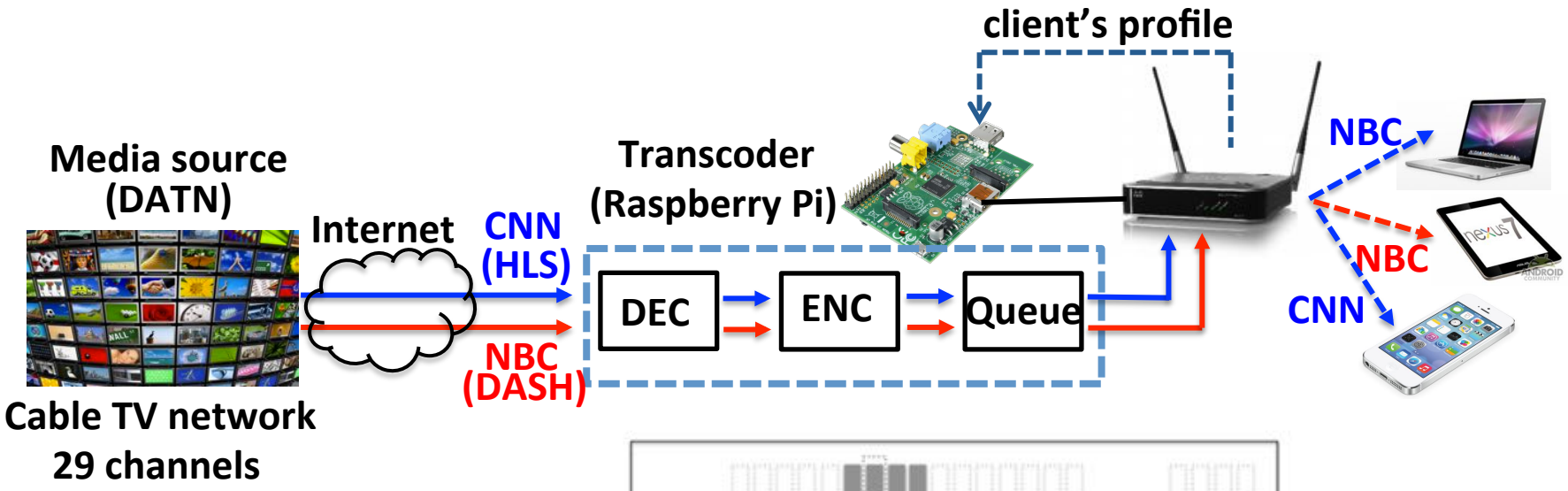
- HLS, MPEG-DASH
- Massive storage
- Coarse-grained adaptation
- Not applicable to live-stream

