Scalable Crowd-Sourcing of Video from Mobile Devices Pieter Simoens<sup>\*†</sup>, Yu Xiao<sup>\*‡</sup>, Padmanabhan Pillai<sup>§</sup>, Zhuo Chen<sup>\*</sup>, Kiryong Ha<sup>\*</sup>, Mahadev Styanarayanan<sup>\*</sup> \*Carnegie Mellon University <sup>†</sup>Ghent University <sup>‡</sup>Aalto University <sup>§</sup> Intel Labs

# Motivation

Head-mounted devices are upcoming



# **System Architecture**

Crowd-sourced videos are valuable

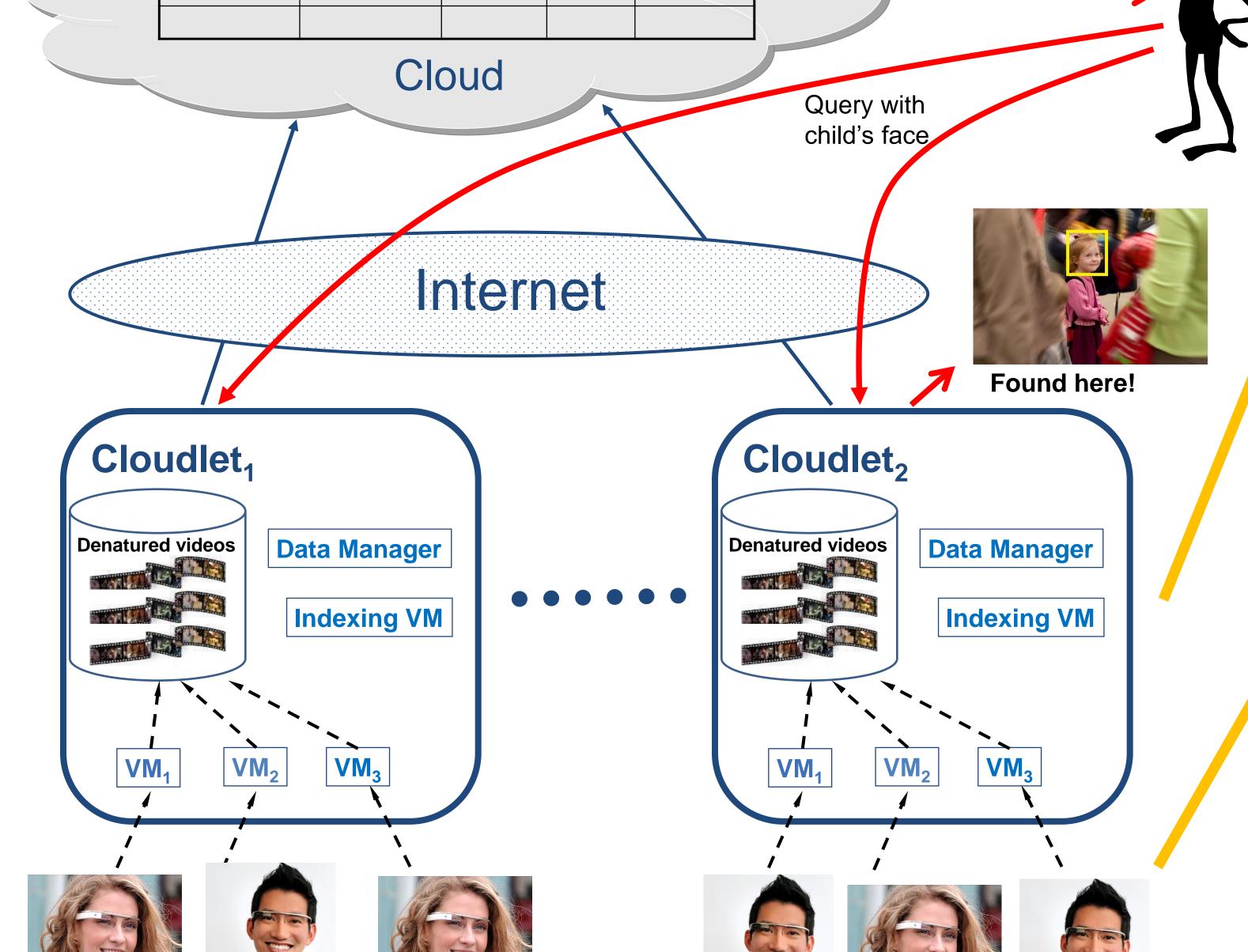




# **Key Challenges**

- Scalability bandwidth limitation
- User privacy
- How to search efficiently?

Videos are stored at cloudlets, metadata goes to the cloud Search Global Catalog of Video Segments By index Face/Body Video info in the Cloudlet IP Owner Video ID Time Tags ... or content park just visited



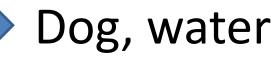
### (face, texture...)

## **Denaturing & Indexing**

Remove sensitive scenes & add tags







## **Uploading to cloudlets**

Can specify privacy settings at client side

PrivacySettingsActivity

Time

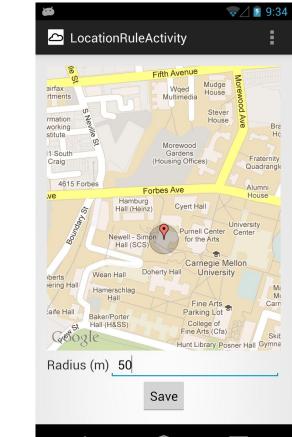
Clear all rules

Locatior

Default Privacy Policy

DEFAULT POLICY: PUBLISH

action: BLUR type: CONTENT objects: Pieter, Yu action: BLANK type: TIMEERAM from: 9:00 until: 17:00 Rule 2 action: BLANK type: LOCATION latitude: 40.44334 longitude: -79.94468 radius: 50.0



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<mark>ර</mark> ු Gigasi	ghtActivity	:
	Capture Video	
	Privacy Settings	
PersonalVM		
128.2.21 Personal VM		
12345		
Personal VM 5555	upload port	
4		_