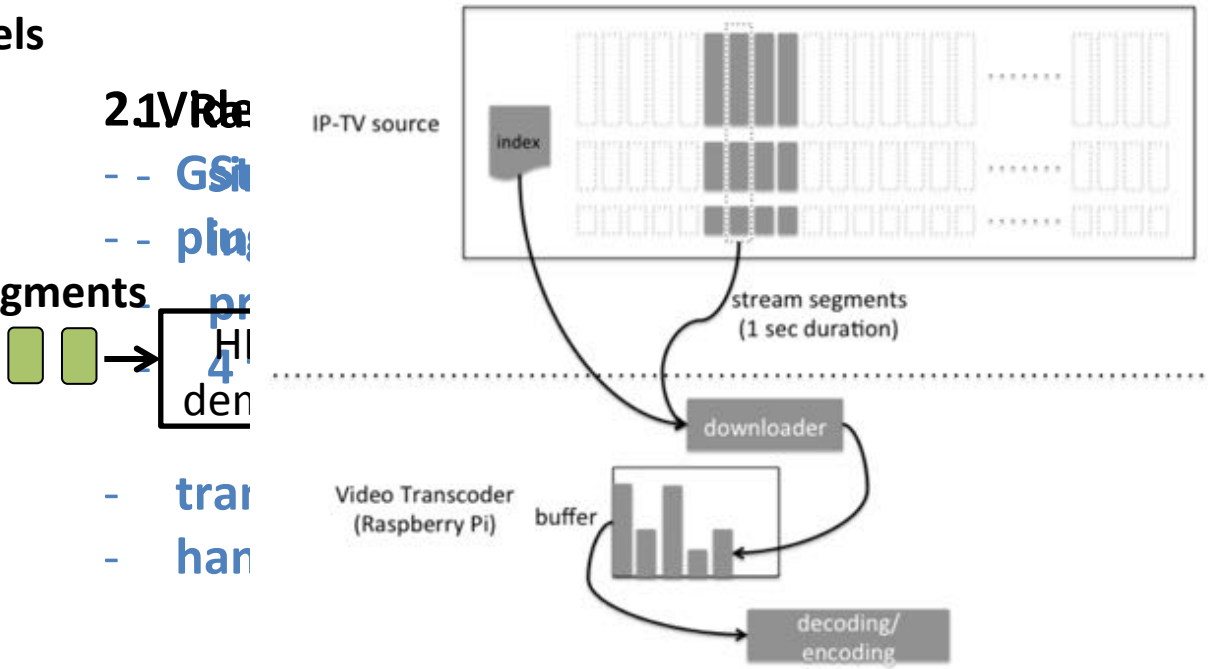
Video Transcoding



- Require high computational power and resources
- Media server, off-line

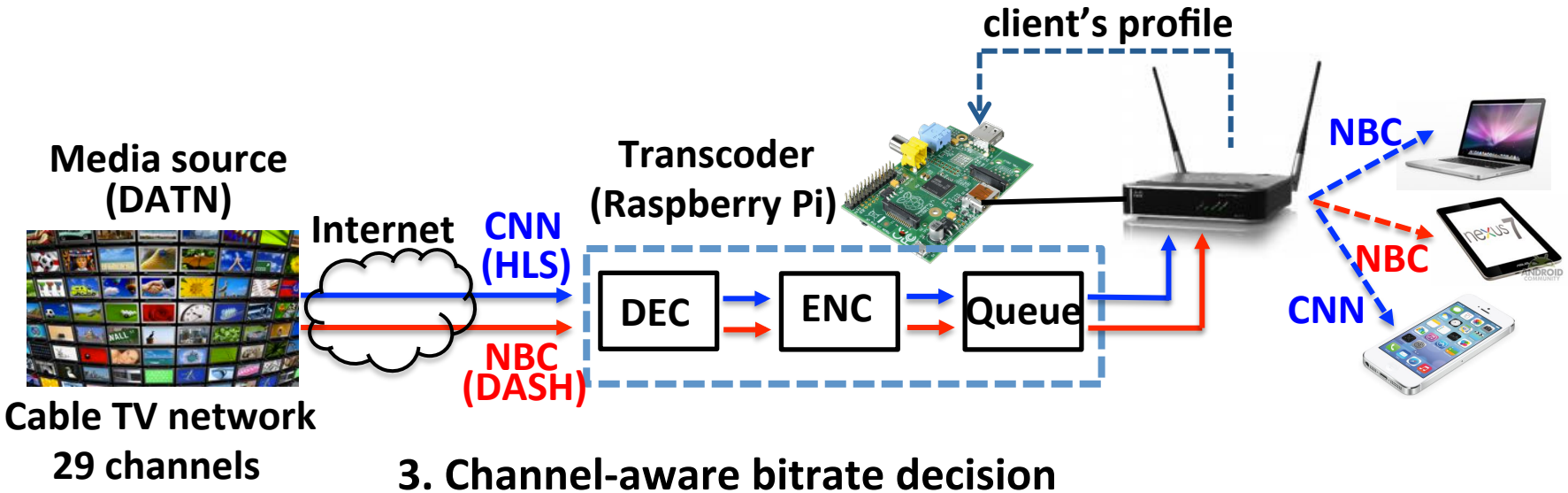
TransPi





video segments

TransPi



3. Channel-aware bitrate decision

- AP passively monitors downlink BW

bi: bitrate for client *i*, *pi*: client *i*'s bandwidth

for *i* ∈ [1: |*r*|] do

if (*pi* > *bi* ×(1+α)) || (*pi* < *bi* ×(1−α)) then

bi = *pi*, *si* = *pi*

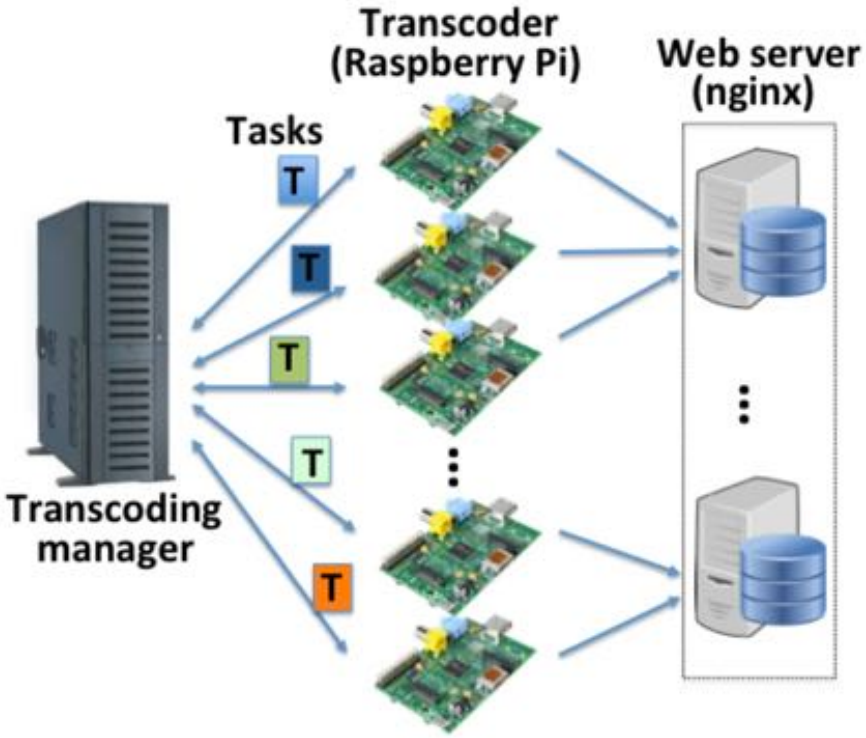
1. Receiving a channel request and the user profile
2. Determining bitrates based on the client's info