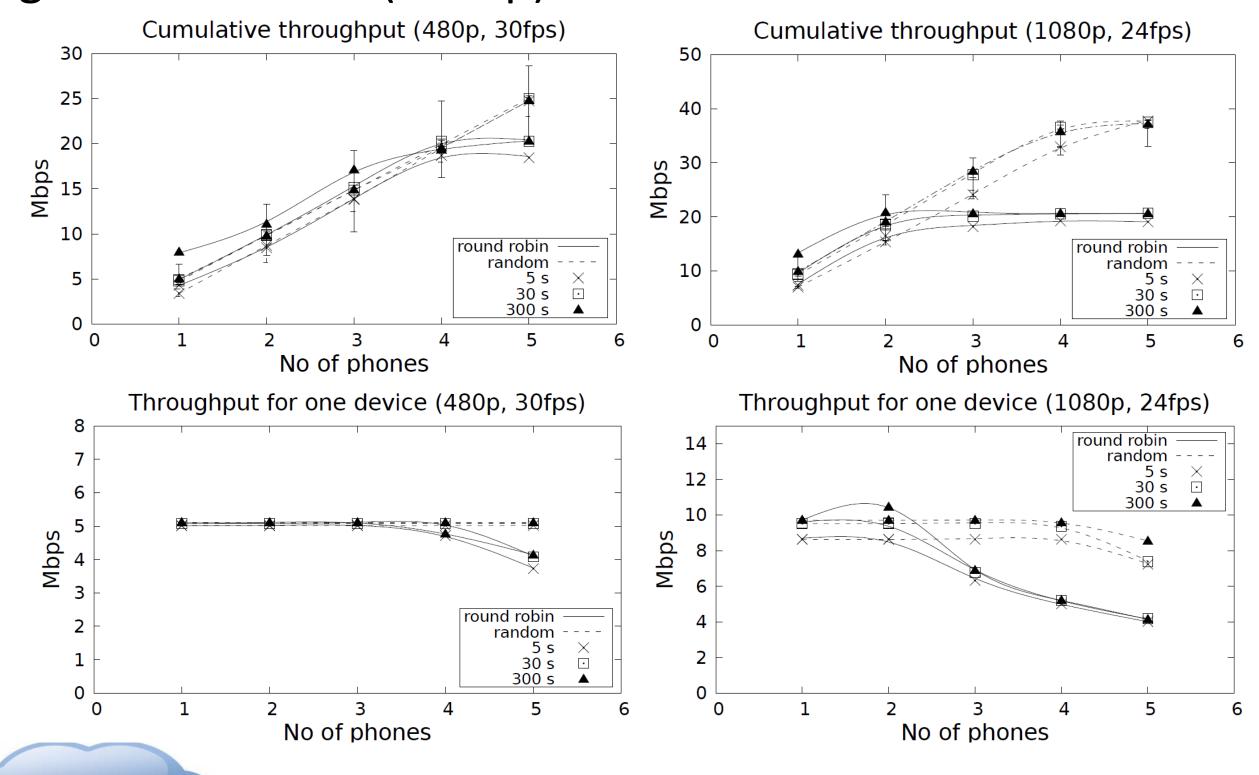




# **Experimental Results**

## **Uploading to cloudlets**

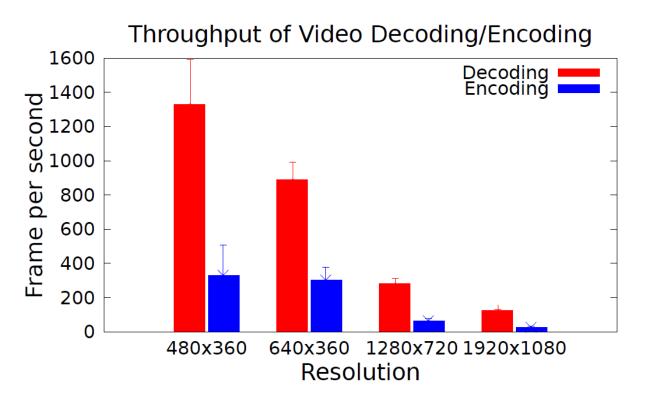
One modern AP can concurrently support around 5 users for highest resolution (1080p)



### Denaturing

Frame per second

Throughput varies with resolution (1fps – 7fps)



Throughput of Video Denaturing (2 threads)

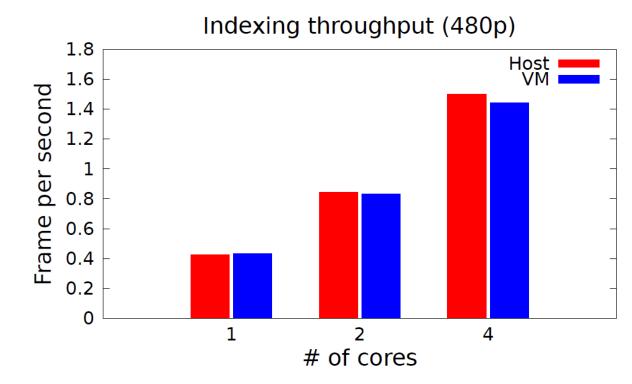
640x360

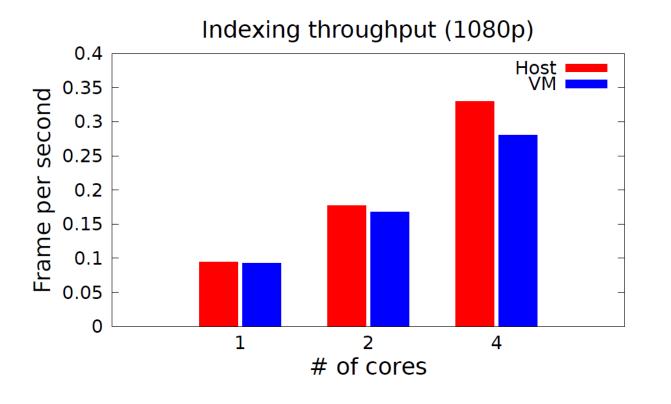
Resolution

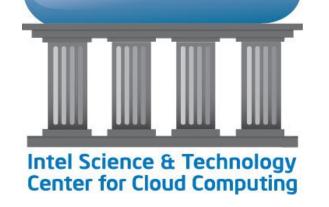
480x360

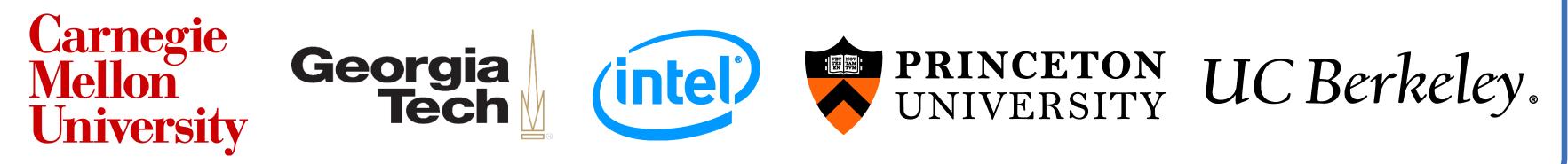
## Indexing

Sufficient throughput to index one frame per several seconds









HAAR LBP

1080x720 1920x1080