3. Transcoding original video with the determined bitrate
4. Delivering transcoded stream to the clients

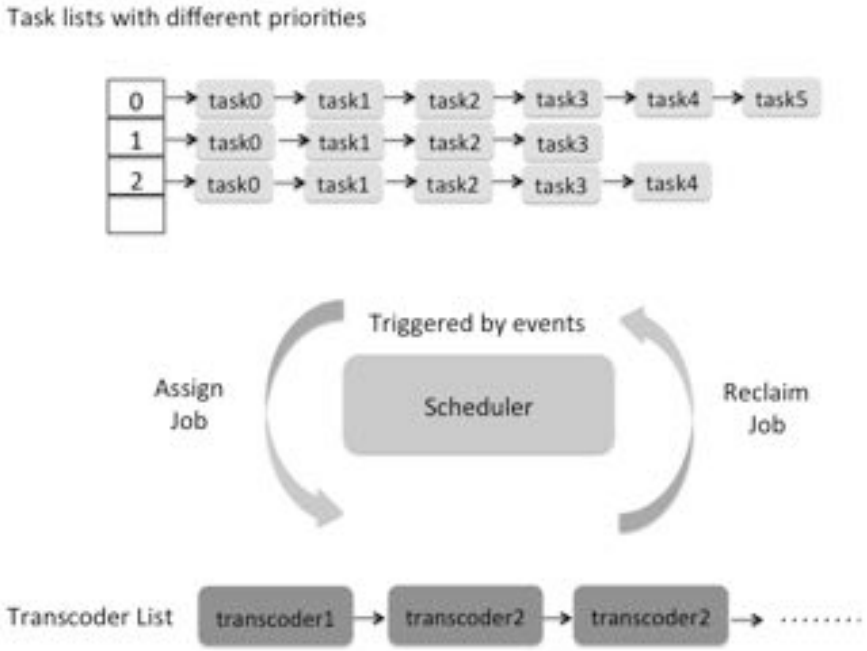
si : selected bitrate for client *i*

4. Client player

- open-source application (e.g., ffmpeg, gst-launch)
- maintains HLS/DASH format

TransPi


Transcoder
(Raspberry Pi)
Web server
(nginx)
Tasks
T
T
T
T
T
Transcoding
manager


Task lists with different priorities
0
1
2
task0
task1
task2
task3
task4
task5
Triggered by events
Assign
Job
Scheduler
Reclaim
Job
Transcoder List
transcoder1
transcoder2
transcoder2

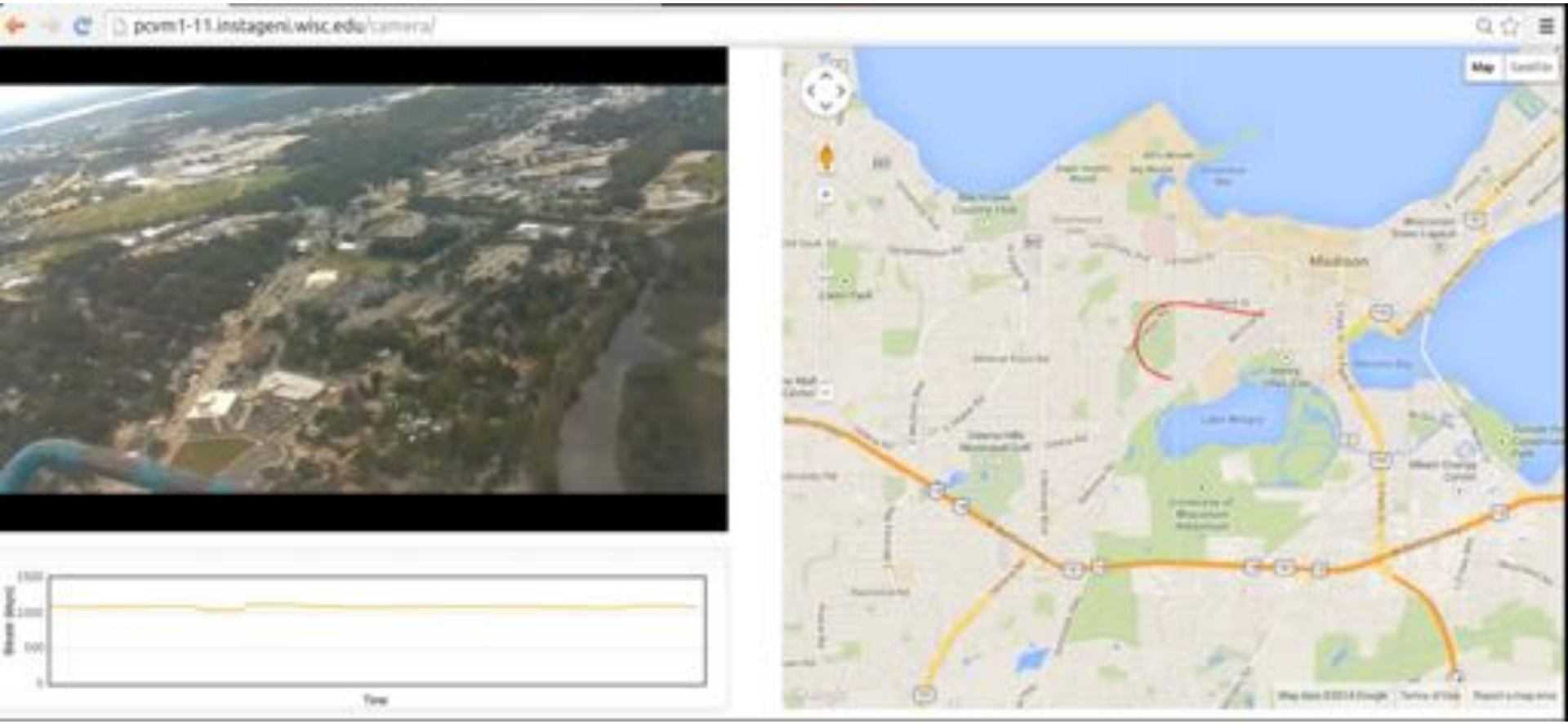
TransPi demo



PI in the Sky


RPi camera
Raspberry Pi (RPi)
WiMAX USB adapter
Aerial image
Users

SkyPi demo (plane)



SkyPi demo (drone)

